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E-Waste Management: A Comparative Study Between the Legal Framework of Bangladesh and United States of America (USA)

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Abstract

The importance of electronic garbage, or "e-waste," in Bangladesh is growing with time due to technological advancements, a lack of disposal and recycling options, and lax enforcement of laws. Due to a lack of implementation of the Hazardous Waste (E-Waste) Management Rules of 2021, the majority of e-waste is handled by unofficial organizations that engage in open burning and acid leaching. Furthermore, the health and environmental effects of deregulated dumping are unchecked since there are no Extended Producer Responsibility (EPR) rules, which exclude importers and manufacturers from liability for disposal. This essay seeks to ascertain the degree of public awareness, the efficacy of e-waste laws, and recycling behavior patterns through a survey involving 60 people. Results show that 23.3% know of the existence of recycling centers, whereas 63.3% sell their e-waste to petty traders, which shows an informal market. Also, 76.3% of respondents did not know of any domestic or foreign legal regulations on e-waste and only 10.2% supported legislating proper disposal by manufacturers. The general attitude towards laws in place appears to be negative, as 35% say the laws do not serve their purpose. The study offers a cross- jurisdictional legal review of the United States, focusing on California and New York, where EPR laws have been effective. It also suggests the need for adoption of EPR policies in Bangladesh with the imposition of tougher sanctions and the establishment of a standalone e-waste management regulatory body. These changes would extend the boundaries of formal recycling, promote responsible disposal through rewards, and provide a scope for informal recyclers within the formal sector. These reforms would make Bangladesh in accordance with global agreements like the Basel Convention, which promote economical and ecologically responsible waste management.

Keywords: e-waste management; circular economy; legal framework; informal recycling; basel convention

Introduction

Chapter I – Introduction

E-waste management is a cross-border issue that affects both industrialized and poor nations. Despite being a developing nation, Bangladesh has issues since its legal systems are weak and its current laws are not sufficiently enforced. However, in the United States, e-waste is governed by numerous legal systems, such as federal guidelines, state laws like the California Electronic Waste Recycling Act, and at the local level, where enforcement is focused on producers and there are incentives for recycling and community participation.

where enforcement is focused on producers and there are incentives for recycling and community participation. At an international level, frameworks such as the Basel Convention must be complied with, which has not been sufficiently done by Bangladesh. This paper seeks to address the gaps in enforcement, stakeholder participation, and compliance with international treaties Bangladesh signed by asking how best practices from international and US laws can be modified and incorporated. Further, unlike Germany or Japan, which have more centralized laws, US laws provide leeway and local level solutions through state- led initiatives.

1.1 Statement of the Problem

The inability to manage e-waste in Bangladesh can be linked to the absence of proper policies and concern for the public's health even when the volume of electronic waste is rapidly increasing. As per the Global E-Waste Monitor1, Bangladesh's e-waste created in 2019 is reported to have reached nearly 400,000 metric tons, which marks a drastic increase from the prior years. With the rapid Urbanization and technology growth, this number is expected to further increase. There are serious issues regarding the enforcement of the Hazardous Waste (E-Waste) Management Rules, 20212 that stem from a loose implementation framework and deficient integration of the informal sector. For instance, 90% of the e-waste generated is processed through the informal industry but they utilize highly dangerous practices such as acid pouring, open flame burning, and other methods that greatly endanger the environment. These practices also present severe health risks such as the potential for developing respiratory illnesses and directly being exposed to lead and mercury. The country's insufficient compliance with several international treaties such as the Basel Convention leaves much to be desired and puts Bangladesh in a position where it can easily be exploited by foreign nations seeking refuge for their e-waste. In summary, Bangladesh needs to develop laws with defined boundaries and a distinct framework that target E-Waste Management policies to combat the discussed challenges. The focus of this study is to find areas where the legislation regarding e-waste in the United States can be used, and modified, to make developments to the Bangladeshi legal framework. The

1 United Nations Institute for Training and Research (UNITAR), The Global E-Waste Monitor 2020: Quantities, Flows, and the Circular Economy Potential (2020) <https://ewastemonitor.info/wp-content/uploads/2020/11/GEM_2020_def_july1_low.pdf> accessed 18 February 2025.

2 Government of Bangladesh, Hazardous Waste (E-Waste) Management Rules, 2021 (2021) <http://www.doe.gov.bd> accessed 18 February 2025.

Resource Conservation and Recovery Act (RCRA)3, California's Electronic Waste Recycling Act, and other Extended Producer Responsibility (EPR)4 laws are examples of US frameworks which offer actionable solutions to critically informed decision making. The United States boasts a highly fragmented legal system which allows for local variation to be addressed through state action, such as in California where the Electronic Waste Recycling Act relies on consumer and government funding as well as tapping producers to assume primary responsibility for the recycling of e-waste. This model is fully flexible and encompasses the informal economy that is critical for a developing nation like Bangladesh. These frameworks provide sustainability as well as adaptability for Bangladesh, which is crucial in order to create a legal system that places the most importance on the environment, and the health of its people.

1.2 Research Questions

1. Is there sufficient legal framework in Bangladesh to deal with the management of e-waste?

2. To what extent existing legal framework regarding e-waste management in Bangladesh comply with that of U.S. legal system?

1.3 Objectives of the Study

1. To investigate the RCRA and EPR laws authorized by the American states and how they integrate stakeholder participation.
2. To find out if Bangladesh is meeting the requirements of the Basel Convention and other legal standards.
3. To compare the legal framework of Bangladesh and USA regarding E waste management.

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1.4 Research Methodology

A theological approach is used in this investigation at first, meaning that the bulk of the research was done through secondary sources, such as other studies, government publications, and international documents. This study is primarily focused on An analysis of Bangladesh's and the United States' e-waste laws, as well as an assessment of the degree of adherence to global norms like the Basel Convention. Even though the analysis is largely reliant on secondary information, there was also a public survey conducted to understand how people think and whether they are knowledgeable about e-waste management to enhance the analysis.

1.5 Significance of this Study

This study is needed to understand how Extended Producer Responsibility (EPR) laws as well as certain recycling incentives can be adopted in Bangladesh to improve both the environment and human health. This unique aspect of this study is its focus on comparative legal studies to demonstrate how EPR laws and other United States legal models can be successfully modified to fit developing nations. This study seeks to integrate the informal sector, in this case, informal recyclers, to formal systems while also collaborating with stakeholders to help align the laws of

3 US Environmental Protection Agency, Resource Conservation and Recovery Act (RCRA) (1976) <https://www.epa.gov/rcra/resource-conservation-and-recovery-act-rcra-overview> accessed 18 February 2025.

4 California Department of Resources Recycling and Recovery, California Electronic Waste Recycling Act (2003) <https://www.calrecycle.ca.gov/Electronics/> accessed 18 February 2025.

Bangladesh with international best practices. The study assumes that there are policymakers in Bangladesh who are willing to ensure that the significant gaps identified in the country's framework will promote sustainable development policies and practices.

Chapter II – Literature Review

The shortcomings in scholarly research on managing e-waste, particularly in Bangladesh and the United States, highlight why this environmental issue is so vital. Through his research, Mohammad

Abu Taher (2019)5 explains the certain laws pertaining to the treatment of e-waste that the US employs and contrasts it with Bangladesh's e-waste legislation. Through his analysis, he identifies the absence of a particular legal structure designed to address the growing issue of e-waste. With an emphasis on the environment and public health, Taher outlines the need for dedicated laws and regulatory policy frameworks. His research is extremely useful as a starting point for understanding policy reform in Bangladesh and underlines the most pivotal aspects of such a reform.

Rubiyath Chowdhury Afifa (2022)6 analyzes the international legal frameworks' compliance in Bangladesh, including the Basel Convention. Afifa certainly identifies best practices from the world that can be utilized domestically, further propounding the difficulty of implementing international agreements on cross border e-waste trafficking, an issue which is rather poorly managed in Bangladesh. Further research into Afifa's work includes how U.S legal structures provide workable solutions towards achieving greater compliance and enforcement.

