WASTE FROM ELECTRONIC & ELECTRICAL EQUIPMENT'S: WHERE ARE WE?

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Abstract

The concept of Extended Producer Responsibility (EPR) is a policy principle to promote environmental improvement of products and manufacturing systems. Approach to Extended Producer Responsibility (EPR) in various Asian and European countries to increase public awareness and concern about the government's environmental impact of products and production processes, encourage sustainable design, as well as end-use products that focus on the improvement of environmental performance of products and manufacturing systems product. Developing Asian countries have started to apply the principle of extended producer responsibility (EPR) to electronics and electrical equipment waste (e-waste). This policy approach aims to give electronic appliance manufacturers and importers responsibility for the collection and recycling of discarded electronic equipment. E-waste is a market-traded commodity; there are two major difficulties in implementing EPR in developing countries like India. First, it may be difficult for governments to collect funds from producers or importers if smuggled, imitation, or small shop-assembled products have a large share in the market. Second, the system creates incentives for collectors and recyclers to over-report the amount of collected e-waste in order to gain extra subsidies from the fund. Other policy measures such as the enforcement of pollution control regulations on informal recyclers, the prevention of smuggling, and the protection of intellectual property rights should accompany EPR policies.

1. Introduction

Waste electrical and electronic equipment (WEEE, also known as e-waste) is a growing concern of Indian society and policy makers. The penetration rate and variety of many appliances used in India have been increasing in the last few years. In addition, a considerable amount of used electrical and electronic equipment (EEE) has been imported both legally and illegally to India. This will translate into a growing amount of WEEE in the future. Currently, waste from these high-tech and complex products is handled in the so-called 'informal' recycling sector. The rudimentary and uncontrolled methods employed in this informal sector, such as open burning of cables containing PVC and treatment of wastes in acid baths to recover gold and other valuable metals, not only cause environmental risks and negative externalities, but also directly jeopardise the health of people in the sector and surrounding communities. In addition, WEEE not captured by this sector is mixed with other municipal solid waste (MSW) and freely disposed of. In short, there is no system to ensure environmentally sound management of WEEE in India. In just over a decade, India will have on its

hands a whopping 130 million obsolete desktop computers and 900 million laptops to dispose. As per country level Waste Electrical and Electronic Equipment (WEEE) assessment study, Mumbai and Pune falls under the top ten cities that are generating maximum quantities and Mumbai alone generates maximum among all the cities of India. Total WEEE waste generation in Maharashtra is 20270.6 tons, out of this Navi Mumbai contributes 646.48 tons, Greater Mumbai 11017.06 tons, Pune 2584.21 tons and Pimpri-Chinchwad 1032.37 tons.

The magnitude of the waste generated can be summed up from a research paper titled 'E-waste in India' presented in the Rajya Sabha in 2011, which quotes the Comptroller and Auditor-General's (CAG) report to say that India generated around 4 lakh tonnes of electronic waste in 2010, up from 1.47 lakh tonnes in 2005.Of the total volume of e-waste generated, 68 per cent is comprised of televisions and 27 per cent comes from desktops and servers, with Maharashtra leading in waste generation, followed by Tamil Nadu. There are 10 States that contribute to 70 per cent of the total e-waste generated in the country, while 65 cities generate more than 60 per cent of the total e-waste in India. Delhi takes the tenth place, and amongst cities, is the second largest producer of e-waste, behind only Mumbai.

A report of the United Nations predicted that by 2020, e-waste from old computers would jump by 400 per cent on 2007 levels in China and by 500 per cent in India. Additionally, e-waste from discarded mobile phones would be about seven times higher than 2007 levels and, in India, 18 times higher by 2020.

The report is based on research conducted between Jan and May 2014. The research began with an extensive literature review on (1) EPR in general and in relation to WEEE; (2) Indian experiences in the management of WEEE, and (3) solid waste management in non-OECD countries with a focus on the informal sector. The literature on the Indian situation was then preliminarily checked through a small survey with residents in Pune and also observation and interviews with key informants. This report, however, does not go into the details of implementing an EPR programme, which it sees proper to leave for policy makers and stakeholders in the country.

There have been laws in place on the disposal of e-waste for years now, but the problem is one of implementation. The e-waste (Management and Handling) Rules, 2010, came into effect on May 1, 2012 and clearly require manufacturers to take responsibility for the end-of-life recycling of their products, under the Extended Producer Responsibility (ERP) clause. The law talks about authorising collection agencies, and registered dismantlers and recyclers. It also has a provision called the Reduction of Harmful Substances (RoHS), which aims to tackle the problem at the time on manufacture.

2. Extended Producer Responsibility

'why producers?because most of the environmental impacts are (pre)determined when they design the products'

The term 'Extended Producer Responsibility was officially introduced in a report to the Swedish Ministry of the Environment, *Models for Extended Producer Responsibility* (Lindhqvist, and Lidgren 1990). Subsequently, the concept was revised and defined as an environmental principle, giving it a legal nuance in the sense that it "binds acts of international organisations, state practice, and soft law commitments" (Sands 2003:231). Lindhqvist (2000, 154) defines EPR as follows:

"a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product. A policy principle is the basis for selecting the mix of policy instruments that are to be used in the particular case. Extended Producer Responsibility (EPR) is implemented through administrative, economic and informative policy instruments."

This definition reflects three cornerstones of EPR, namely the **'pollution prevention approach'**, **'life cycle thinking'** and **'polluter pays'** principles. In addition, it is broader than the definition used by the OECD (2001, 9) –*"an environmental policy approach in which a producer's responsibility [financial and/or physical] for a product is extended to the post-consumer stage of a product's life cycle"* – in the

sense that the extended responsibilities of a producer are not only limited to the end-of-life stage but also to other stages of the product life cycle where the conventional responsibilities are deemed insufficient to guarantee optimal environmental protection. To date, EPR has been applied in OECD countries and has focused mainly on the end-of-life stage, "the 'weakest link' in the production responsibility chain" (Kroepelien 2000, 166).

