



E-Waste Disposal in India: Challenges and Constraints

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E-waste is one of the fastest growing waste streams in India. Globally, the hazards of improper waste disposal are well known and literature indicates that this awareness level is increasing in India. The major constraint is that the disposal and recycling activities in developing countries are handled mainly by the informal sector where the lack of regulation threatens the health of the people working in this sector and poses significant environmental hazards. Rudimentary techniques are followed to extract reusable materials. Legislative loopholes are exploited by the developed nations to export their e-waste to developing countries in Asia and Africa. Rapid obsolescence is another factor driving the ever-increasing quantities of e-waste being generated. In the Indian context, we have identified that the lack of formal recycling facilities to handle the e-waste is a major constraint. Studies have indicated that regulating the informal sector will address these constraints significantly, as well as provide employment opportunities. Gaps are identified in the Indian context in terms of policies as well as the infrastructure required. Solutions to address these gaps are developed in terms of policy changes, improvements in the existing infrastructure as well as suggestions are identified to address the ever-increasing amounts of e-waste being generated.

Keywords: E-waste; E-waste policy; Recycling Techniques; Waste Management; E-waste economy; Waste Electrical and Electronic Equipment (WEEE).

Introduction

The electrical and electronics industry is one of the fastest-growing industries worldwide. Amongst the various devices that constitute this sector, consumer electronics is growing at the fastest pace. Rapid technological changes, cost-effectiveness and miniaturization of the components have led to shorter life cycles for electronic products (Cucchiella, et al., 2015). Combined with rapid obsolescence due to technological breakthrough, there has been an exponential increase in the quantities of waste being

generated (Cucchiella, et al., 2015), (Dwivedy, et al., 2012)

Broadly, electronic waste (E-waste) defined as end of life electronic equipment which has been disposed of by their original users (Cucchiella, et al., 2015). The disposed e-waste finds its way to landfills and/or to improper disposal units. Enforcing quintessential management practices and techniques ensures that e-waste generated serves environmental, social and economic benefits. The need of the hour is to have dedicated and formalized practices in recycling the waste generated to reduce the environmental burden (Cucchiella, et al., 2015). It is estimated that 20-50 million tons of e-waste are generated annually, and 75-80% of this is shipped to Asia and Africa for processing and recycling. In the United States alone, approximately 80% of the waste generated is either unofficially exported, finds its way to

landfills or is incarcerated (Perkins, et al., 2014) According to ASSOCHAM, an industrial body in India, e-waste is growing at a Compound Annual Growth Rate (CAGR) of 30%. With changing consumer behavior and rapid economic growth, ASSOCHAM estimates that India will generate 5.2 million tons of e-waste by 2020. (Cucchiella, et al., 2015)

In the past few years, the awareness towards environmental protection has gained momentum. Technological innovation and advances, scholarly research, media outreach and most important reforms in international and environmental law have reformed the global waste management landscape.

Despite these efforts in the policy front, national and international regulations have failed to comprehend the dual nature of waste as a phenomenon which encompasses the structure of global perception and movement of waste. From an economic standpoint, waste is a free trade commodity which generates value. whereas from an environmental perspective, it is a nuisance which has been part of the periphery of legal language and policy comprehension.

Over the last three decades, there have been numerous conventions and regulations aimed at reducing global production and circulation of waste. The correlation between the regulation and the global waste reduction has not been mapped. But the growth of the circular economy of E-waste is increasing drastically (Hoorweg, et al., 2013) NASDAQ predicts the emergence of a global multi-billion-dollar (\$1,296 billion) solid waste management market between 2017 and 2022. (newswire, 2017)

To summarize, overall global growth of the waste economy parallels the intensification and densification of international environmental and legal apparatus designed to regulate and mitigate waste production and flows. In this paper, we explore the dual nature of consideration for E-Waste from Legal & Policy perspective orientation, followed by the socio-economic view of E-waste on a global landscape to better understand how this translation is creating avenues for economic exploitation of e-waste economy in India