The United States can teach us a lot about managing e-waste. For example, studies conducted on the Resource Conservation and Recovery Act show clear provisions for the handling of e-waste and other hazardous garbage. The cradle to grave provisions of the Act offers guidelines on how to ensure accountability for hazardous materials across the whole waste spectrum. Likewise, other state level California initiatives like the California Electronic Waste Recycling Act place emphasis on consumers, producers, and funding. It demonstrates how local regions can be provided with autonomy to pursue measures that balance economic and environmental sustainability.

More details can be obtained from the legal framework regarding Extended Producer Responsibility (EPR), that exists in several states of the U.S A. EPR laws give the manufacturers of electronic products the responsibility for the entire lifecycle management of the product's life, including encouraging design features and recycling facilities which are appropriate. This research combines these principles to formulate feasible action plans for Bangladesh with special consideration of the collaborative role of the public and other stakeholders.

Forti et al. (2020)7 examine the alarming rate of e-waste being generated globally and the inadequate disposal systems in place. Moreover, they cover the health and environmental issues that would stem from improper disposal. There is a spotlight on the difference in regions when it comes to e-waste handling, as well as the immense gap that exists in legislation concerning waste recycling and processing. Enhanced international cooperation alongside improved data and enforcement tracking was needed, reinforcing the need for policies surrounding e-waste. Their results called for immediate action when it came to the incorporation of circular economic strategies to solve the surging e-waste problem

Leapawsky et al. (2018)8 investigates the integration of the informal sector that surrounds e-waste recycling as well as the socio-economic factors that come to play. The study covers complexities surrounding the informal recycling sector and the formal economy along with the critics of the policies. Global policies that pertain to e-waste effectively capture and further hinder countless unsung and informal workers is an approach that needs to be challenged. Lepawsky promotes policies that encourage restraints on unsanctioned recycling networks while examining the problems and benefits that come with unsanctioned policies in waste management. His arguments go against the suggested claims, making his efforts towards policies much more credible when looking at the massive gap there is concerning e-waste governance.

The efforts made by Kahhat et al. (2008)9 focus on the outline and structures of the existing e- waste management systems in America, deploring the flaws regarding collection, recycling, and even disposal. The main focus of the study is how waste is handled in the US in comparison with other countries, mainly with reference to the role that extended producer responsibility (EPR) and other regulative policies play. Some of the issues that the authors identify are the inconsistency of policies at the state level, poor consumption of the services provided, and the dumping of e-waste in the developing nations. The authors recommend the adoption of a more rigid and uniform national policy and the introduction of new technology and education to achieve sustainable e- waste management.

Masud et al. (2020)10 report on the multidisciplinary analysis of the problems and challenges as well as the possible solutions of e-waste management in Bangladesh. The study identifies the absence of regulated recycling practices, the gaps within laws, and the lack of regulated sectors as the most important issues that endanger the environment and human health. They, however, criticizing the unbounded nature of that candidature-informed argument, emphasize policy direction cum technological supports or advocacy geared towards improving the management e- waste. The urgent need for government control, EPR, and proper renewable resources waste or recycling technologies for the increasing e-waste problems in Bangladesh are the primary results of the study.

Namias et al. (2013)11 discusses the significance of educational measures in the disposal of e-waste as a feature of the United States' System.

8 J Lepawsky, Reassembling Rubbish: Worlding Electronic Waste (MIT Press 2018)

9 R Kahhat, J Kim, M Xu, B Allenby, E Williams and P Zhang, 'Exploring E-Waste Management Systems in the United States' (2008) 52(7) Resources, Conservation and Recycling 955

10 MH Masud, W Akram, A Ahmed, AA Ananno, M Mourshed, M Hasan and MUH Joardder, 'Towards the
Effective E-Waste Management in Bangladesh: A Review' (2019) 26(2) Environmental Science and Pollution Research 1250

11 J Namias, The Future of Electronic Waste Recycling in the United States: Obstacles and Domestic Solutions
(Columbia University 2013)

Chapter III – Conceptual and Theoretical Framework

3.1 Introduction

Conceptual frameworks lay the groundwork of an academic study.

In particular, a study's objectives and goals are simplified and organized around specific theories. They focus on the laws, policies, socio-economic factors, and the environment that dictate how e-waste is managed globally. Technological innovation has significantly hampered the global attempt to manage e- waste because of the rise in the use of electronic gadgets and the resulting e-waste. When e-waste is disposed of in landfills without adequate recycling or treatment facilities, dangerous substances like lead, mercury, and cadmium leak out, endangering both the natural world and the health of people.

The only way to manage e-waste is to take a comprehensive approach that covers each phase of its life cycle, including manufacture, consumption, disposal, as well as recycling. The goal of this section is to define and describe the various jurisdictions' approaches to managing e-waste.

Comparing the finest e-waste management methods is the aim of this investigation.

3.2 Conceptual Framework of E-Waste Management

3.2.1 Defining E-Waste

E waste, or electronic waste, encompasses disposed of electronic devices and equipment that have surpassed their useful lifetime. The Basel Convention considers it as a hazardous waste if it bears toxic materials with the potential of damaging human life or the ecosystem12. As per Article 4(1)(a) of the Basel Convention, 1989, Bangladesh is obligated to stop the importation of dangerous waste without prior informed consent. A glaring issue is that there is no internationally acceptable definition which means that different countries have different approaches to e-waste regulation and management. The European Union's Waste Electrical and Electronic Equipment (WEEE) directive13 is broader than definitions offered within the United States.

The Hazardous Waste (E-Waste) Management Rules, 2021 of Bangladesh classifies e-waste as matter with different degrees of toxicity and recyclability. However, the Act on Resource Conservation and Recovery (RCRA) in the US takes a more pragmatic stance. 14 which defines waste as electronics that are capable of being modified for reuse or recycles. Under Subtitle C of the Resource Conservation and Recovery Act (RCRA), 1976, certain e-waste components, including lead-acid batteries and mercury-containing items, are classified as hazardous waste and subject to strict regulatory oversight. These definitional differences illuminate the issues of establishing international cohesive e-waste policies.

3.2.2 Categories and Types of E-Waste

12 G Gaidajis, K Angelakoglou and D Aktsoglou, 'E-Waste: Environmental Problems and Current Management' (2010) 3(1) Journal of Engineering Science and Technology Review 193

13 W Zhao, L Ding, X Gu, J Luo, Y Liu, G Li and S Cheng, 'Levels and Ecological Risk Assessment of Metals in Soils from a Typical E-Waste Recycling Region in Southeast China' (2015) 24(9) Ecotoxicology 1947

14 S Quan, B Yan, F Yang, N Li, X Xiao and J Fu, 'Spatial Distribution of Heavy Metal Contamination in Soils Near a Primitive E-Waste Recycling Site' (2014) 22(2) Environmental Science and Pollution Research 1290.

E-waste is separated into three categories, each of which is further classified into small household appliances like vacuum cleaners and toasters, large household equipment like refrigerators and washing machines, IT and telecommunications for example: computers and mobile phones, consumer electronics example televisions and cameras, lighting equipment and also medical equipment. Each category poses different problems in regard to disposal, recycling and recovery of materials.

3.2.3 Impacts of E-Waste

There are certain environmental effects that come from improper disposal for electronics, as well as negative impacts on a person's health. Soil and water get contaminated when The atmosphere is exposed to heavy metals through acid leaching and open burning. Workers in Bangladesh are more susceptible to neurodegenerative disorders and respiratory illnesses due to informal recycling systems which do not use protective equipment and expose them to highly toxic cigarette smoke15. While the United States, which does have problems with exports of e-waste to developing nations, does try to use advanced recycling technologies and strict regulations to solve the problem, it remains burdensome still 16.

3.3 Comparative Perspectives on E-Waste Concepts

3.3.1 Resource Recovery and Recycling

Resource recovery refers to those processes that reclaim useful materials from e-waste like rare earth metals, gold and silver. The United States, due to not having stringent restrictions, makes use of electric shredding as well as chemical extraction for more resource recovery while Bangladesh uses less advanced manual dismantling. More rigid controls on informal recycling and the formal addiction of recycling facilities in Bangladesh would enable better resource recovery through reduced environmental damage.17.