It must be stressed that EPR is not a policy instrument and its application can be implemented through a package of policy instruments. Some authors treat EPR as merely shorthand for either a take-back mandate or a kind of economic instrument (Gottberg , Morris, Pollard, Mark-Herbert, and Cook 2006; Sachs 2006). In this manner, they fail to capture the totality of a programme and to appreciate the policy mix in an EPR programme under consideration. For example, they admit the effects of the EU5RoHS Directive's substances ban (an administrative policy instrument) on the product design but do not count it as a part of an EU EPR policy package. In this paper, EPR is treated as a policy principle and policy makers are free to choose any policy instruments, or their mix, to accommodate particular contexts and to implement the spirit of EPR.

3. OBJECTIVE & METHODOLOGY

The main objective of this study is to provide insights and options to support the decision-making process in India on a future e-waste management system and help policymakers and stakeholders to implement EPR policy in India.

The other objectives include

- Spreading awareness among public about Harmful affects of poor practices of E-waste disposal which results in potential environmental hazard.
- Well orchestral mechanism on collection, treatment and disposal of E-Waste in Pune and Pimpri-Chinchwad region which is home to large user and manufacture base, generating large volumes of E-Waste.

Main Questions

The main questions that are answered by residents of India in this document are

1. What e-waste or waste of electrical and Electronic equipment is?
2. Awareness of presence of metals Precious (Gold, Silver etc)/ hazardous (Lead, Cadmium etc) in E-waste?
3. Awareness if any that some hazardous fractions in e-waste need a special treatment in order to be safely disposed of?
4. Awareness about the bad effects of e-waste on the health of human beings and the earth?
5. Awareness of GOI e-waste Management Policy?
6. Who takes the decision of e-waste disposal at house?
7. Do waste collectors come and pick-up waste at your door?
8. Are there any e- waste collection facilities near your home?
9. Awareness of Government Of India's e-waste Management Policy?
10. Do you have a facility to collect E-Waste, Dry Waste and Wet Waste separately in your society?
11. Awareness of methods to disposal of CFL bulbs?
12. Quantity of Large Household Appliances for Disposal?
13. Quantity of Small Household Appliances for Disposal?

Proposed Methodology:

The approach to carry out this study is planned on three phases. It is planned to begin with field experience and knowledge gained during assessment period followed by arriving at optimum solution to address E-Waste.

Phase 1: Mobilization and work plan
Phase 2: Data Collection/ Field Work
Phase 3: Report Findings and Way Forward

Phase 1: Mobilization and work plan

A work plan will be prepared and presented before the working group/ expert committee. A

student committee team comprising of 2 students is formed and will mobilize to carry out the study.

Phase 2: Data Collection/ Field Work

This task will include identification of study items (TV/ Personal Computer/Cell phone/ any other after discussion with working group) and tracking its geographical movement within the identified geographical limits of the area to its final end of life, places where tracers are unloaded, traded, transported, dismantled, recycled, reused, repaired, processed and disposed.

Major Stake holders:

1st Group:

Importers, manufacturers, distributors, traders, retailers and consumers (end users and super users as per TOR)

2nd Group:

Collectors (traders, scrap dealers, collectors, dissemblers, dismantlers, recyclers, roadside vendors, authorized and unauthorized auctioneers)

3rd Group:

Regulators like MPCB

Three surveys will be administered:

(1) Driver Survey : To investigate public perceptions and behaviour around e-waste.

(2) Equipment Survey: To identify the mix of equipment by brand being dropped off.

(3) Equipment Totals: Survey data from each drop-off site.

Driver Survey Questionnaire: Individual households, school, colleges across Pune city. Online survey using social networking sites using FB, GMAIL.

Categories of electrical and electronic equipment proposed to be covered:

1. Large household appliances
2. Small household appliances
3. IT and telecommunications equipment
4. Consumer equipment
5. Lighting equipment
6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools)

Equipment Collected:

E-wastes	**Area**	**Quantity**
Monitors		
Computers		
Printers		
Cell phones		
Miscellaneous equipment*		

Phase 3: Way Forward

1. Take Back Practices.
2. Implementation of Extended producer Responsibility.
3. Collection Centre across various parts of the city.
4. Environmentally Sound Dismantling and Recycling of E-waste

4. WEEE management in India

E-waste collection, transportation, processing and recycling is dominated by the informal sector. The sector is well networked and unregulated. Most of the e-waste in India is recycled, but often all the materials and value that could be potentially recovered is not recovered. In addition, there are serious issues regarding leakages of toxins into the environment and workers' safety and health.

Collection of valuable discarded equipment is done by numerous kabadiwalas (waste collectors), who buy and sell it on to traders at a profit. Most specialised informal processing and recycling units are located in (urban) villages or unauthorised settlements and are engaged in dismantling the equipment, burning the PVC covering of wires, etc. They sell the parts to industry that processes the materials and, if possible, reassembles electronic goods from parts of dismantled equipment. Equipment or parts thereof that have too little value or need

recovery technology not easily available are discarded at largely unknown locations, posing a risk to health and environment.

A certain quantity of e-waste is dumped from abroad through illegal trade or covered up as donations of second-hand equipment. There are various reports to substantiate dumping of e-waste into the country but there are uncertainties of quantification owing to the unauthorised nature of business operations. Permitted import and export exists, but is very limited.

The formal recycling sector is still small: there are 16 units licensed by the Central Pollution Control Board (CPCB), and most of them do only partial processing and recycling.

India's Hazardous Waste Rules (2008), which would cover e-waste, are not taking the dispersed nature of e-waste into account. Therefore, the MoEF and the CPCB have prepared and released a first draft of E-waste Rules for comments from stakeholders. Civil society had lobbied for this new law, made prior suggestions and had already commented extensively on the draft text.