2. Methodology for the Study

This study relies on literature documenting the adverse effects of waste. Based on literature research as well as legal policy documents studied, we have attempted to highlight different perspectives, which are being considered by policymakers and contrasting this with how economic stakeholders view it. We have also focused on legal literature and policies pertaining to management of E-waste in India and attempted to contrast it against the global benchmark for E-waste management - Basel Convention. We have mapped this understanding of Basel convention against the global scenario of e-waste management in Indian context. Our approach explored the driving forces that act as policy shortcomings which has enabled the rise of e-waste economy in India

3. Dimorphic view of waste

Oxford dictionary defines waste as “of a material, substance, or by-product eliminated or discarded as no longer useful or required after the completion of a process.” or “Unwanted or unusable material, substances, or by-products.” (waste definition lexico)

This understanding based on the value system of each country impacted by the socio- economic conditions leads to waste generation. The item considered waste by developed nations could be a useful entity to the developing nations. The international law does not have a general definition for waste. Existing definitions are convention-based and subject- specific. They provide very little in terms of conceptual or theoretical understanding of waste as a legal object (Environmental law). Correspondingly, the economic insights are equally varied

Legal outlook

From the legal considerations, each convention and/or regulation utilizes very traditional and conventional structure for classification that is towards Hazardous, Nuclear, Shipping, Land and Oceanic. These are compartmentalized in specialized segment and categories, which makes it difficult to develop an understanding of how international environmental laws and electronic waste are interrelated.

International Law has an equivocal definition of waste, drawn from the general understanding of waste as a “substance” or “object” to be “disposed of”. (convention, 1989) (Bamako, 1991) (Convention, 1995)

In continental civil law, a disposable object may be synonymous to an abandoned object. However, in English common law, what can be “disposed of” includes the selling for gain, which subjects the disposable object to mercantile trans-

actions and economic exploitation. (Sadeleer, 2006) which is the most generic view of waste.

Economic outlook

The economic definition of waste is the disposable residue of activities having a negative value to be externalized by the market which in turn converts into a positive value. (Laffont). As such, this definition encompasses a variety of material realities from air pollution, household trash, and industrial waste, to mining residue, organic debris, and so on. Most of these categories are externalized by market mechanisms, such as the carbon trade exchange, bio-methanation plants, and the global multi-billion-dollar recycling sector.

Insights of the dimorphic view

Once the economic definition of waste is accepted, we see most conventions on the protection of the environment and the reduction of pollution act as lustration tools for global distribution and management of disposable waste. By including “improper” objects within the boundaries of economic activity, law allows the circulation of waste as an object to be disposed of, without determining its very nature. Waste, therefore becomes a crucial fuel in driving economic empowerment of stakeholders who wish to capitalize on it and places the emphasis on the global recycling industry. This is accomplished by converting the negative value of waste to be externalized into positive value or as a commodity to be internalized by the global recycling industry.

4. Basel Convention

During the 1970s and 1980s, an increasing awareness of the negative impacts of hazardous waste on human health and the environment led to a proliferation of legislation relating to waste disposal in developed countries (RCRA, 1976) (CERCLA, 1994) (A. Webster-Main, 2002). The resulting decrease in the availability of disposal sites and increase in disposal costs led to an upsurge in exports of hazardous waste to countries in the developing world which lacked strict controls on waste disposal. (RCRA, 1976). A number of disasters have highlighted the dangers of this growing trade, leading to public outcry and an international campaign by environmental NGOs to ban the international trade in hazardous waste (Adeola, 2001)

Negotiations towards an international treaty aimed at regulating the trade in hazardous waste began in 1989 and concluded on 22 March 1989 with the signing of the Convention by 35 states in the city of Basel, Switzerland. (basel)

