

# E -Waste Legislation in India: Study and Comparative Analysis

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**Abstract:** This paper aims at subjective and comparative study and analysis of the existing laws and rules that govern management and handling of electronic waste in India. The assessment and scrutiny of the shortcomings of the existing policies governing electronic waste management in India are done and feedbacks and suggestions have been presented by doing a gap analysis with respect to European practices of electronic waste management so that the contemporary laws can be bolstered and augmented. In this study, the regulatory framework for hazardous waste management with a focus on electronic waste management in the country is elaborately and comprehensively understood and reviewed in proper perspectives to help policy makers, scholars and final authorities develop an environmentally sound management system by identifying the limitations of the existing rules and laws. The required cover ups and measures are also suggested based on the gap analysis between the policies in India and Europe.

**Key words:** rules, import, informal, disposal, hazardous

## Introduction

Due to increasing purchasing power and modernization of lifestyle, the growth of electronic waste (E waste) has been tremendously high in India since it has emerged as a giant in the information technology (IT) arena. The threat of the amount of accumulation of E-waste in India can be felt by the fact that it is estimated that by 2020, only Desktop personal computers (PCs) in India can amass 32511 metric ton of waste<sup>1</sup>, while the rapid increase in the number of consumers of Laptops, Televisions, Tablets and Mobile phones, on the other hand will be generating the estimated 241500 metric ton Ewaste in 2020. Environmental management of hazardous waste has become a major concern in India a haphazard dumping of hazardous waste results in severe environment contamination. The presence of toxic elements like lead, mercury, arsenic, cadmium, selenium, hexavalent chromium and flame retardants beyond permissible and tolerable quantities make E-waste hazardous in nature<sup>1</sup>. The adverse effects of hazardous wastes as well as the significant potential risks posed by them to the life and its supporting systems are increasingly recognized<sup>2</sup>. There cent laws have proved competent enough to channelize there cycling sector there by making it an industry. The aim of this paper is to subjective lyanalyze the merits and demerits of current Ewaste laws in India and identify their shortcomings which are no helping effective and efficient management and handling of Ewaste in India. The European model of Ewaste management is also studied in view of a comparison with the existing laws in India. Subsequently, a

Gap analysis between the laws of the two lands is carried out with the motive of inheriting est practices from Ewaste handling in Europe in India. The laws governing Ewaste management in Europe being considered as a deal in this paper are analyzed to identify loopholes in Indian scenario and adequate measures are suggested to rectify them, thereby presenting a holistic approach government should take while in ducting provisions in current laws and introducing new schemes and rules to make Ewaste laws in India more effective. Several initiatives are also suggested to government which could prove instrumental in taking Ewaste management in India to a much higher level.

### a. Current Practices in India

Ewaste in India starts flowing from informal collection and dismantling which includes scrap dealers who collect end of life waste electrical and electronic equipment (WEEE) from households, offices, educational institutes and corporate sector and sell them to dismantlers and recyclers which are generally unauthorized. The re is no organized mechanism for collection, logistics and safe disposal of WEEE. In India the fact is that the informal sector constitutes majorly in Ewaste dismantling because of the deep rooted informal collection system. On the other hand, the informal sector is yielding a depressingly low percent age of precious metals after extraction even after employing harmful and dangerous methods for dismantling<sup>3</sup>. Harmful processes such as burning and leaching are employed in order to extract metals from the E waste, particularly the printed circuit board (PCB)<sup>4</sup>. The methods of salvaging

material from circuit boards drawn from monitors, central processing unit (CPU), discs, floppy drives, printers etc. are highly destructive as they involve heating and open burning for extraction of metals. Toxic chemicals are used to recover valuable metals such as gold, silver and copper from the PCBs. The most dangerous form of burning E waste is the open-air burning of plastics in order to recover copper and other metals<sup>5</sup>.