The Indian situation and its urgency for action

India, with a population of over 1 billion, is a growing economy and increasing appliances consumption is estimated to generate approximately 400,000 tonnes of waste annually (from computers, mobile phones and television sets only), which is expected to grow at a rate of 10-15 per cent per year. The processing of this waste is largely carried out in an informal backyard set-up, which is unregulated and does not follow the prescribed environmental norms for handling hazardous substances. The operations are mostly rudimentary in nature and cause extensive damage to both environment and human health. Dismantling and recycling is often inefficient, which results in loss of valuable and scarce materials.

The Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008, which apply to e-waste, deal primarily with industrial waste and lack elements to deal with the complexities of e-waste, and are recognised as inadequate. In 2007, the CPCB issued separate guidelines on e-waste management. However, these guidelines were voluntary and had limited impact. Stakeholders have been active in voicing the need for a separate regulatory framework for e-waste. This would provide a level playing field to the industry and also encourage growth and improvement of the recycling infrastructure in the country.

Main Stakeholders

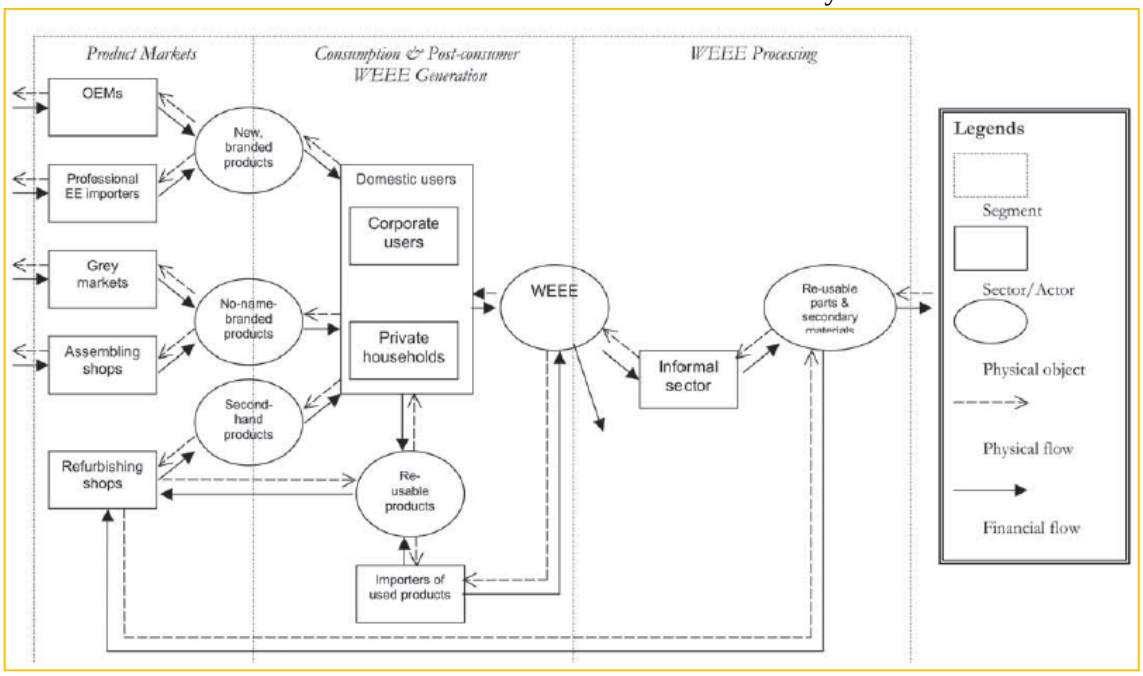
The main stakeholders in e-waste generation and management are the manufacturers, distributors/importers, refurbishment centres, consumers, collectors, recyclers, policy makers and policy implementers are described in the following table.

Stakeholders	Representatives	Interest	Degree of influence
Government: Environment sector Policy makers Enforcement	Ministry of Environment and Forests Central Pollution Control Board, State Pollution Control Board	Protect the environment and health of the population Set standards for environmental norms for processing e-waste and monitor compliance	High but limited in capacity High but limited in capacity High but limited capacity
Government: Other sectors IT Industry	Ministry of Information Technology Ministry of Industry and Commerce	Safeguard the interest of the IT industry in complying with the Rules; to minimise hazards generated from e-waste	Limited
Producers IT Household appliances Office appliances	Industry associations such as MAIT, CEAMA, TEMA, ELCINA Large producers	To comply with legal obligations in the country at minimum cost	High
Consumers Households Corporate Public	Ministry of Consumer Affairs, Food and Public Distribution	Safeguard consumer rights	Low
Recyclers: informal sector	Unorganised and hence not really represented well in this debate. Some civil societies representing their interest.	Maintain gainful employment Healthy work environment	Low
Recyclers: formal sector	Authorised recyclers, ERA (e-waste recyclers association)	Business interest and increasing scale of operation.	Low

Current Situation in India

The following figure summarises the Indian situation in a simplified form. The system is divided into three segments. The first segment is **the market place** for EEE. There are two types of new products: branded products, whose producer is identifiable, and no-name branded products, whose producer is not identifiable, i.e. the born-to-be orphan products. Second-hand products are sold in the re-use market and are dependent partly on the downstream operation for spare parts retrieved from WEEE. The relationship between new branded, no-name-branded, and re-used products is that of price competition. The two latter types are, in general, cheaper and of lower quality, and occupy a niche market for a certain sector of the population. Recently, as the prices of new branded products have dropped continuously, the market share of the other two types of products has shrunk.

The second segment is **consumption and post-consumer WEEE** generation. Domestic users of EEE play a two-fold role both as a consumer of EEE and as a generator of WEEE. Some discarded but functional products will be resold in the re-use market. There are two types of consumers: corporate users and private households. Besides domestic generation, WEEE is also illegally imported into the country.



