



INTO THE FUTURE

MANAGING E-WASTE FOR PROTECTING LIVES AND LIVELIHOODS

by

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Regards,

Mr. Satish Sinha

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Key elements

1. Producer Responsibility Organisation (PRO) based operation
2. All stakeholders' participation
3. Upgradation of existing 'informal' sector
4. Revenue stream to suit Indian situation
5. Regulatory framework to enable proper safety and management

Background

The electronics industry is the world's largest and fastest growing industry and is recognised as one of the engines of economic development in India. The last decade has seen tremendous growth in the field of information technology all over the world, especially in developing countries like India. As a consequence of this growth, combined with rapidly increasing product obsolescence and consumer choices, it has brought in a new kind of waste – electronic waste or e-waste, which on the face of it appears to be very clean and harmless, though this is a myth. This ever-increasing waste is very complex in characteristics and requires another set of equally efficient technology and processes to deal with it.

The issue of electronic waste becomes much more formidable to handle in developing countries on account of lack of proper infrastructure, poor legislations and awareness among citizens. Also the issue of livelihoods of huge number of urban poor involved in processing and recycling of e-waste is dependant on this. India today generates a huge quantity of electronic waste - rough estimate suggest 1,45,000 tonnes annually, which is handled across many cities in India mainly in informal sectors exposing poor workers to environment and occupational health risks.

Sources of e-waste in India

The main source of electrical and electronic waste generated in India happens to be government institutions and public and private sector, which accounts for almost 70 per cent of the total waste. The contribution from individual households is currently relatively small, though this is also likely to grow appreciably in future. Manufacturers of components and assemblers are another important source of e-waste generation in the country and it is extremely difficult to capture the exact quantity of waste generation by this group.



The import of e-waste, which is illegal, is another major source and preliminary estimates do point out that the quantity being brought in is very significant. This takes place both in a legal as well as quasi-legal way, since e-waste is either misclassified as ‘metal scrap’ or imported as second hand or ‘end-of life’ goods, which soon become waste.

Current practices for processing of e-waste and its impacts

The existing system for e-waste processing is mostly handled in a very well networked informal sector, which is the key player at the moment. Most of these operators are neither registered nor authorised and operate in a clandestine manner. Research has shown that these operations are highly dangerous and risky.

These operations are well connected to the supply chain processes of sourcing the raw material to finding market for the recovered materials during post-recycling operation. The actual processing is carried out in small clusters and behind closed doors often located on the periphery of the city. Some of the processes include open burning of Poly Vinyl Chloride (PVC) wires, acid bath, heating of lead solders, etc. These processes are highly toxic impacting both environment and human health.

Some of the immediate and long-term impacts of the current practices are as follows:

- ♦ Release of toxics into air, water and soil;
- ♦ Health concerns to the workers involved directly in such operations;
- ♦ Low recovery of materials due to rudimentary processes (loss of resources);
- ♦ Loss of revenue to state as these recycling centres are not covered under any regulation;
- ♦ Disproportionate sharing of profits.

Convert challenge into opportunity

With e-waste becoming a reality in India and such recycling activities on the rise, a need has been felt in all quarters for an efficient and environmentally sound management of e-waste in the country. Across the world, mainly in Europe, there have been different models for the management of such waste, which have been successful. The following table shows the glimpse of the e-waste management system followed by different countries.

Countries	PRO	Fee System	Legislation
Switzerland	SWICO	ARF- consumer	Yes
Norway	Elektronikkretur	Producers fee	Yes
Japan	Different groups	Disposal cost- consumers	Yes
Belgium	RECUPEL	ARF-consumers	Yes



		+	
		Producers fee	
INDIA	-	-	NO

Since the Indian conditions are currently different, with respect to how e-waste is procured from consumers (both households as well as businesses), we need to develop and evolve a system, which finds acceptability among all stakeholders and is viable and sustainable in long-term. E-waste collected has to be diverted to a proper system, else it will continue the existing system of unsafe and hazardous operations. Existing actors should be part of the proposed system as a key in the collection link.

However, while doing this we must keep in mind the principles of e waste management - fair distribution of costs, protecting livelihoods, ensuring safe working conditions and the need to drive cleaner production and clean materials for the future. Alongside, we must not become the dumping ground of the world's e-waste.