The convention, since inception, has been attempting to conciliate nations which want to ban trade of waste, hazardous or otherwise and those that wish to utilize the wasteful tendencies of developed countries to function. Environmentally conscious countries and environmental NGO's are pushing towards development of waste management practices which force countries to manage waste internally and not export to developing countries. This view heavily opposed by developing countries like India and Taiwan, along with many non-European countries which believed that a total ban would not be an optimal solution to solve economic or environmental concerns that have arisen due to waste. The Convention achieved a compromise between these two positions by regulating rather than prohibiting trade in hazardous waste. (1989)

Aims of the convention

The Convention sets out three key aims, based on a recognition of the threat posed by hazardous waste to human health and environment: (Kummer, 2002) First, a reduction in the amount of hazardous waste generated; Second, a reduction in the amount of trans-boundary movements of hazardous waste; and Third, the promotion of the ‘environmentally sound management of hazardous waste’. (Rafia, et al., 2013) Environmentally sound management (ESM) is defined as ‘taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes. (Kummer, 2002)

Key Provisions of the Convention

The Convention places a complete prohibition on trade-in hazardous waste between parties to the Convention and non-parties, reinforcing the sovereign right of any party to prohibit the import of hazardous waste. In order to achieve the Convention's objective of minimizing the trans-boundary movements of hazardous waste, the Convention requires that such movements only be allowed where the exporting state does not have the technical capacity and suitable

disposal sites, or where the wastes are required by the importing states for raw materials, for recycling or recovery industries

The trade between the parties must be carried based on Prior Informed Consent (PIC) procedure and in compliance to the Environmentally Sound Management (ESM) principles. Both the parties must agree upon the nature of the waste by notifying the other in writing. Competent authorities must verify the nature and content of the waste being transported based on the notification which contains complete details on the nature of the waste being transported trans-boundary.

5. Socio-Economic Impact of E-Waste

Our study indicated that e-waste handling in Asian countries is primarily carried out in the informal sector. In countries such as China and India, the informal sector also provides a livelihood to people. The operating conditions in the informal sector poses a significant threat to environment and health of the people employed. Globally, a major constraint pertaining to e-waste disposal is that commercialization opportunities are frequently overlooked; this needs to be addressed on an international scale since resource use and depletion have an effect on a global scale (Wath, et al., 2011) Addressing the e-waste issue in India previously was a major concern; however, the E-Waste Handling and Disposal Rules, 2011, which is loosely based on the EPR framework. (Garlapati, 2016) (Bhaskar, et al., 2017) has identified that Extended Producer Responsibility (EPR) to be the most appropriate framework to handle e-waste generated. The principles of EPR promote environmental friendliness in design, encourage cleaner production processes and ensure that products are designed for longevity. (Garlapati, 2016) EPR also mandates manufacturers to factor in disposal costs at the design stage itself. Many Asian countries are taking proactive steps towards implementing principles of EPR; EPR in China is legally enforced since 2011, South Korea since 2013 and Vietnam has mandated it only recently. Due to a lack of systemic inventory mechanism, the quantities of e-waste generated in India is not readily available (Bhaskar, et al., 2017)

Studies indicate 23% of the e-waste generated globally finds its way to 7 countries in Asia and Africa. Exporting e-waste to developing countries in Asia and Africa is a “win-win” situation to the EU and the United States. (Perkins, 2014) Only 25% of the e-waste generated in Europe is recycled in formalized processing plants, where the workers are protected by industry standards. High labor costs and stringent environmental regulations are the major factors driving the illegal export of e-waste. Importing these wastes generated also leads to some short-term economic benefits in the recipient countries. Frequently, primitive techniques are employed to extract valuable resources from these wastes. Some of these practices include:

- Physical dismantling using hammers, chisels, and screwdrivers.
- Melting plastics without using proper ventilation or taking any other necessary precaution.
- Burning electrical cables in open pits, at low temperatures to extract copper.
- Using open-pit acid baths to recover gold and other precious metals.