Source: Extended Producer Responsibility Non-OECD context

The third segment is **WEEE processing**. As they currently handle the majority of WEEE, only the informal recyclers are shown, despite the existence of two authorised WEEE recycling plants in India. WEEE entering the informal sector is traded through several actors in their hidden, but vertically well-organised, networks – i.e. they have established fairly stable partnerships with actor's one-tier up and down the supply chain. These actors in the Eol chain then extract re-usable components and valuable materials from WEEE according to their specialities. Re-usable components are resold in the re-use market, while valuable materials are sent to the secondary material markets, outside the system boundary of this analysis.

Strengths and Weaknesses of the current system

Main strengths of the current system:

- The total amount of historical e-waste in India is still low; hence it will be simpler to deal with this aspect.
- Most computers in use are with the governmental or corporate sector which

makes it easier to control generated e-waste.
- Experiences from informal collection systems exist and could partly be applied to e-waste collection.
- There is a recycling industry, which could absorb the plastic and ferrous metals and aluminium fractions.
- Availability of human resource leads to more mechanised processes and reduce cost.
- Ability of informal sector to recycle and extract value from most e-waste prevents landfilling of such waste

Main weaknesses of the current system:

- There is no specific policy or legislation for e-waste management.
- There is no special infrastructure available for the formal collection and recycling of e-waste.
- The problem of imported computer junk seems to be serious.
- The informal activities associated with e-waste might lead to the exposure of individuals to hazardous substances and local pollution of the environment.
- Improper recycling and disposal of e-waste lead to an increase of pollutants in environment.
- There is a general lack of awareness among consumers and collectors of the potential hazards of e-waste to human health and the environment.
- There are weak regulatory and monitoring mechanisms in the country.
- Disproportionate sharing of profits among the informal recycling community.

5. Opportunities for implementation of EPR in India

'a continuous increase in the penetration rate in India hints at increasing costs of policy inaction'

This section lists six opportunities in the current Indian situation for the establishment of an EPR programme with minimum requirements.

Big share of corporate users

For *certain product groups*, corporate users have the lion's share of the consumption in India. For example, they have accounted for more than three-quarters of the computer shipments by unit (MAIT 2007). On a practical level, the waste generated by corporate users is easier to manage as it comes in bulk and has a rather high value. In addition, big corporate users have their image to protect and most have an environmental policy. This in turn makes it relatively easy to get them to cooperate in a take-back programme, when compared with other dissipative sources. The Electronics City Industries Association in Bangalore (e-Waste Agency 2006), representing large consumers of ICT products, has developed a code of conduct for e-waste management under the concept of a 'Clean e- Waste Channel.' One of the notable elements of the code is Preamble 5 stating that "The members should not focus on profitability through disposal of e-waste" (e-Waste Agency 2006). B2B e-waste has the potential to smooth out the transitional period where normally the set-up of the collection and treatment networks, together with the need to secure the
sufficient and constant supply of WEEE into the system, are key challenges. Specifically for the Indian case, this might lessen the challenge of competition from the informal systems .The amount of WEEE from corporate users can be overestimated. Interviews and a survey have revealed that not all corporate EEE becomes B2B WEEE, as some functional equipment is sold for nominal prices to the employees, where it ultimately becomes B2C WEEE.

Lucrative downstream business

Downstream activities in India, despite being carried out in the informal sector, have established very lucrative businesses involving a number of actors. High-value used appliances such as computers, televisions, refrigerators, air conditioners, washing machines, and mobile phones are collected by, among others, kabadiwalas (rag pickers) who go door-to-door and later pass on collected items to known WEEE dealers/middlemen. Unless they are resold as second-hand products, collected items are manually disassembled to an extent never experienced in OECD countries. Depending on the disassemblers' resources and demand for different spare parts, certain components are separated and stored for re-use. Others are sent to informal recyclers to recover saleable materials, including plastics and glass. Recovered materials are then supplied to huge,

domestic markets for secondary materials through waste dealers/middlemen, who also deal with materials recovered from other waste streams.re

The existence of these actors in the informal sector provides a unique opportunity for an EPR programme to exploit. However, the backyard recyclers whose methods are considered to be too risky, dirty and inefficient would not be in line with an EPR programme. Collection can be performed economically in India without significant environmental impacts. Due to its heterogeneous and complex composition, which renders automatic disassembly difficult, disassembly of WEEE is largely undertaken manually (Li, Shrivastava, Gao, and Zhang 2004, 34; Cui,and Forssberg 2003, 245). Workers in the informal sector are already skilled in this operation. Therefore, it is beneficial to integrate existing collectors and skilled disassemblers into an EPR programme - it is preferable for the latter to be employed in authorised treatment facilities. Not only would this already skilled workforce smooth the start-up of the EPR programme, but the integration into the formal sector would also provide the workers with better and more secure working conditions and fringe benefits. In some cases, small actors and workers are locked in a one-way dependent relationship with the so-called 'waste mafias' in the chain. The area where integration would be contentious is in material recycling which should be handed over to ATFs with controlled processes.

Relatively small stock of domestic historical products

Historical products are an addition to an EPR programme. Within this fraction of the waste stream, there is an unpreventable problem of historical, orphan products which might unfairly burden existing identifiable producers. In India, however, due to a low penetration rate in the past, this fraction has not been as big as that in OECD countries, and the market is far from saturation. The Central Pollution Control Board (Press Information Bureau 2007) estimates that the domestic generation of four waste products – televisions, refrigerators, air conditioners, and computers – amounted to 146 000 tonnes in 2005. This is equal to 0.1 kg per capita, compared with 17-20 kg per capita in the EU (IPTS 2006, 1). Meanwhile, the amount of EEE placed on the Indian market has increased every year. Together, this means that even if all historical products were (or were treated as) orphan and their Eol costs were borne by new products, the ratio would be substantially less than 1:1. Metaphorically, even in the worst case of all historical products being orphan, it would resemble a pension system in which a bigger and growing labour force works to support a handful of pensioners.