Disposal of Ewaste in India is carried out through and filling and incineration. The land fill sites are always found to be contaminated and a change in the nature is observed pertaining to leaching behavior of metals<sup>6</sup>. The incineration leads to emission of substances escaping flue gas cleaning and the large amount of residues from gas cleaning and combustion<sup>7</sup>. The formal sector comprises of government authorized agencies or companies which are supposed to collect, recycle and dispose the E waste in an environment friendly way. The registered recycling units use proper equipment and provide a safe and healthy environment for workers, ensuring safe and sound recycling and disposal. As most of the E waste is channelized to the informal sector, the formal sector is facing the problem of not having sufficient input material<sup>8</sup>. The waste. Incineration plants contribute significantly to the annual emissions of cadmium and mercury<sup>9</sup>. Man-made emissions of cadmium either from the manufacture, use and disposal of cadmium containing products like nickel-cadmium batteries, cadmium pigmented plastic, cadmium stabilized polyvinyl chloride (PVC) products, cadmium coated ferrous and non-ferrous products, cadmium alloys and cadmium electronic compounds present in electrical and electronic equipment (EEE) are the cause of environmental pollution<sup>7</sup>.

#### **b. Government set up**

In India, the Ministry of Environment and Forests and Climate Change (MoEF&CC), is the nodal agency for planning, suggesting, monitoring and regulating the environmental programs including management of E waste. It is the national authority responsible for legislations regarding waste management and environmental protection. The management of E waste is covered under the Environment and Forests Hazardous Wastes (Management and Handling) Rules 2008. The Central Pollution Control Board (CPCB), India has released guidelines during 2008 for environmentally sound management of E waste, which apply to all those who handle the E-waste<sup>10</sup>. An exclusive notification on E-waste (Management and Handling) Rules, 2010 under the Environment (Protection) Act, 1986 was notified to address the safe and environment friendly transporting, storing, processing and disposal of E waste. The Central Government hereby makes the following rules, namely E waste (Management) Rules, 2016, which come into force from the 1.10.2016<sup>11</sup>.

These rules are applicable to every manufacturer, producer, consumer, bulk consumer, collection centers, dealers, E-retailer, refurbisher, dismantler and recycler involved in

manufacture, sale, transfer, purchase, collection, storage and processing of E waste or EEE listed in Schedule I, including their components, consumables, parts and spares which make the product operational. These rules shall not apply to - (a) used lead acid batteries as covered under the Batteries (Management and Handling) Rules, 2001 made under the Act; (b) micro enterprises as defined in the Micro, Small and Medium Enterprises Development Act, 2006 (27 of 2006); and (c) radio-active wastes as covered under the provisions of the Atomic Energy Act, 1962 (33 of 1962) and rules made there under<sup>11</sup>.

The E waste (Management) Rules, 2016 mandated CPCB to prepare guidelines on implementation of E waste Rules, which include specific guidelines for extended producer responsibility and random sampling of EEE for testing of RoHS parameters also. The E waste Management Rules, 2016 will now also apply to Compact Fluorescent Lamps (CFLs) and other mercury containing lamps, as well as other such equipment. In this document all the above guidelines have been compiled except guidelines for random sampling of EEE for testing of RoHS (Restriction of Hazardous Substances) parameters<sup>12</sup>.

#### **Existing Laws and Rules in India**

Prior to the much awaited E waste (Management and Handling) Rules, 2016, there exist several rules and guidelines which correlate with E waste management in India each having its own advantages, utilities and loopholes. Various provisions and salient features of the existing rules and laws are mentioned below.

##### **a. The Environmental Protection Act 1986**

This is the umbrella act which engulf all other rules, regulations and guidelines which later came into force. It was the Environmental Protection act which is considered to be the pioneer in management and handling of hazardous wastes which have adverse impacts on health and environment. The decision was taken at the United Nations Conference on the Human Environment held at Stockholm in June, 1972, in which India participated, to take appropriate steps for the protection and improvement of human environment. It is considered necessary further to implement the decision aforesaid in so far as they relate to the protection and improvement of environment and the prevention of hazards to human beings, other living creatures, plants and property<sup>13</sup>. Under this act, a National Strategy on Hazardous Waste Management was formulated to facilitate effective management of hazardous wastes and implementation of the action plan brought out in National Environment Policy, 2006. A project on GIS-based National Hazardous Waste Information System was sponsored by Ministry of Environment and Forest under this act. In Schedule VI of the Environment (Protection) Rules, 1986 various new standards for noise limit for generator sets run with diesel, emission standards for diesel engines, boilers using agricultural waste as fuel and pollution control in ginning mills have been

incorporated. The amendments with respect to Hazardous Waste (Management and Handling) Rules 1989, the Noise Pollution (Regulation and control) Rules 2000 and Recycled Plastic Manufacturer, Sale and Usage Rules, 1999 have been incorporated in respective Rules<sup>7</sup>. This act is more so important for paving the way for E waste rules, 2011