3.3.2 Lifecycle Management of Electronics

Sustainable development of products with a longer shelf life that are also easily disposable is something that manufacturers can be encouraged to do through administration. This is the case in the United States done through EPR policies which work to make the manufacturer responsible for the waste management of their products when they reach the end of their life. Had Bangladesh incorporated these efforts, it could have done much more in terms of e-waste management18.

3.3.3 Consumer Awareness and Participation

15 S Sthiannopkao and MH Wong, 'Handling E-Waste in Developed and Developing Countries: Initiatives, Practices, and Consequences' (2013) 463–464 Science of the Total Environment 1147.

16 O Paramonova, V Bespalov and E Lysova, 'Selection of Ecologically Efficient and Energetically Economic Engineering-Ecological System for Municipal Solid Wastes Collection' (2017) 106 MATEC Web of Conferences 07012.

17 MT Islam and N Huda, 'Reverse Logistics and Closed-Loop Supply Chain of Waste Electrical and Electronic Equipment (WEEE)/E-Waste: A Comprehensive Literature Review' (2018) 137 Resources, Conservation and Recycling 48

18 J Lepawsky, 'Waste and Waste Management' (2017) International Encyclopedia of Geography 1

Managing e-waste requires consideration of consumer practices. Efforts such as take back programs, subsidization, and other forms of education have increased recycling in the U.S. Bangladesh can gain from this approach by modifying them to the local socio-economic conditions to improve recycling participation and responsible disposal practices and public participation 19.

3.3.4 Circular Economy Approaches

Shifting to a circular economy includes policies for product remanufacturing, reusing, and recycling. Providing tax breaks to manufacturers who use eco-friendly materials and those who support the repair industry can help Bangladesh move toward a circular economy model that reduces the production of e-waste and enhances resource productivity20.

3.3.5 Green Supply Chain Management (GSCM)

GSCM incorporates the notion of long-term growth throughout the entire supply chain from sourcing to manufacturing through to disposal. Several multinational companies are now practicing green procurement and logistics in response to international environmental regulations. In Bangladesh, public policies can encourage GSCM practices to achieve economic development together with environmental protection21.

3.3.6 Industrial Ecology

In the case of industrial ecosystems, Industries are perceived as functioning systems wherein the waste generated during processes of one industry acts as the other's resource. The site for recycling e-waste hubs close to industrial areas would enable a material circulation system which decreases the need for newly mined materials and cuts down on pollution. Public-private partnerships could facilitate the construction of these systems in Bangladesh.

3.3.7 E-Waste Monitoring and Digital Tools

Technologies like Internet of Things (IoT) and blockchain improve the precision and visibility of recycling, which helps with efficient e-waste monitoring. and disposal processes. Tamper-resistant waste flow records can be captured through blockchain22. IoT sensors placed in bins can also enhance the efficiency of waste collection routes23. Test projects using these technologies in Bangladesh might increase efficiency and compliance.

3.4. Theoretical Framework of E-Waste Management

19 S Hung and K Tsai, 'Mapping E-Waste Distribution to Form a Circular Supply Chain – An Investigation on E- Waste Towards Circular Economy in Taiwan' (2024) Applied Environmental Research

20 H Yang and S Zhang, 'Risk Management of E-Waste Disposal in China: A Life Cycle Perspective' (2022) 35(3)
Energy & Environment 1235

21 NJ Maynard, VRK Subramanian, C Hua and S Lo, 'Industrial Symbiosis in Taiwan: Case Study on Linhai Industrial Park' (2020) 12(11) Sustainability 4564

22 RW Ahmad, K Salah, R Jayaraman, I Yaqoob and M Omar, 'Blockchain for Waste Management in Smart Cities: A Survey' (2021)

23 NA Ali, R Ramly, AAB Sajak and R Alrawashdeh, 'IoT E-Waste Monitoring System to Support Smart City Initiatives' (2021) 13(2) International Journal of Integrated Engineering

Strategy for e-waste management begins with developing a regulatory framework followed by studying the behavior of consumers and formulating policies aimed at fostering sustainable waste management.

3.4.1 Extended Producer Responsibility (EPR)

Under the EPR framework, manufacturers of a product bear the responsibility of the product's disposal. Many developed countries have adopted this policy model which makes it necessary for producers to implement take-back schemes, enhance recycling, and minimize the ecological footprint. Countries that adopted these EPR policies have been able to improve efficiency in waste management and minimize waste in landfills.

3.4.2 Circular Economy Model

The circular economy model encourages the movement away from the traditional method of "take- dispose-to a system where reuse, refurbishment, and recycling are core elements. The model reduces the possibility of e-waste and improves resource retention by making products that last longer and easier to recycle. The European Union's directive on WEEE serves as an example of how policies are crafted in line with the principles of Circular Economy24.

3.4.3 Socio-Technical Transitions Theory

This theory seeks to explain the relationship between a society's technological development, societal change, and environmental policies. It points out the need to combine new public-friendly waste management technologies with social marketing techniques. Good e-waste policies integrate technology, such as automated sorting and recovery equipment, and social innovation through education and motivation for correct disposal of e-waste25.

24 M Andersson, ML Söderman and BA Sanden, 'Adoption of Systemic and Socio-Technical Perspectives in Waste Management, WEEE, and ELV Research' (2019) 11(6) Sustainability 1677

25 H Iyamu, M Anda and G Ho, 'Socio-Technical Systems Analysis of Waste-to-Energy from Municipal Solid Waste in Developing Economies: A Case for Nigeria' (2017) 2 Renewable Energy and Environmental Sustainability 21

Chapter IV - Legal Frameworks on E-Waste Management

The Hazardous Waste (E-Waste) handling Rules, 2021, are the main regulations governing the handling of e-waste in Bangladesh. The Hazardous Waste (E-Waste) Management Rules, 2021, Rule 6(1), mandates that importers and manufacturers gather and properly dispose of their e-waste. To handle e-waste, approved recycling facilities must be set up in accordance with Rule 11 of The Hazardous Waste (E-Waste) Management Rules, 2021. The regulations classify e-waste based on its toxicity and recyclable nature, control how potentially hazardous electronic trash is disposed of, and promote Extended Producer Responsibility (EPR) by holding manufacturers accountable for product disposal. However, the informal recycling sector is not well incorporated, which makes implementation difficult.

An amendment to the Bangladesh Environment Conservation Act of 1995 was made in 2010, outlines excessive legal provisions for e-waste and other environmental protection policies as well as hazardous waste laws. Government has the authority to enact environmental legislation under Section 12 of the act and in Section 6 the government is us has the power to grant environment clearance to industrial projects involving hazardous waste26.

Legal instruments to deal with activities that violate environment law are contained in The Environment Court Act, 2010. Courts have the jurisdiction to hear different kinds of environmental cases under section 4 and administrative penalties for breach of these laws is governed under section 927.

The 2015–2018 Import Policy Order limits the inflow of both primitive and used electronics into the borders of Bangladesh to avoid turning the country into a dumpsite for outdated electronics, which go to waste without proper E-waste regulations28.Pursuant to Clause 26(1) of the Import Policy Order, 2015-2018, the import of used electronic goods is restricted to keep Bangladesh away from turning into a landfill for global e-waste. Furthermore, the Penal Code of Bangladesh, 1860, in section 268 of public nuisance and section 278 environmental nuisance, might sanction

unjustified dumping of e-waste into the environment29.

Bangladesh officially adopted the Basel Convention on the Management of Hazardous Waste Transboundary Movements and Disposal signed in 1989 which controls the movement of hazardous waste, including e-waste, across borders. The treaty requires prior informed consent between parties before any hazardous waste is exported, along with the requirement of proper disposal of waste. Nevertheless, there are issues with Bangladesh's complete adherence to the treaty, thus there are loopholes in place that allow for unrestricted illegal e-waste imports30.

26 Government of Bangladesh, Bangladesh Environment Conservation Act 1SS5 (Amended 2010)

27 Government of Bangladesh, The Environment Court Act 2010 2025.

28 Government of Bangladesh, Ministry of Commerce, Import Policy Order 2015-2018 <http://mincom.gov.bd> accessed 18 February 2025.

29 Government of Bangladesh, The Penal Code 18c0 <https://moj.gov.bd> accessed 18 February 2025.

30 United Nations Environment Programme, Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury (2001 C 2013) <http://www.pops.int> accessed 18 February 2025.