On the other hand, a continuous increase in the penetration rate in India hints at increasing costs of policy inaction. Until now, the problem of domestic WEEE in India has been relatively small but it is expected to grow rapidly. The same study by the Pollution Control Board (referred to in Goel 2006) forecasts an 11-fold increase in the amount of domestic WEEE to 1 600 000 tonnes by 2012. In the Indian context, where the use of the end-user-pays mechanism is dubious, this implies a need to have a system capable of securing the finance for the future Eol management of the new products.

Existing business practices and initiatives

Currently there are two business practices upon which a national EPR programme can be built: producers' voluntary take-back and retailers' trade-in schemes. Voluntary take-back is a marketing strategy driven mainly by environmental concerns, as take-back schemes, in general, incurs additional costs. Big Indian manufacturers are currently under pressure from local civil society to take responsibility for the entire life cycle of their products. In response, they have promised to comply with RoHS in India and to incorporate a free take-back scheme into their businesses, despite the absence of a national programme. In the same way, multinational corporations (MNCs) are facing the demand from the international civil society to be globally consistent in their EPR policies (see Greenpeace 2007) so as to avoid double standards. Some of them have already promised to introduce RoHS-compliant products to the Indian market in the near future, regardless of local legal requirements.

Furthermore, most retailers in India offer a trade-in option for their customers. Here, a retailer offers discounts for a used product of equivalent function from customers buying a new product. This has been a marketing strategy driven mainly by economic factors. From our market walk, retailers determine discounts based on the

remaining value of the traded-in products, and the discount of a used product is fixed regardless of the value of a new product (with some deviations). This valuation practice means that retailers expect to earn a fixed amount of money from traded-in products at a later stage, and the discounts do not merely reflect a margin between wholesale and retail prices.

Both types of schemes can be improved further under an EPR programme. So far, the producers' take-back schemes have scored poorly in terms of collection. In the Indian context, free-of-charge take-back does not give enough incentive to users to hand over their WEEE to the schemes. And the take-back schemes are worthless unless they can collect WEEE. On the other hand, it would seem unfair to further ask the forerunners who initiated the schemes to incur additional costs while there is no system to force other producers to do the same. A national EPR programme would provide a foundation to level the playing field. Regarding retailers' trade-in schemes, an EPR programme might enable them to cover low- or negative-value used products. Currently, the scope of the schemes is limited to functional and high value used products. Retailers simply offer discounts to customers without taking back their used products with nominal values and/or low demand in the re-use markets, such as food mixers. In a mandatory programme, all WEEE would be included. In addition to these benefits, the establishment of a formal treatment sector in an EPR programme would ensure that WEEE collected through these channels would be handled in an environmentally sound manner.

Lessen the burden on municipalities

Unless there was separate collection and treatment of WEEE, the rapid increase in EEE consumption in India would eventually translate into growing amounts of MSW which would over burden the limited capacity of the municipalities and the taxpayers. Although in the current situation, most WEEE would first be diverted from the MSW stream into the informal sector, low-value items and the residuals, (which are usually highly toxic owing to uncontrolled and inefficient processes), would be dumped on-site and in neighbouring areas. To collect and treat these residuals and clean the sites would be expensive. On the other hand, an EPR programme for EEE implies a separation of WEEE from other MSW and dedicated physical and financial infrastructures for WEEE. In addition, where municipalities have spare capacity, they might be physically involved in the collection of WEEE and be reimbursed for their efforts through the EPR programme.

Harmonisation and learning lessons

Besides the domestic situation, the time is also right for India to capitalise on and harmonise with the experiences and examples abroad. It is true that to have an effective system adapted to the Indian context, studies and a process of trial and error are needed. But it is also true that many countries have gone through these painstaking processes. Most OECD and some non-OECD countries have a system for WEEE in place (but not all are based on EPR) while others are in the process of developing one. India can, instead of starting from scratch on her own, benefit from them, e.g. by emulating good practice and not repeating the mistakes. In addition, when faced with similar responsibility in India, global players, i.e. MNCs, might facilitate the transfer of technologies and know-how they have developed elsewhere, to India.

There are two areas particularly advantageous for India to support the harmonisation of international standards and practices: the RoHS-like product standards and the trans boundary movement of used products. Hitherto the EU RoHS Directive has prompted other countries to adopt similar standards restricting the use of six substances in new products. This is the move that India should follow, not because of the export argument, but rather the opposite. The Indian hardware sector is currently underdeveloped and India is not a big exporter with only 14% of its production being exported (Information, Planning & Analysis Group of Department of Information Technology 2006a). Thus the direct impact of foreign product standards on Indian manufacturers is not that high. In addition, exporters have to comply with these foreign standards anyway, regardless of domestic standards. (This partly explains why the China RoHS does not include the production of products destined for export (Article 2).) The real rationale for harmonisation is, however, to prevent the import of non-RoHS-compliant products, components and sub-assemblies.

Although it is likely that the production of these products will eventually end (as more and more countries adopt RoHS-like standards), in the transition period, its legacy in the global market would result in non-compliant products seeking unprotected markets. The threats of an inflow of imported non-RoHS-compliant products are twofold. Firstly, the Eol management of these products will be comparatively costlier and inherently less clean than those which are RoHS-compliant.

Secondly, these dumped products could damage the development of domestic EEE production if they are under-priced due to the low demand in the global market (Goel 2007).

6. Challenges in Implementing EPR

This section lists six challenges in the current Indian situation to the establishment of an EPR programme with minimum requirements.