One key challenge is to upgrade the working conditions of the existing informal sector players who are involved in the recycling at the moment. Also, the fact that Indian customers expect a payment for the waste they discard off, needs innovation for the system to work well and with the required principles in India.

Urgent need for regulatory framework for e-waste management

A regulatory framework is also enabling besides being regulatory. In this case, we need to enable proper collection and recycling and to 'set the rules' therein. Clear-cut responsibilities and requirements go a long way in ensuring that there is adequate investment by responsible actors on the ground, and not providing that clarity only continues the chaos.

Secondly, as stated above, the legal framework needs to ensure that health and safety aspects of the people involved in the operations is protected, along with issues of emissions and waste emerging from such operations.

A proper legal framework is very essential not only to streamline the existing setups but also to attract recyclers who make the recycling process safe and efficient. Government incentives like land, financial subsidies, etc. can go a long way in ensuring a viable collection and recycling system.

Since the major source of the waste is from the organised sector, a formal legal channel along with strict implementation on ground can ensure a viable and sustainable system to manage this waste. It is essential to draw up the critical components, which can make a significant difference in supporting the system.

The factors that will contribute towards supporting and consolidating such a system are as follows:



1. Legal framework for e-waste disposal
2. Participation of all stakeholders
3. Availability of proper infrastructure
4. Assured supply of raw materials
5. Integration of workforce from informal sector.

Toxics Link attempts to look at a workable e-waste recycling model.

The proposed model and its constituents

The model being suggested is a linear model and is based on the input-output principle. It recommends a very important role for the manufacturers/producers of electronic goods. Other important players in this chain will comprise of the generators of waste, the recyclers (entrepreneurs – both new as well as existing) and the policy makers and regulators who will direct and monitor the whole process.

Categories of WEEE to be covered in the proposed model

The proposed model intends to cover a broad range of electronic products, which require a range of technological interventions for their efficient management. This will ensure that the end-of-life goods with lesser potential of material recovery are also included with products, which have higher material value. The broad range of products/equipments being included as WEEE is:

- ♦ Consumer electronics like television, refrigerators, audio systems, etc
- ♦ Computers
- ♦ Telephones including mobile phones

Categories of generators of e-waste

The generators of e-waste in this context also need to be broadly categorized and listed for clarity.

The generators of the waste include:

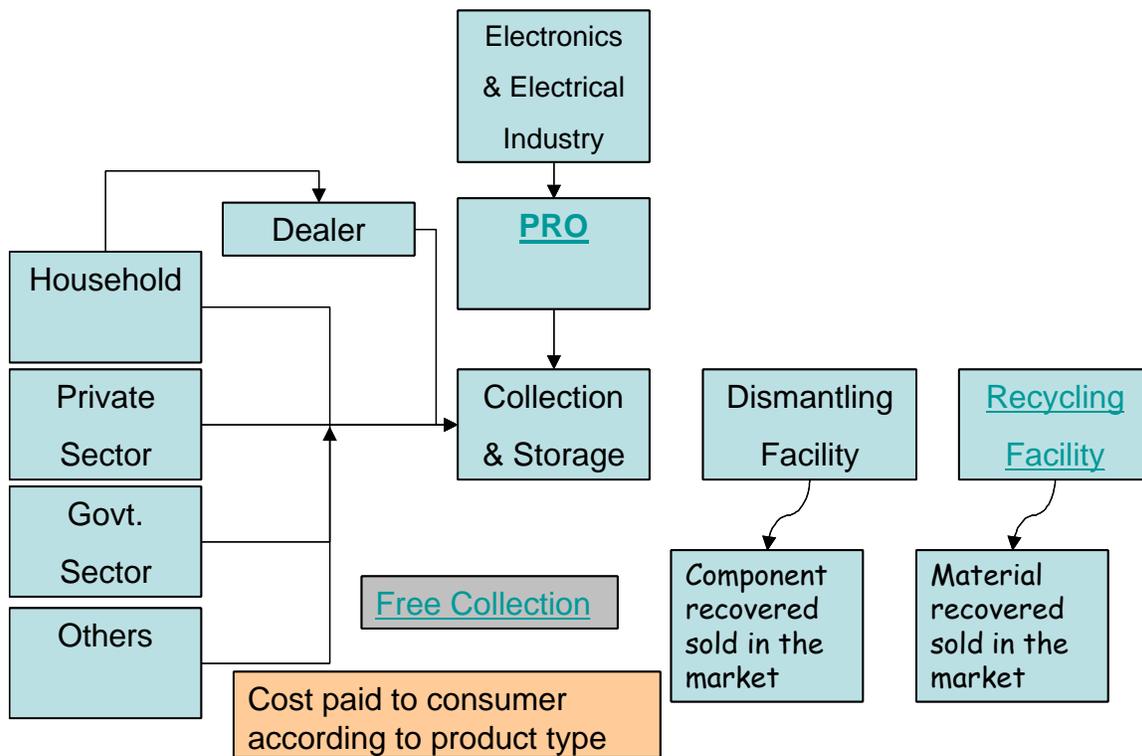
- ♦ Manufacturers
- ♦ Assemblers
- ♦ Individual consumers
- ♦ Corporate users
- ♦ Government organisations
- ♦ Importers of electronic waste