#### **b. Hazardous Waste (Management, Handling & Transboundary Movement) Rules**

These rules first came in the year 1989 and have been amended later in the years 2000, 2003, 2008 and 2016. The Rules lay down corresponding responsibilities for CPCB, State/UT Governments, SPCBs, Pollution Control Committees, Port Authority and Custom Authority of safe handling, generation, processing, treatment, package, storage, transportation, use reprocessing, collection, conversion, and offering for sale, destruction and disposal of Hazardous Waste.

Under the Rules no permission for import of E waste has been granted during last three years by the Ministry of Environment and Forests, Government of India<sup>14</sup>. However, permission for export of 10,575 MT of E waste has been granted for export of E waste to various countries viz. Belgium, Germany, Japan, Singapore, Hong Kong, Sweden, UK and Switzerland. Keeping the issue of E waste import in focus even the amended rules in 2016 provide the importers an opportunity to bring E waste under the name of recycling, recovery, reuse and utilization including co-processing which is permitted under these rules<sup>15</sup>.

#### **c. E waste (Management and Handling) Rules, 2011**

The guidelines issued by MoEF\$CC are parameters for the management, handling and disposal of E waste providing guidance and broad outline for the minimum rules to be followed by CPCB and SPCBs, which are the regulatory agencies for implementation of E waste Rules in respective states. Under these rules, the producers of EEE listed in Schedule 1 shall be responsible for collection of E waste generated during the manufacturing and channelizing it for recycling or disposal by authorizing collection, dismantling and/or recycling agencies. Also, they will be liable to collect the obsolete and discarded equipment as per EPR (Extended Producer Responsibility) principle. The producers shall also be responsible for transparent financing of a system involved in E waste management from the end of life of its own. These rules were applicable to producer, consumer, collection center, dismantler and recyclers. They were limited to EEE listed in Schedule 1 only (“Gazette Notification: E-Waste Management and Handling Rules, 2010” 2011). The rules also state that the producers of EEE have to ensure that their products are in line with RoHS (Restriction of hazardous substances) and proper labelling of unique identification is mandated. SPCB’s have also issued official circular to the bulk consumers and producers enunciating their roles, responsibilities under the E waste Rules. The Collection centers were to be set by producer or any other person or agency after taking separate authorizations from SPCB’s

#### **d. E waste (Management) Rules 2016**

The draft rules, namely the E waste (Management) Rules, 2015, were published by the Government of India in the Ministry of Environment, Forest and Climate Change. They came into force from the 1.10.2016<sup>17</sup>. The major features in these Rules are that they are applicable to manufacturer, dealer, refurbisher and Producer Responsibility Organization (PRO) also. Their applicability is further extended to components, consumables, spares and parts of EEE. Collection of E -waste has now become the sole responsibility of Producers who can set up collection centers or arrange for buy back mechanism, though these rules remove the need of separate authorization for collection from SPCB’s.

Flexibility is provided to producers by giving them options between various mechanisms to implement EPR for setting PRO, E waste exchange and Deposit refund scheme. Under Extended Producers Responsibility target based collection approach is adopted for implementation by producers.

#### **e. Guidelines on Implementation of E waste (Management) Rules**

The E waste (Management) Rules, 2016 mandate CPCB to prepare guidelines on implementation of E waste Rules, which includes specific guidelines for extended producer responsibility, channelization, collection centers, storage, transportation, environmentally sound dismantling and recycling, refurbishment and random sampling of EEE for testing of RoHS parameters<sup>12</sup>. These guidelines emphasize on implementing EPR for channelization of E waste to authorized dismantlers or recyclers. Producer is to give a plan of its overall scheme to achieve targets of collection and environmentally safe disposal and recovery of E waste. It also provides the guidance to estimate the E waste generated from their products and mandates them to give estimated budget for implementing EPR and outline for the scheme of creating awareness.