Lack of formal recycling infrastructure

The first challenge in developing an EPR programme in India is a lack of ATFs and a collection infrastructure to channel WEEE to controlled facilities. Currently, there are only two facilities authorised to recycle WEEE and a handful of enterprises authorised to dismantle WEEE. However, this problem is not limited to India. Many countries have shown ways of overcoming it with various degrees of governmental intervention. At one extreme, there is public ownership, where the government owns and operates ATFs as in Taiwan. Alternatively, the government might provide financial incentives, such as recycling subsidies in California or favourable loans in China, to induce the establishment of private ATFs. At the other end of spectrum, the government simply sets a clear legal framework together with collection and re-use and recycling targets, and leaves it to producers to develop the necessary facilities to meet the targets, as in the EU, Japan, and South Korea.

ATFs can be developed either after or before the establishment of an EPR programme. An advantage of the former is that resources can be mobilised through recycling fees on new products under the programme. The challenge is the timeliness of the project. Taiwan experienced a shortage in treatment capacity in the beginning, and had to store collected WEEE for a few years owing to the delay in constructing and authorising recycling plants. On the other hand, the risk of constructing ATFs before the programme is running , is that there might not be a sufficient supply of WEEE to support continuous running of ATFs. This is especially the case when there is fierce competition for WEEE from the informal sector.

The authorisation process itself is equally important. The process must be rigorous, transparent but not cumbersome. To make the authorisation process meaningful, the government needs to be competent and have sufficient resources, which unfortunately is not always the case. During interviews, some stakeholders expressed concern over a lack of specific standards for WEEE treatment in India and a lack of resources on the part of the Pollution Control Boards. Currently WEEE recycling plants in India have to apply for permits under the existing Hazardous Waste (Management and Handling) Rules, 1989 (as amended in 2003), which are not tailored to WEEE. In addition, although there is a legal clause in the Rules that the authorisation process has to be completed within 90 days (Article 5(4A)), the process can be overly lengthy and demanding in practice (Parthasarathy, and Shankar 2007). If we view the authorisation as an exchange transaction between the government and enterprises (Nelson, and de Bruijn 2005), for WEEE recycling in India the benefits of authorisation are limited while the costs are rather high. Therefore, it is unsurprising that the majority of Indian recyclers remain in the informal sector.

Competition for In-Formal sector

Unless the whole informal sector was upgraded and authorised, informal recyclers would compete with ATFs for WEEE. Here, it is advantageous to make at least a conceptual distinction between competition for WEEE and for re-usable products. Here, only the former is of concern. Without any interventions, informal actors would have an edge over their formal counterparts in terms of their non-compliance with environmentally sound production/specification standards, absence of related costs and tax payment. As far as material recovery is concerned, recovered materials will, at the end of the day, be sold in the secondary material markets at similar prices, regardless of where they originate. Therefore, unless ATFs are able to earn higher net profits from processing

WEEE, by using more efficient technologies than the informal recyclers with rudimentary methods, the informal sector would have more money to offer users for their discarded WEEE. With the presence of informal competitors in India, the formal system would score poorly in terms of collection. And any WEEE management system would not be viable without the ability to collect WEEE – the problem highlighted in Chinese pilot projects. An Indian ATF has complained about this problem, stating that while the amount of domestic WEEE has increased continuously, (never mind the illegally imported WEEE), it has been struggling to find materials to fully operate its five-tonne-per-day facility (Parthasarathy, and Shankar 2007). Currently, the plant relies on WEEE collected through producers' service centres, which have to be disposed of in a sound manner due to the producers' environmental policies. This is also a reason why foreign companies are deterred from investing in the Indian WEEE (Mahesh 2007; Parthasarathy, and Shankar 2007; Rochat 2007).

All these are reasons why an additional financial flow is still necessary, even for those products for which Eol management is profitable in India. Under an EPR programme, this additional finance in terms of recycling subsidies, would be sourced from the (identifiable) producers. Here, the use of front-end mechanisms is even more preferable because an end-user-pays approach would further weaken the formal sector's collection potential. In the programme, only an ATF with official certification confirming the amount of WEEE it physically handles, would be eligible to receive the subsidies proportional to the amount of WEEE it processes. This would bridge the gap between their purchasing power and that of the informal recyclers. Here, auditing and certification mechanisms are needed to ensure that the right amounts of subsidies go into the right hands.

Illegally imported WEEE

Illegally imported WEEE, presents two major challenges. Firstly, it keeps the informal businesses viable. Though there is no official data on the amount of illegally imported WEEE, previous studies refer to it as the biggest source of computer scrap supplying India's informal sector (Mundada, Kumar, and Shekdar 2004, 267; Toxics Link 2003, 14). This is why the size of the informal sector in India is bigger than it would otherwise be if it only handled domestic WEEE.

Unless measures are taken against this practice, illegally imported WEEE will sustain a sizeable informal sector, which in turn, perpetuates its competition with the formal sector for domestic WEEE. Worse still, illegally imported WEEE can even disrupt measures to correct that competition – representing the second challenge. If the formal sector has an additional financial mechanism to attract domestic WEEE away from the informal sector, it is likely that it will attract illegally imported WEEE as well. In other words, illegally imported WEEE is like orphan products and free-riders and unfairly burdens the WEEE management system - at least in terms of sorting, monitoring and auditing.

A rigorous enforcement of the Basel Convention can stop this illegal transboundary movement of WEEE. The Supreme Court of India ruled on 14 October 2003 that WEEE shall not be imported into India, as she is a party to the Basel Convention (though India has not yet ratified the Ban Amendment). However, putting the Supreme Court's order into practice is not straightforward. Currently, this rule does not apply to the import of used products for direct re-use. This distinction between re-usable and waste EEE has become a loophole in the system as it has not been clearly defined in India. Most exporters/importers declare their shipment as "reusable" irrespective of the condition of the imported products. Therefore, clear guidelines and criteria for customs to implement this distinction are needed.