The Minamata Convention on Mercury, which was signed in 2013, and the Stockholm Convention on Persistent Organic Pollutants, which was established in 2001, control the use of flame retardants and mercury, which are present in e-waste and can have negative effects on both human health and the environment. These impose limitations on the production, use, and disposal of these hazardous components of electronics31.

Strict guidelines for the collection, recycling, and disposal of WEEE are established in the region by the European Union's Directive 2012/19/EU on Waste of Electrical and Electronic Equipment (WEEE), which also holds manufacturers accountable for the correct treatment of their products after use. Extended Producer Responsibility (EPR) is one of the policies that make it possible to manage e-waste32.

By creating a "cradle-to-grave" system that controls and records dangerous material from its point of origin to its ultimate resting place, the Resource Conservation and Recovery Act of (RCRA) governs the treatment of harmful waste in the United States. It is one of the most thorough laws on waste management because of its clear guidance on the e-waste treatment measures. Moreover, The Electronic Waste Recycling Act of 2003 in California follows an EPR model under which manufacturers pay for recycling programs to be instituted, which enables proper disposal of e- waste

The Extended Producer Responsibility (EPR) Guidelines from the Organization for Economic Development (OECD) strengthens waste management responsibility by producers even further. According to the Extended Producer Responsibility Guidelines of the OECD, producers should bear both financial and operational responsibility for the management and disposal of their electronic items nearing the conclusion of their useful lives. These guidelines require that producers take financial and operational responsibility for the faecal matter which is generated by their items when their useful lives are coming to an end along with encouraging waste minimization design.33

31 United Nations Environment Program (UNEP). (2001 C 2013). Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury. Retrieved from <http://www.pops.int>18 February 2025.

32 European Parliament and Council of the European Union, Directive 2012/1S/EU on Waste Electrical and Electronic Equipment (WEEE) (2012)<https://eur-lex.europa.eu> accessed 18 February 2025.

33 Organization for Economic Co-operation and Development, Extended Producer Responsibility: Updated Guidance for Efficient Waste Management (2016) <https://www.oecd.org> accessed 18 February 2025.

Chapter V - E -Waste Management in Bangladesh

5.1 Legal Gaps in E-Waste Management in Bangladesh

The Hazardous Waste (E-Waste) Management Rules, 2021', which were created in accordance with the Bangladesh Environment Preservation Act of 1995 (modified in 2010), also demonstrates Bangladesh's early efforts to address e-waste. In accordance with Environment Conservation Act of 1995, Section 12, the government has the authority to regulate and oversee hazardous waste, including e-waste. The legal framework of Bangladesh, however, has various defects. Failing to extend Producer Responsibility (EPR) is among them, named so that manufacturers and importers would be held responsible for gathering, recycling, and disposing of e-waste in an environmentally responsible manner. Bangladesh also, unlike the U.S. California Electronic Waste Recycling Act of 2003, lacks it. Bangladesh does not have a proper way to finance e- waste management although the Act has included a fee for e-waste recycling. The reliance on unofficial and risky methods like acid leaching and e-waste incineration put the lives of the workers on a risk and hamper the purity of the environment.

Implementation and oversight are a gigantic loophole when regulating and overseeing e-waste in Bangladesh. Although The Environment Conservation Act of 1995, Section 12 provides the government with the power to control hazardous waste, it is not well enforced. Furthermore, the Environment Court Act of 2010, which provided for courts to deal with environmental offenses, does not include illegal dumping of e-waste or uncontrolled recycling. According to Section 4 of the Environment Court Act, 2010, courts are empowered to hear cases related to environmental violations, including improper e-waste disposal. Order of the Import Policy 2015 – 2018 also prevents the shipment of used electronics to some extent but unguarded borders allow for the exportation of e-waste. Though Bangladesh is a signatory of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes 1989, still it is lagging in controlling the imports of e-waste from industrialized countries without or with inadequate tracking and reporting mechanisms. In India, these enforcement mechanisms can be strengthened, EPR regulations can be implemented, and the informal sector can be institutionalized to bridge the gaps and enable sustainable e-waste management in Bangladesh.

5.2 Results of the Inquiry Awareness and Practices in Bangladesh

An attempt was made to study the general public in Bangladesh's degree of understanding and willingness towards e-waste management by using a social media survey on a sample size of 60 people. The results uncovered lacking levels of knowledge,

accessibility, and perceptions regarding the achievement of policies.

Looking deeper into the analysis, 16.7 % of respondents stated that they are very familiar with the e-waste laws, whereas 41.7 % stated that they were somewhat familiar, and another 41.7 % stated that they are not familiar at all. A certain segment of the population is well-informed but much of the population seems to be unaware of the existing laws, which in turn leads to inadequate disposal and recycling actions. It is clear There is insufficient understanding and a monitoring system in place after the disposal is done.

Even lower, e-waste recycling knowledge was only reported by 23.3 % of respondents who claimed to know of a designated recycling center while 76.7 % said they knew of none. It is plausible that these centers do not exist, or don't exist due to bad publicity. Unlike the centers, many people are acquainted with informal methods to dispose of electronic garbage because of the ambiguous guidance. Even though respondents were unaware of official centers, 13.6% said that they have participated in an e-waste recycling or disposal program, with 86.4% falling under not having done so. In this however, there were reports for some level of informal e-waste disposal.

A vast majority indicated that they sell their e-waste to local market traders instead of using certified recycling institutions. Specifically, 63.3% of respondents preferred selling their e-waste to local vendors, 15% sent their e-waste to certified recycling institutions, 10% stored it for future disposal, and another 10% threw it in with their overall domestic waste. This points to the overwhelming preference for informal sources of waste e-disposal. The overwhelming preference for selling e-waste to local vendors instead of utilizing certified recycling centers suggests a lack of access to formal recycling options, or perhaps a greater concern for economic gain rather than environmental care.

In relation to knowledge of national and international policies, 23.7% of respondents were aware of e-waste management policies while 76.3% were unaware. Further, only 10.2% felt that the legal burden for disposing and recycling of electronic products rests on the manufacturer, while 89.8% did not, meaning that there is insufficient comprehension of EPR policies. In comparison, the e-waste regulation did receive mixed reviews in terms of its effectiveness. Only 20% of respondents thought that the existing framework was very effective. 25% claimed that the framework was somewhat effective, 35% did not consider it effective and 13.3% were indifferent or apathetic to the answer.

In regard to the comparative analysis of the systems, 12.1 % of respondents believed that Bangladesh managed e-waste more effectively than other countries, while 69% believed that United States of America had a more effective management system. Further, other 12.1 % believed that both systems are equally effective, while 12.1 % thought none of the systems were effective. Without excluding any demographic, the questionnaire wanted the respondents to elaborate on the forms of electronic devices in their possession. These include 26% respondents owning smartphones, 17% owned laptops, 13% had tablets, 15% were television owners, and 29% had other electronic devices like cassette players and radio recorders. Such findings affirm the conclusion that respondents are not limited to a single electronic device and many possess e-waste, with smartphones being the most widespread.

Regarding the legal, logistical, or financial barriers associated with appropriate electronic waste removal, 15% of the respondents indicated that it was not difficult at all, whereas 8.3% indicated that it was somewhat difficult. 20% found e-waste disposal moderately difficult, 21.7% indicated that it was somewhat difficult, whereas 35% found it extremely difficult. The responses demonstrate that while some people have no obstacles related to e-waste disposal, a larger

proportion of the population appears to be facing issues which stem from the use of informal channels.

The survey shows that there are a number of significant flaws in managing e-waste in Bangladesh. Despite having an understanding, they do not seem to have access to a formal recycling system and depend heavily on the informal sector. There is also grave reluctance towards industries supporting recycling, which stems from the very little knowledge surrounding EPR policies and appropriate disposal of waste. These issues are going to require more public awareness, additional e-waste recycling facilities, more stringent regulations, and rewards for good waste management practices.