The proposed process flow

At the heart of the proposed e-waste model is the electrical and electronics industry, which comprises of various players in the field. This group contains not only the manufacturers but also the importers and assemblers of the EEE (Electrical and Electronic Equipments).

This is the most important group and hence it is appropriate for them to come together as consortium and establish an organisation, which takes the responsibility of the end-of-life disposal of products being manufactured or assembled by them. This organisation, which can be established with support from all producers, can be designated as **‘Producer Responsibility Organisation (PRO)’** and will largely be responsible for environmentally sound management of e-waste.

Proposed e-waste recycling model



Rationale for PRO: The principle of Extended Producers’ Responsibility or EPR has been accepted worldwide and is most appropriate and logical framework for finding solutions to waste arising from products. This not only helps in locating end-of-pipe solutions but also contributes greatly in minimising toxic waste through cleaner production technologies and cleaner input materials.



The composition of electrical and electronic goods being complex on account of materials used during manufacture, it requires a set of highly specialised technology for retrieval of these materials and manufacturers are in best placed to provide such technologies.

The product manufacturers will also enjoy a major advantage of their sales and service network to utilise this channel to collect the waste back at the end of life of such products.

Structure of PRO: It is suggested that PRO operate as a non-profit organisation built on the ethos of Corporate Social Responsibility (CSR) and be an active participant in this process. The top management of this PRO should have representation from various sectors making it truly multi-stakeholder organisation.

The cost of establishing this organisation needs to be supported by the individual companies. The details on the contribution made by individual companies can be worked out through detailed deliberation. A part of revenue can also be generated through the sale of the e-waste being sold to the recycler/dismantler.

The PRO should operate with all stakeholder participation (including representatives of the informal sector) and with full operational transparency.

Function of PRO: The Producer Responsibility Organisation will take on overall responsibility of the complete recycling process of e-waste with different levels of engagements in various processes. The PRO will take on direct responsibility of collection and storage of all WEEE generated across the country and then pass this on to the dismantler/recycler for a price.

The nature of goods being classified as WEEE, have an intrinsic material value and this value is key to the complete financial planning of this model. It is a globally accepted fact that e-waste has a material value assigned and all recyclers, big or small, procure electronic wastes at a price and then make profits by selling the recovered materials.

This model suggests and recommends that a part of this material value be passed on to the generators of the waste. Part of this value (revenue) be utilised for logistical support of collection and storage of waste. This mechanism also provides incentive to the generators to be active participants and streamline the storage and collection system to an authorised agency. The PRO will pay the generators for the material collected and provide free collection system. The dynamic fee system for different end-of-life products will be fixed by the PRO and will be open to review at periodic intervals. This will give an option to vary the prices according to the prevailing market values of the materials extracted.

The revenue generated by PRO through sales of this waste to the recyclers will be utilised for financing the take back process from the consumers (cost paid for the WEEE) as well as the collection and storage of the waste.



Function of recyclers: The collected material will be sold to an authorised dismantler and recycler, who is an important component in this e-waste management system. The dismantling and recycling infrastructure will be set up by individual entrepreneurs and will be responsible for establishing environmentally sound technologies to manage WEEE.