### **Shortcomings and Limitations of the Laws in India**

#### **a. The Environmental Protection Act 1986**

These rules do not promote small units which ultimately find it unaffordable to install pollution control devices and waste treatment plants. The act also doesn’t have any directives for Central government to adequately fund SPCB’s so that they can have the latest technology while scanning and checking the private players when they come for installation projects. Although in EU, Member States have to ensure that inspection and monitoring of infrastructure fulfils minimum criteria for environmental inspections in respective states<sup>18</sup>. There is no provision for the surety of reliable data on E waste production and growth which presents a challenge to policy makers wishing to design an E waste management strategy and to an industry wishing to make rational investment decisions<sup>19</sup>. This act forbids a person to file a petition directly in court with a question related to environment.

#### **b. Hazardous Waste (Management, Handling & Transboundary Movement) Rules**

Hazardous constituents are not taken seriously and equipments that contain less than 60% of the toxic substances are considered as safe for recycling. On the other hand, EU has stricter regulations than India for the threshold values of these substances<sup>20</sup>. These rules create confusion regarding the permission for registrations as they include additional provision which states that recyclers have to obtain permission from relevant SPCB's<sup>21</sup>. E waste import even in the amended rules in 2016 provide the importers an opportunity to bring E waste under the name of recycling, recovery, reuse and utilization including co-processing which is permitted under these rules. Thus, there is no ban on the export of E waste to India under the name of charity and reuse. Also, there is no stringent directive for considering burning and dumping of E waste in water bodies as illegitimate and hazardous while, dumping in landfills has been banned in most of the EU<sup>22</sup>.

#### **c. E waste (management and handling) rules 2011**

These rules don't talk for the integration of the informal sector in the collection, segregation and dismantling of E waste, but proposes penalties for unregistered recyclers<sup>23</sup>. This shows that E waste rules advocate blind formalization of informal sector as sudden and complete ban is bound to create rehabilitation problems in front of the unorganized sector. There will be huge unemployment if such forceful shut down takes place as 95% of the E waste recycling in India is carried out in non-formal units<sup>24</sup>.

These rules don't have any provision for promoting the take back system which is presently confined to IT sector only<sup>25</sup>. Whereas in EU, a provision is there for the private households to return their used equipments at least free of cost<sup>26</sup>, and the producers are made responsible to finance the collection of equipments from the collection facility. The EU's waste management rules for EEE promote producer responsibility. Manufacturers are responsible for the sound re-use, recovery or eventual disposal of the product.

Also, E waste rules don't mention any standards to be followed during recycling. While in Europe, any establishment or undertaking carrying out recycling and treatment operations should comply with minimum standards to prevent negative environmental impacts associated with the treatment of WEEE<sup>27</sup>. Though the rules have provisions for ban on illegal import of E waste, still the rules fail to direct any ban on import of second hand electronic goods brought to the country for charity and reuse purpose<sup>28</sup>. This suggests that mere rules and regulations are not at all sufficient, but also government must ensure their effective enforcement and implementation on the ground.

The E waste rules do talk of implementing EPR but do not include stringent provisions for its successful implementations, whereas European waste legislation gives a global framework for the implementation of EPR in Europe. The Member States and their respective legislations are

responsible for the implementation of EPR<sup>29</sup>, including regulating the operational aspects of EPR. Hence due to lack of strict provisions, many stake holders are reluctant to act in line with these rules.

#### **d. E waste (Management) Rules 2016**

These rules have been amended to a certain extent to address the issues raised by many E waste experts and to make them more relevant in the current scenario but a number of issues are still a matter of concern.

These rules also do not talk about any involvement or upgrading of integration of informal sector in any of the operation involved in E waste management leaving the issue of unorganized sector unsolved. There is no provision of involving the collection mechanism of local scrap dealers into the channel of formal E waste management, which could provide a strong backbone for channelization of E waste from door to door collection to PRO's.