Chapter VI – Comparative Study Between the Legal Framework of Bangladesh and United States of America

6.1 Introduction

Because of the quickening pace of technological development, shorter product life cycles, and rising consumer demand, the management of electronic trash, or "e-waste," has emerged as a crucial worldwide concern. The Global E-Waste Monitor 2020 estimates that 53.6 million metric tons of e-waste were produced worldwide in 2019, and this amount is predicted to increase dramatically. If e-waste is not treated properly, it can contain dangerous materials like lead, cadmium, and mercury as well as valuable metals like copper, silver, and gold.

Developed nations have implemented comprehensive regulatory frameworks to mitigate e-waste's impact. The United States employs a combination of federal and state-level regulations, including the Resource Conservation and Recovery Act (RCRA) and the National Strategy for Electronics Stewardship. Additionally, several states have adopted Extended Producer Responsibility (EPR) laws, requiring manufacturers to be accountable for their products' entire lifecycle, promoting sustainable product design, recycling, and proper disposal34.

Bangladesh, facing a rising e-waste problem, lacks a robust regulatory framework. Informal recycling dominates, leading to unsafe disposal techniques that pose serious risks to the environment and human health, like leaching of acids and open fire, which cause severe environmental and health hazards. The government introduced the Hazardous Waste (E-Waste) Management Rules, 2021, but enforcement remains weak due to insufficient oversight, inadequate infrastructure, and limited consumer awareness.

This study compares the legal frameworks governing handling of e-waste in America as well as Bangladesh, examining how U.S. policies, particularly EPR laws, can inform regulatory improvements in Bangladesh.

6.2 The U.S. E-Waste Legal Framework

6.2.1 Federal Regulation

The Environmental Protection Agency (EPA) enforces the Resource Conservation and Recovery Act (RCRA), which was passed in 1976 and regulates the disposal of hazardous waste in the United States. It implements a cradle-to-grave strategy, controlling hazardous waste generation to disposal. Subtitle C of the RCRA

classifies certain e-waste components, like products containing mercury and lead-acid batteries, as hazardous, but consumer electronics remain largely unregulated, creating a regulatory gap35.

34 M Heacock, CB Kelly, KA Asante, LS Birnbaum, ÅL Bergman, MN Bruné and WA Suk, 'E-Waste and Harm to Vulnerable Populations: A Growing Global Problem' (2016) Environmental Health Perspectives

35 R Nuwematsiko, JKB Matovu, D Nabukalu, JC Ssempebwa and AA Halage, 'Knowledge, Perceptions, and Practices of Electronic Waste Management Among Consumers in Kampala, Uganda' (2021) Journal of Environmental and Public Health 1

Due to RCRA's limitations, many states have adopted stricter laws, including take-back programs and landfill bans for e-waste. Discussions continue about expanding RCRA's scope to include broader e-waste categories, improving nationwide consistency and recycling rates.

6.2.2 State-Level E-Waste Regulations

More than 25 U.S. states have passed EPR laws mandating manufacturers to oversee the gathering and disposal of e-waste in order to fill in federal regulatory gaps. In order to finance appropriate disposal and recycling, California's Electronic Waste Recycling Act (2003) levies an Advanced Recycling Fee (ARF) at the point of sale. The Electronic Equipment Recycling and Reuse Act of 2010 in New York mandates free take-back programs, improving collection rates. As per Article 27, Title 26 of the New York Electronic Equipment Recycling and Reuse Act, 2010, manufacturers are required to provide free take-back programs for consumers to promote responsible e-waste disposal. Washington's E-Cycle program has successfully integrated local governments, retailers, and recyclers into a cohesive system 36.

These state-led initiatives demonstrate the effectiveness of EPR in promoting corporate responsibility and sustainable waste management, offering a model for Bangladesh to adopt structured e-waste policies.

6.3. E-Waste Management in Bangladesh: Legal Challenges and Regulatory Gaps

6.3.1 The Administration of Regulations for Hazardous Waste (E-Waste), 2021 Bangladesh's 2021 e-waste management rules represent an initial step toward formalizing waste collection and disposal. However, the law lacks mandatory EPR provisions, leaving manufacturers unaccountable for waste management. Weak enforcement, limited oversight, and a lack of financial incentives for safe disposal hinder its effectiveness. Without government support for formal recycling infrastructure, informal recycling continues to dominate, exacerbating environmental and health hazards.

6.3.2 Informal Recycling and Environmental Risks

Unlike the U.S., which integrates informal recyclers into formal systems, Bangladesh lacks structured policies to regulate, train, and financially support recyclers. The absence of proper disposal facilities results in widespread contamination of air, soil, and water

6.3.3 Compliance with International E-Waste Treaties

Since Bangladesh is a party to the Basel Convention, it is expected to manage the import of e- wastes. Its lack of capacity, however, results in undetected shipments of e-wastes disguised as second-hand electronics. Numerous developed Nations like the United States possess strict export controls to curb the international trade of their hazardous waste, but Bangladesh's lack of monitoring is a cycle violation.

36 Y Zhong and Y Zhao, 'E-Waste Deposit System Under EPR in China' in 2012 International Conference on Service Systems and Service Management (IEEE 2012) 1

Bangladesh would enhance its compliance by implementing tracking systems, increasing the rate of customs inspections, and enforcing heavier fines on illegal e-waste imports.

6.4. U.S. Legal Frameworks and Lesson for Bangladesh

6.4.1 Implementation of Mandatory Extended Producer Responsibility (EPR) Laws

In Bangladesh, manufacturers will be forced by law to set up systems for collection and recycling of their products, which will discourage setting up informal recycling plants, thanks to the already established EPR laws. A shaped charge recovery fee qualifies to fund the national electronic waste management campaign, akin to California Jewry. There should be compliance within the vicinity of spending reports and tax breaks should be provided to boost product design sustainability.

6.4.2 Establishment of Government-Regulated Collection Networks

There should be instruments in place that facilitate appropriate e-waste disposal in all parts of the country. Retailers should act as collection points, and customers should be given rewards for returning outdated electronics. A Tracking system could help waste disposal practices.

6.4.3 Strengthening Legal Enforcement and Compliance Mechanisms

The government of Bangladesh should increase fines levied for unlawful e-waste imports as well as noncompliance with waste legislation. Creating a new E-Waste Compliance Authority (EWCA) would allow more focused monitoring, inspections, and driving corporate responsibility. Border patrols should be made more stringent to identify and block illegal e-waste shipments.

6.4.4 Formalization of the Informal Recycling Sector

They should be brought out of the shadows and into the formally registered workforce with training and funding. Granting e-waste industrial zones for which working conditions are improved would lessen some health threats and increase the ease of recycling. Giving access to more advanced recycling methods would further aid e-waste retrieval.

6.5 Formalization of the Informal Recycling Sector

They should be brought out of the shadows and into the formally registered workforce with training and funding. Granting e-waste industrial zones for which working conditions are improved would lessen some health threats and increase the ease of recycling. Giving access to more advanced recycling methods would further aid e-waste retrieval.

6.6 Expected Impact of These Reforms

These measures could be sufficient to hinder the unlawful disposal of e-waste and expand the gathering rate while mitigating and protecting the environment and the people's health. Improved collection practices could lead to more jobs while boosting the economy and helping Bangladesh integrate into the broader framework of international sustainability. Limitations of Adopting U.S. E-Waste Policies in Bangladesh Adopting U.S. e-waste management laws in Bangladesh presents offers both possibilities and difficulties, requiring modifications to suit the country's economic, infrastructural, and regulatory landscape. The U.S. model, particularly Extended Producer Responsibility (EPR),

digital tracking, and public-private partnerships, has effectively managed electronic waste. However, differences in governance, financial capacity, and the dominance of the informal recycling sector make direct adoption impractical. Instead, a modified regulatory framework incorporating the strengths of U.S. laws while addressing local constraints would be more effective.

6.7 Limitations of Adopting U.S. E-Waste Policies in Bangladesh

Increased employment opportunities, investment prospects, and technological innovation are some of the benefits that adoption of the US E waste management laws and policies can provide. However, severe infrastructural shortcomings, regulatory frameworks, and the overall legal flexibility may serve as a challenge for receiving these benefits, as direct implementation within Bangladesh is simply not feasible. Still, the application of EPR, partnered with public-private collaboration, alongside advancements in digital traceability offers some direly needed IoT in Bangladesh. Undoubtedly, the difference in formalization, financial capabilities, and even differing governances make integration within the region challenging. Instead, a reasonable middle ground would be to create a modified approach which emphasizes the strengths of the US laws while effectively providing solutions to the local constraints.