The revenue generated through sales of the materials recovered will support the administrative, plant and machinery and other overheads. The critical factor deciding the breakeven period will be both an assured material supply as well as the scale of operation. The experiences across many countries suggest that the scale of operation for recycling such waste is growing and such ventures are considered viable and profitable.

The collection mechanism of the proposed model

1. **PRO take-back:** The PRO will provide free collection for the waste and the generators will be paid for the material according to the product type (fixed by PRO). A proper reporting system has to be established for this to ensure transparency.
2. **Dealer take-back:** Only in case of households, the dealers selling such products will have to take back the old products and the household generators will get a discount on new purchase of electrical and electronic goods (the end-of-life cost can be fixed according to product type). These products will be then transferred back to the PRO with proper reporting.
3. **By existing informal network:** One of the biggest challenges to this model is from the existing informal sector and the operators will need to address this. The issue of livelihoods of existing informal sector players need to be a key component in the new model. The best option may be to channelise this sector in the collection and storage of waste from various sources, which is then passed onto authorized distribution channels.

The financial component of the proposed model

The critical difference in this model is that, it proposes cost of materials to be paid to the generator, whereas all other existing models levy a fee for recycling the waste to be borne by generators. Most European models have a component as Advance Recycling Fee (ARF) to be utilised for supporting the collection and storage of waste. However, in most existing systems the recycler has to procure the materials from the collecting agency by paying a price for the waste. Even all Indian recyclers, presently engaged in e-waste processing, are procuring waste at a cost.

The financials as drawn up below does reflect that the model has adequate capacity to support the cost paid to generators as a strong incentive to be an active participant in the process.



Estimated financials for recycling of 5 tonnes of e-waste:

5 tonnes of computer waste: $5000\text{kgs}/27.2\text{kgs}$ (wt. of one component) = 183 nos.

Waste estimation from 183 computers:

Sl No.	MATERIALS	Material in 1 Computer (in kgs)	Material in 183 Computer (in kgs)	Recoverable material	Market Price	Total value
1	Copper	1.91	348.63	313.77	291.00	91306.01
2	Tin	0.27	49.80	34.86	605.00	21092.07
3	Lead	1.72	315.43	15.77	75.00	1182.85
4	Aluminium	3.86	705.56	564.45	143.00	80715.98
5	Nickel	0.23	42.33	33.87	1600.00	54186.95
6	Iron	5.58	1020.99	816.79	18.00	14702.19
7	Zinc	0.60	109.57	65.74	170.00	11176.06
8	Plastic	6.26	1145.50	229.10	60.00	13745.95
	Total					288108.06

Thus, taking a very conservative estimate of the materials recovered, total value of the recoverable materials from 183 computers will be Rs 2,88,108

The input cost of 183 computers (from various market sources) is approx. 183×600 (inclusive of the logistics) = Rs. 109800

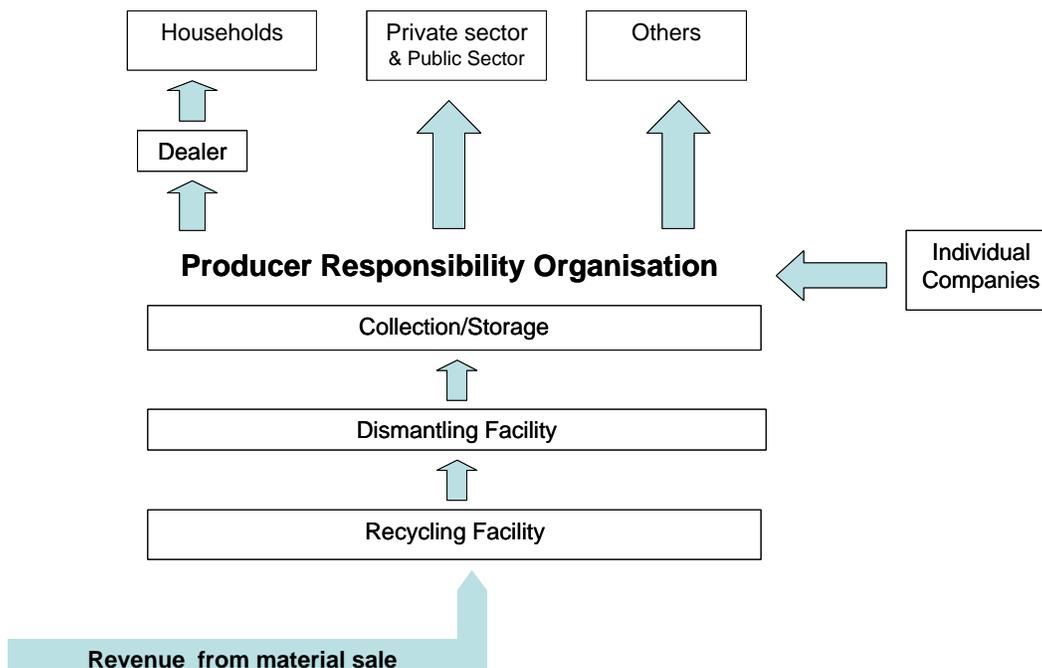
Therefore difference: output–input = Rs. 1,78,308