In this respect, it is particularly useful to look at practices abroad in order to make an international synergy on this global issue. The work of Mobile Phone Partnership Initiative (MPPI) on the trans-boundary movement of collected mobile phones under the Basel Convention provides a good basis. A decision tree procedure is comprised of a series of questions to determine a category, and rules are applied under the Convention to a particular shipment of collected, used mobile phones. This is in line with a three-step approach laid down by port authorities in the EU in the guidelines on shipments of WEEE. According to the guidelines, used EEE not deemed to be WEEE should have: (1) functionality tested and hazardous substances evaluated; (2) records containing the details, and (3) proper packaging.

It is clear in the guideline that a visual inspection alone is unlikely to be sufficient to fulfil the first step. Generally speaking, obsolete items which should be allowed to move under normal commercial rules, are those which have been tested and considered as used EEE that can be re-used *without* further repair or refurbishment and those destined for repair or refurbishment *under warranty* by the producer. However, a grey area of used EEE which might possibly be re-used after repair or refurbishment in the importing country, still exists. This is a contentious issue in functionality testing. To circumvent the testing, the Thai government employs a much cruder approach by setting arbitrary maximum ages of used products allowed to be imported into the kingdom – two years and five years after the year of production for 28 appliances and for copy machines, respectively. At any rate, the burden of proof of compliance should rest on exporters/ importers. India, as an importing country, can also benefit from strict enforcement in exporting countries via cooperation and harmonisation of criteria and procedures.

Identification of Producers

The biggest challenge to the prospect of an EPR programme in India lies not in the downstream, but in the upstream segment. Most, if not all, stakeholders express their concern that EPR would not be applicable in India where a large share of the market comprises "no-name-branded products" (Goel 2007; Hazra, and Mehta 2007; Jain 2007; Khanna 2007).The challenge is real if these no-name-branded products are new, orphan products.Here, they are the ultimate form of these born-to-be orphan products as not only the producers disappear from the market (e.g. bankruptcy or withdrawal from the market), but also the whole transaction between the producers and consumers is not identifiable. Under an EPR programme, when these products reach the Eol stage, they will unfairly burden the formal system.Where the programme sources finance from identifiable producers, they also have to shoulder the costs of these free-riders' products. In addition, because one possible consequence of costs internalisation in an EPR programme is an increase in the prices of new branded products, this might worsen the price competitiveness of the branded products on the market. Consequently, the market share of the no-name-branded products might increase. The bigger market share would translate into a bigger share of orphan WEEE, which in turn, increases the EPR costs of identifiable producers and the prices of their products even further, and so the vicious circle continues. For the smooth operation of an EPR programme, this group of no-name-branded products must be eliminated or reduced. This requires a good understanding of its nature and sources.

Secondly, there are assembled products, which are specific to computers. In places such as Nehru Place, Delhi, small-time shops assemble components into computers. Although most of them do put their brand on the assembled PCs, it might be difficult to target them in an EPR programme. Thus, they are practically non-identifiable. However, some of these shops do pay taxes, though possibly not in full, as some shops offer products at a discounted price without a receipt, and aspire to become a big, recognisable and hence identifiable actor. This partly explains why they have their brand, and offer after-sale services. Unlike the grey market, this sub-segment of the informal sector provides a "low-risk entrepreneurship learning space" (Nelson, and de Bruijn 2005, 582) for small entrepreneurs and it is possible to address the problem of their identity under specific arrangements of an EPR programme without scrapping the assembling sector. This possibility lies in the fact that components of assembled products are branded and their producer is identifiable. In this case, the comprehensive scope of an EPR programme would cover not only EEE as such, but also all components and subassemblies, and using the Californian definition of a final consumer – a
person who purchases a new or refurbished covered electronic device in a transaction that is a retail sale, or in a transaction to which a user tax applies – would effectively make the transaction between component producers and assemblers correspond to an EPR frontend financial mechanism. For example, a big manufacturer, X, who sells a monitor to a computer assembler, Y, would be considered a producer in an EPR programme and might be obliged to provide a financial guarantee. For example, an EPR programme might include only computers (selective) but have the definition of a "computer" that includes its components and subassemblies sold to final consumers. The disadvantage of this hybrid scope is a disparity

and a loophole when certain components and subassemblies are used in other non-EPR targeted products.

Small & medium sized enterprises

An effective EPR programme changes the market structure to favour those manufacturers who are able to develop environmentally superior products and product systems. Surveys repeatedly show legislation, including laws embracing EPR, as one of the strongest stimuli for DfE (Schischke, Mueller, and Reichl 2006; Veshagh, and Li 2006; van Hemel, and Cramer 2002). However, not all manufacturers are equally well-equipped to face this levelling of the playing field. Of special concern are small and medium sized enterprises (SMEs). In their proposal for a WEEE take-back scheme in China, Lin *et al*. (2002, 575) foresee that:

"The economic opportunities proffered by the implementation of the proposed take-back scheme are more likely to inure to the larger, economically and technologically better endowed foreign-invested facilities than either TVEs [Township and Village Enterprises] or the domestic computer production facilities."

It is generally recognised that DfE is rarely a management issue in SMEs and they lack resources, systematic approaches, and suitable tools to practise DfE (Schischke *et al*. 2006, 235; Woolman, and Veshagh 2006, 281; van Hemel, and Cramer 2002, 439). In addition, case studies of DfE in SMEs are limited and the experiences of large manufacturers might not be transferable to SMEs (Schischke,Mueller,and Reichl 2006, 235). Therefore, it is advisable to have supportive measures to increase the penetration rate of DfE among SMEs. Examples of such measures are research and development e.g. in tools adapted to SMEs' needs (e.g. Lindahl 1999), in cleaner products (e.g. the Danish Environmental Protection Agency's 'Cleaner Products Support Programme', see Greenpeace 2005, 13-14),
information sharing programmes and workshops (e.g. Schischke, Mueller, and Reichl 2006), and benchmarking programmes (e.g. Altham 2007).

Effects on the re-use market?