Commercial enforcement of e-waste regulations in the U.S. is less of a problem than in Bangladesh, where a single body of government manages the nation's waste. The absence of flexibility in e-waste regulations creates greater barriers to region-centric waste management solutions. For instance, applied strategies in Extended Producer Responsibility (EPR) favorable to the United States are unlikely to succeed in Bangladesh due to lacking economic support. Unlike the U.S. where the government and corporations spend substantial funds to make sophisticated recycling systems, not having sufficient waste management facilities and lean financial resources renders Bangladesh a paradoxical challenge. Trying to implement sophisticated digital monitoring systems or large-scale producer-funded recycling frameworks replicating the U.S. model is not reasonably practical. Moreover, the prevalence of imported electronics over domestically produced ones makes it hard to guarantee full compliance to EPR laws. Tight restrictions on informal e- recycling traders would greatly mitigate this challenge, but it would only deepen poverty. Bangladesh is unlike the U.S. that a significant amount of electronic waste is not processed through formal recycling facilities, so another standard that needs to be mitigated is why so much risk is taken without having proper safety measures. In the U.S. informal e-waste trade is strictly regulated in order to enforce international compliance, but extreme measures such as these are a risk of putting numerous people out of work in the process.

6.8 Creating a Modified Model for Bangladesh's E-Waste Management

Figure 1 : Chart for Bangladesh's E-Waste Management

Under these restrictions, blending U.S. policy along with a local strategy is critical. Retrieving an EPR model based on a manufacturer approach on Bangladesh is counter-productive mostly because of its dependence on electronics imports. Importers and retailers in the country should contribute to an e-waste management fund that would allow for local recycling centers, informal recycler training programs, and public campaigns to plastic pollution so the government spends less.

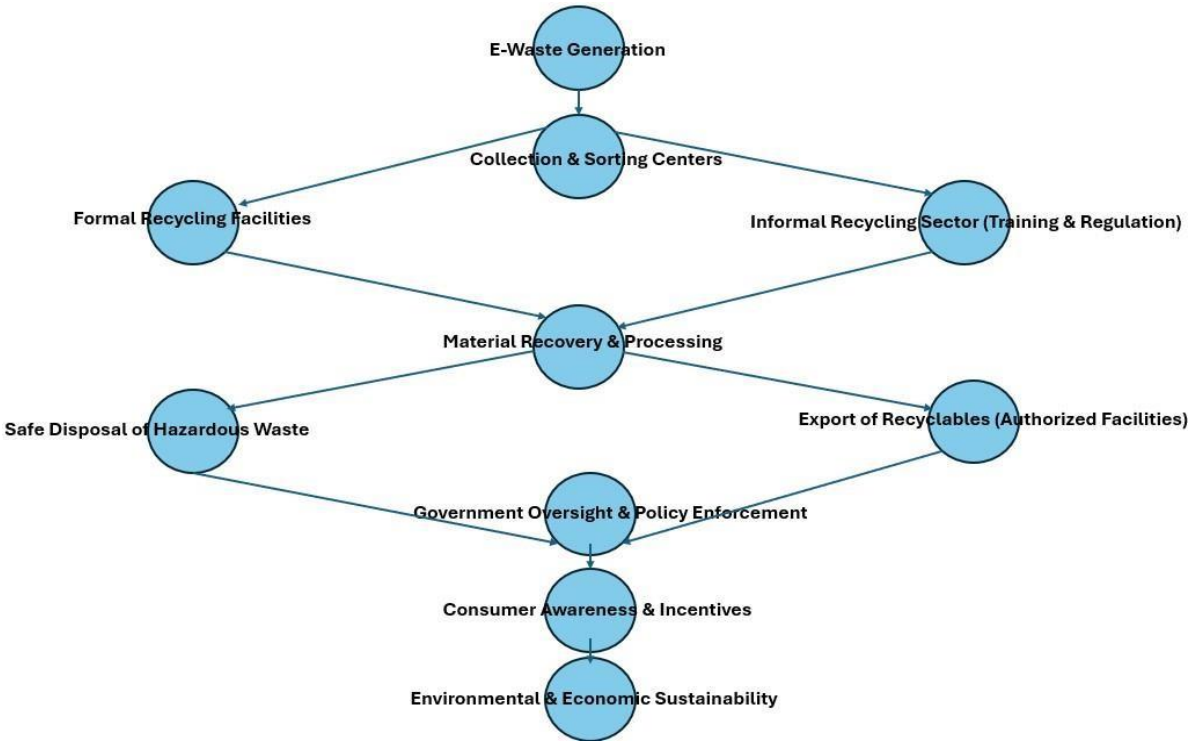


Figure 1: Chart for Bangladesh's E-Waste Management

One of the main changes is that instead of comprehensive tracking systems as applied by the US Environmental Protection Agency (EPA), a cost-effective digital tracking system can be put in place. A barcode-based tracking system will enable importers and recyclers to load e-waste register records of disposal which is cheap within a developing economy

With the aim of formalizing the informal recycling industry, the Bangladesh government should create a licensing scheme for certified recyclers. By ensuring funds, safety equipment, and training materials can ease informal workers into a modern, safer industry without economic shock. Bangladesh, unlike the US model which has stringent laws requiring occupational safety, has to adopt a more supportive approach to integrate informal recyclers to the formal sector.

This adjusted model in Fig. 1 embodies important features including regulated EPR contributions at the point of import, digital tracking, low-cost transition for informal recyclers, etc. The e-waste flow begins at the collection and sorting centers, which service both formal recovery facilities and regulatory trained informal recyclers. Material recovery and processing are performed at the monitored level, hazardous waste is managed within governmental approved sites, while valuable materials are either disposed/hatched out or reintroduced to the local industry. The government supervises the implementation of the policies with the blockchain tracking and restriction rules, while consumers are encouraged to dispose of the resources irresponsibly and get paid for recovery services. This model

encircles the economy within its socio-political confines while ensuring environmental sustainability.

Chapter VII – Concluding Remarks

7.1 Summary of Findings

This research indicates that e-waste management systems in Bangladesh face significant problems, such as poor regulatory enforcement, lack of public education, a weak recycling system, and an unmanaged informal economy. The primary findings are as follows:

(1) Regulatory Weaknesses – The Rules for the Management of Hazardous Waste (E-Waste), 2021 have been enacted to formalize consequences for e-waste regulation. However, these rules are deficient in enforcement mechanisms, financial incentives, and the clarity regarding responsibility of the manufacturers.

(2) Absence of Extended Producer Responsibility (EPR) – Bangladesh does not have any laws like those of California's E-Waste Recycling Act or New York's EPR law that mandates manufacturers or importers to be liable for disposing of electronic waste, thus creating an uncontrolled environmental nuisance.

(3) Bangladesh's E-Waste Management policies are Implementation-Oriented and not Existence-Oriented - There are policies but no enforcement at the ground level. Without enforcement mechanisms, the policies are nothing more than a statement, leaving a vacuum in which informal e-waste shredding prevails.

(4) A Profit-Making Enterprise Rather than an Environmental Conservation Initiative – Unlike nations with effectively managed recycling, Bangladesh views e-waste as a resource to be tapped and scrap dealers and informal recyclers make throwaway profits from a discarded electronic product instead of destroying it in an appropriate way.

(3) No Systematic Design for Determining Producer Responsibility – While most developed nations have programs of recycling, governed by companies, Bangladesh is devoid of legal action and electronics producers are free from any obligation, hence resulting in the need for consumers relying on the least expensive and injurious to environment options.

(4) Permitting Regulations Put Bangladesh in a Position to Import International E-Waste – The open borders with Bangladesh through which used and obsolete electricals from developed countries pour into the market lead to waste electronics in improvised recycling plants. With open border control, Bangladesh's borders are becoming an international hub for piling up e-waste in switches with toxic materials.

(5) Digital Solutions and Technology are Absent from Waste Monitoring – Advanced technology is available with developed countries to monitor the e-waste movement, but no central control center, barcode system of tracking, or even digital facility exists for regulating waste collection in Bangladesh. Therefore, it becomes easy to dump waste illegally.