Buy back mechanism is given as an option rather than making it a compulsion, which in turn will not boost the returning of equipment by the consumers, leaving a possibility of it entering the municipal waste. Deposit refund scheme is also given as an option which will leave the consumer with an unclear picture of the proper way of returning the product to the dealer or producer or E waste collector to get the refund of the fees he paid for safely disposing the product he purchased. It is proposed that dealer or retailer shall refund the amount as per Deposit refund scheme but this would not solve the issue of gifting the product to someone, buying the products online (where no dealer or retailer is involved) or shifting or changing the place by the buyer due to some reason.

Mandating of either setting up of PRO or Buy back or Deposit refund scheme could be more fruitful by giving clear cut path to be followed by every player without any failure.

These lenient and flexible options will not prove instrumental in taking E waste management and handling in India to a desired international level.

#### **e. Guidelines on Implementation of E waste (Management) Rules**

The salient feature of these guidelines for implementation is the provision of approach for EPR.

According to this, it is the responsibility of the producer to give a plan for implementation for achieving the targets of collection of E waste generated by producer<sup>12</sup>.

However these guidelines remain silent on the bulk of EEE entering through the grey market and coming through the import of reusable and refurbishable products and contributing to unaccounted E- waste.

These guidelines have provided the details about the average lifespan of EEE to be used in a formula to estimate the E waste generation. However it gives only a rough estimate of the average lifespan of equipment because all the equipments do not reach their end of life at the same time. In today's scenario it is not justified to give an average life span of 5-7 years to cell phones. A more practical and justifiable lifespan needs to be decided for Indian scenario.

The collection targets are to be more clearly and more precisely decided. As per the example quoted in the guidelines, if a product enters the market in 2016-17 and becomes waste after 8 years of useful life i.e. becomes waste in 2021-22, and producer is to reach a target of 50 % collection in that year. One cannot expect all the products to become waste in the same year and it is an impractical task for producer to achieve 50 % collection target in that one year. On the other hand there is no penalty or fine levied on producer in the case of failing to achieve the target collection proposed by their own plan.

### **Need for Stringent E waste Laws in India**

A discussion about the shortcomings of all the laws and regulations clearly indicates towards further possibilities for stringent laws of enforcement and implementation. It is surprising that after this number of new guidelines and waste management rules not even a single step has been taken to increase the ‘reuse’ by implying any testing mechanism at the initial collection stage. A simple plug and play test at PRO or collection center stage can reduce a large burden from the reprocessing and recycling processes. Second hand goods at a reasonable price can be a great relief for the poor strata of society. Most of the equipment entering waste stream can be refurbished by making small repairs or changing some component. Obsolete or out of fashion products also enter the E waste stream without even reaching their end of useful life. In Indian scenario people are in a habit of selling the EEE appliances to door to door scrap collectors in lieu of some amount, it will be extremely hard for them to pay for disposing their products and all the way going to the retailer to get the deposited amount back after a span of several years and keeping the sales record data intact for this time.

Most of the people in India do not know how to dispose their obsolete electrical and electronic gadgets. In India, both the industrial and household consumers don’t pay attention to the processes these electronic goods have to go through once these are discarded<sup>4</sup>.

The amount of E waste recycle and recovery by informal sector is much higher than the formal sector. The informal sector has more manpower with unskilled employee and not governed by any health and environmental regulation. Moreover it leads to more pollution thereby intoxicating the environment. The management practices currently in operation in India have severe health and environmental implications.

Also, with the progressive stride that the country has made in the Information Technology sector and the electronic industry, the import of E waste is a controversy as its handling and disposal along with the domestic waste is an issue to be mulled over<sup>30</sup>. E waste from developed countries is being dumped into India for the sake of cheap labor here. India has ratified Basel Convention in 1992 which banned the export of toxic waste; there is no ban on import of such wastes. The convention is unable to prevent the inflow of hazardous

wastes into India from countries that have not ratified the agreement. Large quantities of used electronics that are typically sold to India have very high repair capability and high raw material demand. This can result in high accumulations of residue in poor areas without strong environmental law<sup>31</sup>. In this way the toxic effluent of the developed nations is flooding India which necessitates implementation of appropriate management measures including stringent regulations.