India has a very lucrative re-use market for used products. Repair, recondition, and component re-use are widely practised in Indian refurbishing shops. This is partly due to the cheap labour that makes minute disassembly possible. Re-use in general, is environmentally superior to material recycling as the material and energy values embodied in products and components when they are shaped or moulded, for example, are retained. However, there is a concern that the establishment of an EPR programme would lead to the collapse of this re-use market. This fear is based on the fact that the re-use objectives in existing foreign EPR programmes are rather limited, and the majority of collected WEEE is sent directly to material recovery processes, one step lower in the waste management hierarchy.

However, the threat of an EPR programme to the re-use market has been taken too far. Figure 4 graphically shows that an EPR programme, represented by the box of formal recyclers and the re-use market, is after WEEE and re-usable products, respectively. The economic values of these two types of discarded products are significantly different. In the Indian context, where users require compensation for the perceived remaining value of used products, the system designed to collect WEEE would not be able to compete head on with the re-use system. For example, Lu, Wernick, Hsiao, Yu, Yang, and Ma (2006, 17) report that the average price offered in the second-hand market for notebooks is 44 times higher than the collection subsidy of the Taiwan WEEE system. The same is true in India. An enterprise in the re-use business claims to have a much higher purchasing power than an ATF and does not experience any difficulty in finding its supply, in contrast with an ATF (Syed, Shetty, and Manoharan 2007; Parthasarathy, and Shankar 2007). In addition, the re-use market might benefit from the increased prices of new branded products as the latter bear additional EPR costs. Unlike the case of no-name-branded products, however, here the front-end mechanism can break through the vicious circle. Unless producers get the unclaimed deposit, there will be money left in the system when the re-used products finally reach their end of life. In this sense, re-used products would be covered under the physical elements of EPR when they become WEEE but not be subject to the front-end mechanism, i.e. no deposit on the transaction of second-hand products. Deposits already collected when the reused product was first put on the market as a new branded product, and

charging the re-use transaction, would be double accounting.

7. Conclusion & Discussion

The Role of the Government

Even though many governments around the globe have already enacted legislation to regulate the management of WEEE - or are awaiting forthcoming legislation - the issue of *mandatory and voluntary* EPR programmes is still worth revisiting to establish a rationale for government intervention by showing that one can reinforce the other. It is true that EPR is a market-based principle and draws invaluable lessons from existing voluntary practices in the business world. However, the government intervention can provide a springboard and give leverage to the strategic transformation. In fact, some so-called 'voluntary' programmes are a response to pre-empt legislation rather than a pure business initiative. This implies the possibility of various degrees of intervention. Regardless of the form of intervention,to provide any leverage an intervention must be designed to reward the good, e.g. innovators, and punish the bad, e.g. free-riders. In addition, it is important that a government sends a clear and consistent signal to the targeted industries once it determines to intervene, in order to trigger positive anticipatory behaviours.

There are a few examples where a producer initiates his/her own EPR programme, especially where he/she is responsible for the management of own products at the end of their life. However, despite the inspiration and the promising business and environmental benefits they give, these voluntary business practices are exceptions rather than the rule. Consequently, in most cases environmental benefits are treated as positive externalities and are under-provisioned. Thus, a levelling of the playing field is needed. In addition, a closer investigation shows that some practices such as leasing would not entail the promised environmental benefits unless: (1) the manufacturer of products leased them directly, and had interest in their design improvements; (2) the products at the end of their life were returned to them for extracting embodied values; and (3) the waste management hierarchy was followed (Mont, Dalhammar, and Jacobsson 2006, 1510). In other words, there is a strong case for government intervention to stimulate and steer business practices in an environmentally beneficial direction.

One lesson that policy makers can take from this discussion is that the intervention can come in various forms with different degrees of governmental involvement. For example, the Norwegian packaging industry concluded a covenant with the government to avoid a regulatory proposal for a perceived costly packaging tax (Røine, and Lee 2006, 225). At the other extreme, in Taiwan, the government eventually took over the control from joint recycling, clearance and disposal organisations (PROs) and has operated the Resource Recycling Management Fund to increase the credibility of the system. The nature of a trade association is an outstanding factor here. The existence of a strong and responsive trade association is a necessary condition to make a voluntary initiative, such as a covenant, sufficient. Such a collective body is able to develop industrial solutions, gain commitment from its members and hence circumvent the problem of free-riders to an extent; and win confidence from regulators and the public at large. In an absence of this condition, the government might consider more direct forms of intervention. However, there is also a risk of too much involvement, especially when the government moves towards the extreme by taking over the administration and does not allow producers to develop alternative solutions.

Developing an effective EPR program

Hall (1993) suggests that conceptually there are three levels of policy change. The most fundamental and abstract level is a change in the 'policy paradigm' – "a framework of ideas and standards that specifies not only the goals of policy and the kind of instruments that can be used to attain them, but also the very nature of the problems they are meant to be addressing" (Hall 1993, 279). The principle of EPR itself is at this level. EPR redefines the root cause of the WEEE problem and specifies design improvements as higher policy objectives, on top of traditional MSWM goals, i.e. high utilisation of product and material quality through effective collection, treatment, and re-use or recycling in an environmentally friendly and socially desirable manner. Therefore, fundamentally a

WEEE management programme cannot be labelled EPR unless it also aims to stimulate design improvements. Policy makers should also keep in mind that, all things being equal, the closer to IPR, the stronger the incentives for design improvements in the programme. Ideally, this should be explicitly spelled out in legislation or an agreement governing the programme. It is advantageous if the policy makers are clear on the first level as a policy paradigm will describe how policy instruments should be used to achieve policy objectives. In general, Porter and van der Linde (1995, 99-100) identify six characteristics of 'correctly formulated [environmental] regulation' as follows: (1) signal likely resource inefficiencies and potential technological improvements; (2) focus on information gathering; (3) reduce uncertainty as to whether investment to address environmental impacts will be valuable; (4) create pressure that stimulates innovation and progress; (5) eliminate the possibility of free-riding; and (6) focus on the long term.

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