(6) Public Participation is Non-Existing Due to Lack of Recycling as it is Seen as Added Cost – People in the United States recycle on a regular basis due to incentives that they have, including saved money on fresh electrical devices. The people of Bangladesh feel no incentive to recycle e- waste properly since informal collectors collect it from them or it remains in their houses for many years.

(7) The disposal of electronic waste treatment is aided by the private industry but operates Without Training or Safety – The government's policy to avoid informal recycling is unjust because informal recyclers can be captured by the government and trained in such a manner that legal provisions can be enacted so that adequate safety conditions are offered to these workers to work.

(8] Bangladesh Can't Copy-Paste US Policies- It Needs a Hybrid Approach – Just like Taiwan, Bangladesh can't simply copy US policies without considering differences in socioeconomic and infrastructural dimensions. Solutions involving state-driven efforts combined with financial aid, and increased regulation of the informal sector would make e-waste management more effective and simpler to execute.

7.2 Recommendations

Considering the above, there is a clear potential for adopting best practices from state laws in the United States and combining them into a unique comprehensive legal reform to address e-waste management. Here's how we suggest the legal framework looks like:

(1) Adopting Legal Policies

It is advised that Bangladesh enact EPR laws similar to those found in the California Electronic Waste Recycling Act, which impose financial obligations on importers and producers to cover the costs of product collection, recycling, and disposal. Additionally, taking an idea from the Electronic Equipment Recycling and Reuse Act of New York,, retailers should be mandated to buy back or collect old electronics from consumers. A minimal-based environmental fee should be applied at purchase to assist with e-waste management at a Californian province's level.

(2) Capturing Legal Enforceability and Compliance Gaps

Similar to the American Environmental Protection Agency (EPA), there is a need for an e-waste compliance authority in Bangladesh to monitor waste disposal, enforcement of penalties, and recycling

activities of registered companies. Strict customs controls must be put in place to stop the influx of e-waste into Bangladesh by outsourcing. Businesses breaching e-waste import controls should be subject to more severe financial penalties. In addition, following the U.S. precedent of digital monitoring, a barcode-based e-waste tracking system may be used to guarantee that electronic waste is safeguarded when being disposed of.

(3) Merging the Informal Waste Sector with the Formal Economy

Informal recyclers should be educated, registered, and subsidized to enhance waste management safety, which is in accordance with OSHA standards. Setting up industrial centers for recycling e-waste by employing informal workers into formal positions to minimize dangerous activities.

Providing microfinancing alongside government funded awards for private sector engagement in transforming e-waste recyclers.

(4) Improving Consumer Education and Involvement

In cooperation with state-sponsored programs, it is recommended to raise social media, school, and workplace responsibility in recycling through campaigns. Utilizing the eRecycle model, it is advised to give money after purchasing the new product for turning in older electrical appliances which include credits towards other purchases. It is also suggested that the collection points for e- waste in the form of kiosks with QR Codes placed in the center of cities so consumers can earn bonuses instead of points for waste disposal.

(5) Promotion of Circular Economy Strategy Towards E-Waste

It is recommended to offer tax relief to businesses where green materials are used or advanced engineers are hired to make longer lasting products. Create a national push wherein repair services that are modelled on the United States economics of repair are encouraged for electronic devices. Work with private sector technology companies and educational institutions in developing and financing novel approaches for e-waste management.

(6) Enhancing Compliance with International E-Waste Treaties

It is proposed to enhance inspection and monitoring at ports of entry to deal with e-waste stockpiling in the country, implement laws on e-waste in a particular country in line with OECD EPR 2016 guidelines for better global participation and collaborate with other countries in South Asia to formulate subcontinental policies on e-waste for establishing common facilities for recycling and disposal.

7.3 Conclusion

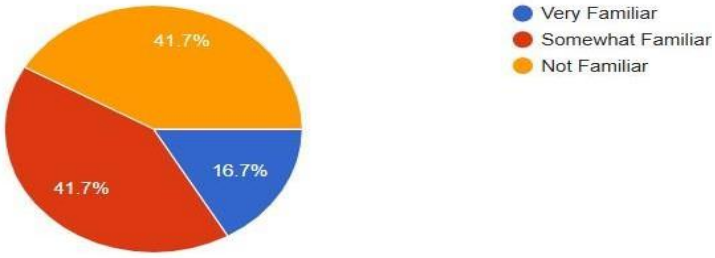
The outcome of this research shows the current managing e-waste framework in Bangladesh is incapable of meeting the new demands posed by emerging technologies and the increasing volumes of electronic waste. While the 2021 hazardous waste (E-Waste) Handling Rules are a good place to start, the lack of adequate enforcement, collection infrastructure, and Extended Producer Responsibility (EPR) policies prevents effective e-waste management. The objective of this project was to determine whether Bangladesh's legal framework is sufficient, analyze its international comparability, and investigate what elements of the U.S. model legal system could be used in Bangladesh. The analysis reveals that the US EPR model cannot be adopted in its entirety, but the bottom-up policies for EPR in some states, along with their collection and compliance regimes, offer valuable lessons for changing the practices in Bangladesh. The study's main goal was investigating if the existing legal structure of Bangladesh is sufficient to manage e- waste effectively. The study determined that while there are some legal provisions, the law's execution is poor, which results in uncontrolled informal recycling, environmental damage, and health risks to workers dealing with toxic waste. Moreover, people's understanding of suitable disposal techniques and recycling activities is limited, which worsens the situation with waste management. In contrast to the U.S, where money is a great motivator for responsible disposal, there are no such benefits in case in Bangladesh for consumers or producers to be involved in a developed e-waste management system. Another objective was to analyze and collate the legal structures of Bangladesh and the U.S. while identifying aspects that can be incorporated into the former. The results show that EPR measures enforced in states like California and New York have greatly enhanced e-waste recycling of the electronic manufacturers by making them responsible for the disposal. With the introduction of an EPR model tailored specifically for Bangladesh where importers and retailers pay into a governmental fund for e-waste recycling, may generate positive financial outcomes for e-waste management. Also, the setting up of government-supported collection networks would enable more organized disposal that lessens the need for informal solutions. Moreover, establishment of a system of providing licenses to recyclers would formalize informal waste handlers and strengthen enforcement of safety and environmental rules. Such companies like JR Enterprise, who are genuinely engaged in e-waste recycling in Bangladesh, can act as role models for formalizing informal recyclers into an organized system with improved safety and more efficient handling of wastes. Nonetheless, giving Bangladesh the same policies as the U.S is ineffective due to its developmental and economic limitations. A better answer would be to adopt a middle ground approach by using parts of the U.S. EPR legislation, Experiments with e-waste tracking. Offering e-waste dismantlers formalized status, reasonable consumer subsidies, and the sponsorship of informally operating e-waste recyclers. The study sought to investigate how well Bangladesh meets the qualitative international frameworks on electronic waste, specifically the Basel Convention on the international transportation of dangerous wastes of 1989. The results suggest that although Bangladesh is a signatory, gaps in the implementation of the convention ratification enable the illegal entry of hazardous e-waste under the guise of second-hand electronic goods. More robust border control and stricter customs regulations are required to stem the tide of Bangladesh becoming a foreign e-waste dumping site. Furthermore, domestic policies matching OECDs guidelines on extended producer responsibility would improve international compliance and foreign investment in e-waste management in Bangladesh. Consequently, while Bangladesh cannot take the approach to the direct United States e-waste policies, it must change to a more thoughtful blended approach that considers local contours but retains the essence of global best practices. The research acts as blueprint strategies for policy implementation that transform Bangladesh's e-waste management system to one that is environmentally safe and economically viable. The amalgamation of regulation, technology, and economics will assist Bangladesh in building an orderly and responsible e-waste management system

Appendix

1. Awareness of E-Waste Regulations

o How familiar are you with the legal and regulatory framework governing e-waste management in your country?