### **Gap Analysis**

Gap analysis is done to attain the standard and desired state from the current lacking and deprived situation. In order to analyze the gap between the two states, primarily we need to identify our future state and the objectives we need to achieve. Secondly, we need to analyze our current situations with respect to the objectives we want to achieve. And finally, the analysis of how we could bridge the gap remains to be pondered and contemplated.

The case study of practices in European Union is taken as reference for setting up the benchmarks for E waste management and handling in India<sup>25</sup>. The legislations in EU are studied and analyzed and the best suited practices and norms are identified as goals for India to achieve in successfully managing E- waste<sup>32</sup>. Based on the loopholes in E waste regulations in India and directives in European Union, a Gap Analysis is formulated envisaging an ideal future state in India incorporating best practices from EU in areas where rules in India have shortcomings. The time limit for the attainment of objectives however depends on Government’s initiatives and cognizance of the current problems hampering clean, green and safe handling of E waste in India.

#### **a. Identifying the future state**

- (1)The readiness and working of EPR is a must, when producers and retailers would pay for the recycling or disposal of the waste emerged.
- (2)Recyclers and their technology must pass the test of their mechanized recycling activities by various boards and regulatory bodies.
- (3)The recyclable content from the total discarded appliances collected must be minimized and reverting back as re-usable.
- (4)The formal sector has to be involved for the monitoring of the intake of end-of-life appliances in the processing chain.
- (5)Absolute and comprehensive transparency is to be attained in recycling where the producers have to report new and discarded appliances collected and recycled.
- (6)Complete check on illegal imports of E waste dumped in India.

#### **b. Analyzing the current scenario**

- (1)The take back system is limited to IT industry and bulk producers only, and there is complete absence of accountability and responsibility otherwise.
- (2)Both the Central Pollution Control Board and the State

Pollution Control Boards, have limited capacity in terms of technical expertise and human resources

(3)The informal sector involved in collection is highly unskilled in terms of testing and dismantling of appliances.

(4)The threat of unemployment to the workers is involved in informal sector due to the emergence of the formal sector.

(5)There is no data available for the domestic in flow and recycling of E waste as most of it is collected by the informal sector.

(6)There is neither any exact data nor any strict provision in rules to check the illegal imports of E waste dumped in India through sea.

**c. Bridging the gap**

(1)A collective compliance system has to be created which demands flow of funds for collection, transport and recycling infrastructure.

(2)The informal sector must be utilized in its well acquainted jobs of collection and dismantling, and leave the rest of more technical tasks with the formal sector, therefore shredding the burden from both; the recyclers and the regulatory bodies.

(3)The informal sector involved in the collection, if provided with the testing mechanism (to check whether the discarded device if damaged or in plug-and-play condition), will increase the re-usable entities if the collected units are not damaged or contaminated.

(4)The private sector must be forced to ensure employment of a quota of the experienced workers from the informal sector.

(5)Authority of on-site examination of the informal collection or recycling unit must be granted to the local administration, vis-à-vis the formal sector should report based on Hazardous Rules 2008. The Right To Information Act should be made more approachable and convenient without any discrepancies

and difficulties.

(6)Stringent guarding and checks on India’s vast coastline are emphatic, involving coast guards and/or navy with specific tasks to check in-flow of E waste from other countries.

The Gap analysis is summarized in Table1 below.

**Recommendations**

In order to make E waste rules more effective, Government can contemplate on bringing amendments in existing law for the stricter and provision of an agency to control, supervise and regulate the relevant activities of government departments concerned with E waste management. E waste rules have been proved narrow and less deterrent when it comes to checking the import of E waste in India that overseas exporters can exploit them to dump their E waste considering India a wasteland. Therefore, there is a need of provisions for efficient security and intelligence on coastline must be formed which can take dumping of hazardous wastes into India under its scanner. Along with that, there is a need to build the financial and technical capacities of state pollution control boards and place additional resources at their disposal to ensure better implementation of the regulations.