These practices lead to improper working, living and health standards of the people employed in places that follow these practices.

Illegal export of e-waste takes place despite legal enforcement, such as the Basel Convention which has been in effect since 1989. The treaty has been ratified by 181 countries worldwide. However, developed nations exploit legal loopholes in this treaty to continue exporting e-waste to developing countries.

In the absence of a formal inventory system, it is not possible to determine the exact quantities of e-waste generated in India. This issue assumes larger proportions since India is among the favored destinations for the west to discard their e-waste (Bhaskar, et al., 2017). Most of these wastes are processed by the informal sector and determining the exact quantities of e-waste that is exported to India in such a scenario is a challenging task. (Perkins, 2014), (Bhaskar, et al., 2017).

A common theme across Asia and Africa is that most of the informal e-waste recycling facilities are often home-based and family-run. It is estimated that annually New Delhi region in India annually recycles 10-20,000 MT of e-waste, providing a source of livelihood to approximately 25,000 people. As of 2013, there were only 23 recognized recycling

facilities that were set up in India. (Dwivedy, et al., 2013) The informal network accounts for approximately 95% of the recycling activities in India and regulating this industry can provide a regular source of employment to thousands.

6. E-Waste Disposal in India

The issue of E-waste in India arose only after the economic liberalization in the 1990s. One of the biggest issues pertaining to e-waste management in India is the lack of a methodology which can address the increasing quantities of e-waste generated. Currently available literature points towards segregation, recycling, and recovery as the efficient techniques towards e-waste recycling. The largest gap in India is due to the absence of a formalized system to handle e-waste in a scientific and environmentally sound manner. Being rich in ferrous metals, non-ferrous plastics, and precious metals, scientific recycling of e-waste presents a major business opportunity.

India has implemented regulations in 2012 to address the ever-increasing quantities of e-waste being generated, which is periodically reviewed with the most recent revision in 2018. The challenges get compounded due to the fact that e-waste from developed finds its way to India even today and most of the recycling activities are carried out in the informal sector. The major loopholes in the Basel convention and the local legislations observed are discussed in detail below

The Prior Informed Consent (PIC) Procedure

The Basel Convention places the responsibility of reporting exact nature of the waste being transported lies with the local authorities who share the PIC notifications. In many of

the cases, it has been noticed that illegal or out of scope exports are carried out under false pretenses and are carried out by willfully misclassifying the waste as “used goods”. (Garlapati, 2016)

The second factor which allows trans-boundary trade by exploiting the PIC mechanism is falsification of adequate facilities and infrastructure to optimally process the incoming waste. For developing countries where the local industries rely on imported waste as an economic driver, countries might willfully falsify PIC record

There also exists a possibility of countries receiving the waste and not having technological and technical expertise to ascertain the nature of the waste which might be optimally processed at its facilities.

Lack of required technological infrastructure

E-waste in India is handled mainly by the informal sector which consists of vendors, scrap dealers, dismantlers and recyclers. It is also seen that in the informal sector, there is a distinct lack of technical or infrastructural ability to handle the waste generated, as well as little knowledge pertaining to the implications of improper e-waste disposal on human and environmental health (Wath, et al., 2011), (Dwivedy, et al., 2012) (Dwivedy, et al., 2013)

The informal sector is characterized by the presence of an unregulated, large scale informal recycling network where the recycling techniques are at best, primitive and pose a hazard to the environment and human health. (Perkins, 2014) Though the e-waste is imported to be processed in designated facilities, it is generally forwarded to this recycling network due to cheaper labor and lack of processing capabilities to meet the growing demand.

In many instances, the complexity of the e-waste prevents scrap dealers to dismantle individual components to maximize the recycling efficiency leading to improper management and residual non-process able waste.