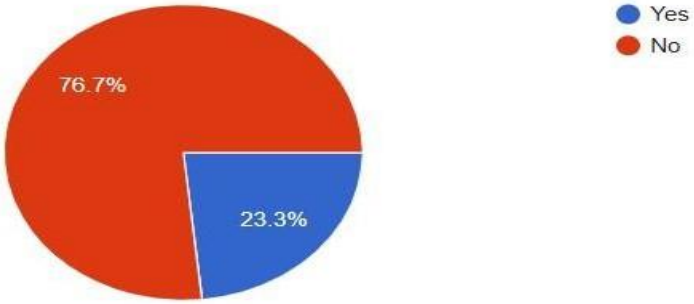
- ☐ Very familiar
- ☐ Somewhat familiar
- ☐ Not familiar



2. Knowledge of Recycling Facilities

o Are you aware of any designated facilities or institutions for e-waste recycling in your locality?

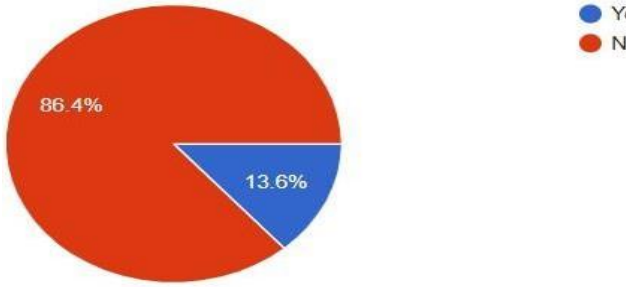
- ☐ Yes
- ☐ No



3. Participation in Recycling Programs

o Have you ever participated in an official e-waste recycling or disposal program?

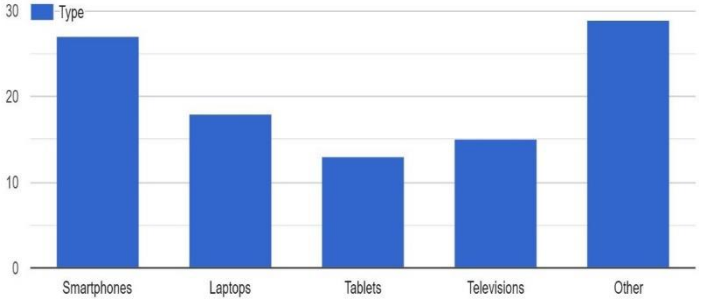
- ☐ Yes
- ☐ No



4. Types of Electronic Waste Recycled

o What types of electronic waste do you currently recycle? (Select all that apply)

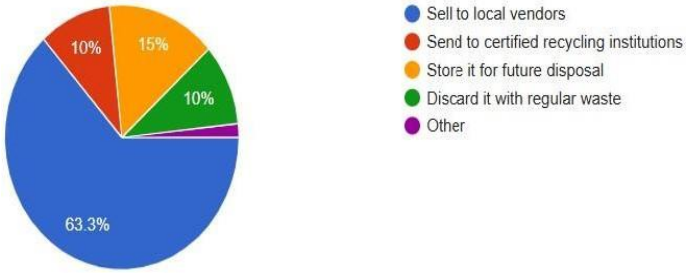
- ☐ Smartphones
- ☐ Laptops
- ☐ Televisions
- ☐ Other (please specify)



5. E-Waste Disposal Methods

o How do you usually dispose of e-waste generated in your household?

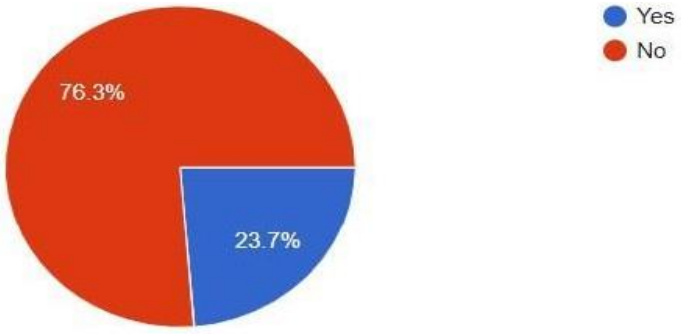
- ☐ Sell to local vendors
- ☐ Send to certified recycling institutions
- ☐ Store it for future disposal
- ☐ Discard it with regular waste
- ☐ Other (please specify)



6. Awareness of National and International E-Waste Regulations

o Do you know if your country has any appropriate national or global handling of electronic waste regulations?

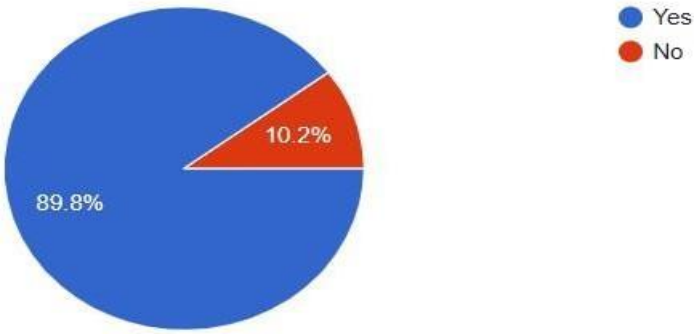
- ☐ Yes
- ☐ No

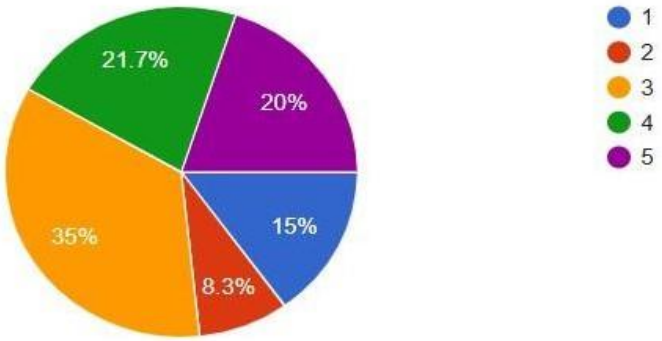


7. Manufacturer Responsibility for E-Waste

o In your opinion, should electronic manufacturers bear legal accountability for their products' appropriate recycling and disposal?

- ☐ Yes
- ☐ No

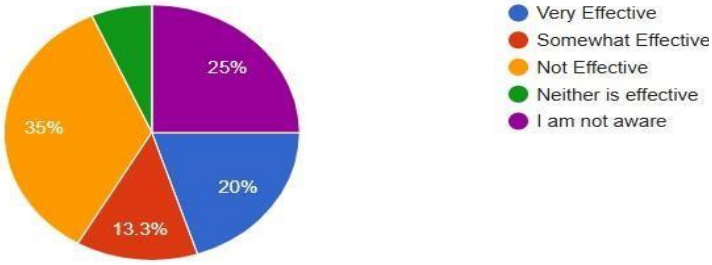




8. Effectiveness of Existing E-Waste Regulations

o How does your nation's current legal framework govern the treatment of e-waste?

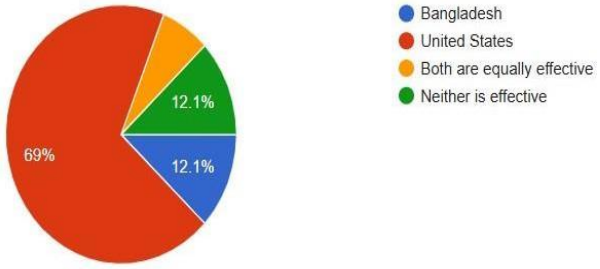
- Very effective
- Somewhat effective
- Not effective



9. Comparison of E-Waste Management Systems

o In your view, which country has a more effective e-waste management system?

- Bangladesh
- United States
- Both are equally effective
- Neither is effective



10. Barriers to Proper E-Waste Disposal

• On a scale from 1 to 5, how difficult is it for you to appropriately get rid of e-waste

• due to legal, logistical, or financial barriers? (1 = Not Difficult at All, 5 = Extremely Difficult)

Acknowledgement

I would like to express my sincere gratitude to great environmental researcher Dr. S M Nazmuz Sakib for his invaluable guidance and unwavering support throughout this research. His profound knowledge, insightful suggestions, and consistent encouragement have been instrumental in shaping this study. Dr. Sakib's expertise in the field of e-waste management and his thoughtful advice on legal frameworks significantly enhanced the quality and direction of this work. I am deeply grateful for his mentorship and for the time and effort he dedicated to this project. Without his support, this research would not have been possible.

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