The rules and legislations must be enforced to apply EPR as per the guidelines so that a producer’s responsibility for a product is extended to the post-consumer stage of the product’s life cycle, including its final disposal. A collective compliance system has to be incorporated as adopted by EU<sup>33</sup>, which enforces all stakeholders (producers, suppliers and consumers) to share the financial, physical and legal Table1. Gap analysis for E waste management in India in comparison to that in European Union

Objectives	EU Legislations	Challenges in Indian scenario	Measures
EPR	Member states are responsible for the implementation of EPR(European Commission 2014)	Very flexible approach is given to EPR by giving various choices	Collective and strict compliance system with mandating any one best suited approach
Qualified and eligible recycler	Recyclers have to comply with minimum standards to prevent negative impact on environment (European Environment Agency 1996)	Lack of technical expertise of government bodies(CAG 2007)	Technology transfer and division of task of monitoring by authorities.
Increasing the re-use	Manufacturers are responsible for re-use of discarded product(Parliament European 2003)	Unskilled workers and lack of testing in informal sector(Research Unit LARRDIS 2011)and no rules for producers to follow for testing for fuctional/refurbishable EEE to enhance Reuse	Plug and play as elementary test for informal sector collectors at collection centers and compulsion for formal recyclers and collectors for setting up testing units

Involvement of formal Sector	Producers finance the collection of discarded devices through private collectors (Parliament European 2003)	Threat of unemployment due to no vision for integration (Agarwal & Mullick 2014), guideline for formal collectors to involve informal sector at any stage.	Quota in formal sector and training for informal dismantlers/ handlers about safety and precautions. Involvement of informal collectors.
Transparency and monitoring	Member states fulfill minimum criteria for environmental inspections (Anon 2001)	No reliable data from informal sector (Joseph 2008) Producers have to propose a plan with their own calculations about waste generation and collection targets.	RTI be made more consumer friendly, Better approaches to dictate producers about calculating end of life products, to maintain transparency in setting collection targets in their plan.
Banning illegal imports	EU states export their waste into developing countries (Geeraerts et al. 2015)	No provision or mention of any instrument to ban such dumping (Singh & Seth 2013)	Assigning navy/coast guards with the task of checking dumping through sea and By putting a blanket ban on any kind of EEE entering the country.

responsibility of collecting and safely disposing the E waste. “Reuse” must be boosted and promoted, thereby minimizing the recyclable components and hence the disposal and dumping. The formal sector involved in collection and segregation for this pursuit must be bolstered with competent and effective testing mechanism.

The apt and optimized balance in India can be hit if the discarded material is collected, separated and transported by the informal sector, and recycling, recovery and disposal is carried out by the formal sector<sup>34</sup>. The informal sector although still illegitimate, has some definite advantages over the formal sector in terms of door-to-door collection and the experience in dismantling. Therefore, there is a need to club the competence and advantages of both the sectors in an optimized way through which the formal sector can not only exploit their handy experience but will somewhat deal with the issue of job snatching. The producers of a particular product can form PROs (Producers Responsibility Organizations) and set up common collection sites to where the informal collectors hired by producers shall deliver the end of life electronic devices collected from households and firms to comply with the rules. Also, the common collection site shall house testing and primary dismantling/ separation/ segregation for which semiskilled workers previously involved in informal recycling can be employed after imparting moderate specific training. The producers can avail the finance required for this through one time ARF (Advanced Recovery Fee)<sup>35</sup> instead of Deposit Refund Scheme. This would help in implementation of EPR as well. In this way, a realistic and viable model for the formalization of informal sector can be realized coping with the problem of unemployment in informal sector. Such a model can eventually come up with EPR and formalization of informal sector as driving factors for both.

Stricter rules and provisions do not necessarily mean effective enforcement always. To ensure the enforcement of rules and

amendments in future, government bodies must form a mechanism to regularly monitor the ground situation. The effective enforcement can begin with the smallest level, i.e. municipalities and urban corporations. The regulations should prohibit the disposal of E waste in municipal landfills by inculcating heavy penalties and punishment in legal framework. It’s the smallest level which would inculcate and build the change in higher levels. The municipal boards have to show some responsibility and present themselves as the epitome of responsible E waste handlers and managers in India.

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