The Compliance Committee

Current legislation in India does not explicitly specify the responsibilities of the manufacturer or the end-user. Currently, the Ministry of Environment and Forests (MoEF) is responsible for developing legislation pertaining to waste management in India. Collection methodologies currently practiced in India include segregation, recovery, and recycling. The lack of a proven, standardized and scientific process to collect, segregate and recycle e-waste is a massive issue that needs to be addressed before it reaches alarming proportions (Wath, et al., 2011). The current legislation in India does not have any provision for handling e-waste. (Dwivedy, et al., 2013) This has resulted in a significant gap pertaining to a systematic and scientific method to collect the e-waste generated for recycling and refurbishment (Wath, et al., 2011)

Even though India brought Basel convention norms into force in 1992, it has numerous exceptions which allow India to import a wide variety of waste. The corruption of management committees and competent authorities can also create advice scenarios where hazardous waste may be categorized as acceptable waste for certain industry usage

Failure to Establish a Liability Mechanism

It can be noted that a majority of consumers in India are unaware of safe disposal practices. It was also seen that in Mumbai, most of the e-waste was disposed of along with the regular waste. This indicates that more than developing policies to address the e-waste issue, the need of the hour is to build awareness at grassroots level amongst consumers about the hazards of improper e-waste disposal. (Borthakur, et al., 2017)

Producers are not legally mandated to be responsible for the waste generated; moreover, it is not very convenient for consumers to deposit their waste at formal collection centers, which may be located far away.

ASSOCHAM has estimated that only 1.5% of the e-waste generated is processed by the formal recycling industry. This presents huge opportunities in the recycling sector. Currently, India is the fifth largest generator of e-waste annually, with an approximate annual generation of 2.7 million tons (base1)

Similar cases are also observed in imported waste where improper handling of e-waste at the source results in existence of contaminants which make the recycling process futile.

The Recycling Loophole

Since the phenomenon of exporting wastes from developed countries to developing countries arose a few decades ago, there have been recorded studies which indicate positive and negative aspects of trans-boundary waste management

This issue gained significance when hazardous waste was also being exported to be dumped in developing countries without much consideration to impact it would have on the countries which accept them. The impact of processing e-waste in term of environmental pollution and human health cannot be quantified. It has been observed that any efforts to restrict or ban e-waste by one region, encourages other regions to try monetizing the opportunity. This just shifts the issue rather than solving it. (Shinkuma, et al., 2009)

It is also observed that many countries including India import e-waste by illustrating the intention of “recycling” the waste, but after being flown through the informal recycling network they end being dumped in landfills or incinerated. As stated earlier as well, the lack of proper processes and technology, the recycling process also produces wastes which adversely affect the health of the workers at such recycling plants and also pollute the immediate environment.

7. Conclusion

It is difficult to assess the success of the policies proposed by the Basel convention because of significant of both legal and illegal trade. The most critical weakness of the convention is that the definition of waste is limited to ‘substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law’. It opens up avenues for any form of waste being labeled as waste, which can be used to create economic value.

A rough estimate indicates that over 80-85% of e-waste generated finds its way to landfills or is exported to developing countries in Asia under various pretenses, violating the norms of Basel convention. This waste trickling through informal recycling networks, though tries to extract most economic gains from the e-waste generally harm the persons managing the waste and also pollute the environment. The lack of technological infrastructure, callous

nature of the waste producers, and economical reliability on value extraction of e-waste creates a recycling loophole which is difficult for developing countries to escape.

There is a need to establish a proper recycling system in Asia. The system can be developed in lines with the disposal systems employed elsewhere in the world such as RoHS (Return of Hazardous Substances) practiced in Europe and EPR practice in South Korea to effectively address the e-waste issue. Such a system would allow the countries to formalize the informal sector dealing with the recycling of the electronic waste. A joint effort is needed by all countries to come together and address this issue by developing a mutually agreed-upon framework to minimize environmental damage, so that the collective risk in the region is minimized without pushing the liabilities on limited excluded parties.

8. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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