Rs 1,78,308 will include the processing cost and profit for the recycler.

Percentage cost distribution:

- 38 per cent on input materials
- 62 per cent on processing of materials and profit

Financial flow in the proposed model





Roles and responsibilities of the stakeholders

Generators

- To dispose of WEEE to the authorised dealer/ PRO
- Corporate users to maintain records of donations
- Individual companies and public bodies need to file returns to show their disposal practice

Producer Responsibility Organisation (PRO)

- Responsible for the collection, storage of the e-waste
- To provide free collection from all generators
- To pay for the material collected from generators (individuals and corporate)
- To sell the material collected to an authorised dismantling and recycling facility
- The revenue from the sale of collected material used to finance the cost paid to the consumer, the collection and the storage of the e-waste
- To ensure that the end-of-life products are cleared of the all critical information
- Needs to maintain annual records of the material management and be open to auditing and scrutiny by external agency
- To be part of the regulatory body monitoring the dismantling and recycling facilities

Existing informal sector

- Potential to be part of the storage and collection process
- Skill up gradation to enable participation in dismantling and recycling process

Dismantler and recycler

- Material to be bought from PRO
- To employ authorised technologies for dismantling and recycling
- To regulate hazardous materials as per Hazardous Wastes (Management and Handling) Amendment Rules, 2003;
- To maintain proper environmental and health standards;
- To maintain and produce records for inspection and verification.

Regulators/policy makers

- To frame appropriate guidelines/legislation to support the model;
- To monitor the processes regularly;
- To provide incentives to entrepreneurs to set up facilities;
- To regulate/control the number of facilities in a geographical area
- To approve technologies;
- To form multistakeholder monitoring committee;
- To create awareness among generators of waste.



Benefits of the proposed model

The benefits of the proposed model are as follows:

- **Efficient resource recovery:** Setting up of facilities with appropriate technologies is going to ensure higher recovery of materials post recycling. The targets for recycled materials can gradually be pushed higher to increase our recovery percentages eventually leading to resource conservation.
- **Potential to create jobs:** The model has components of collection; storage, dismantling and recycling incorporating advanced technologies. Setting up of large infrastructures will help create many jobs across the country at all levels.
- **Environmental benefits:** The biggest advantage of this process will be the environmental benefits, as the complete process will follow the norms of environmentally sound management. All toxic materials such as lead, cadmium, mercury, barium, BFRs etc which are currently leaching out to the environment will be highly minimized thus reducing the environmental burden.
- **Occupational safety:** This is another major gain for the workers who will not be exposed to the hazards of the toxic elements and gases being released as technology and strict monitoring and standard setting will help minimize this exposure.
- **Integration of present informal recycling sector:** In the present informal set up, workers are most disadvantaged sections as they continue to slog in most difficult environment with lowest remuneration. The proposed model will help to address this problem by involving these workers in the collection and storage of waste. The dismantling operation, which will require trained human interface, will also provide opportunity to this existing work force to be part of this system.
- **Revenue to the state:** Setting up of facilities as per the existing norms of industry will bring in revenue for the state.

Additional points

- There should be strict ban on import of e-waste into the country.
- Permanent ban should be imposed on donations of computers by developed countries.
- Encouragement should be given to weight-based recycling targets, which may vary, by product.



- Encouragement should be given for sustainable productions by separate cleaner material legislation by restricting the use of certain hazardous materials.
- Only limited number of recycling facilities to be allowed within a geographical area to ensure financial sustainability of the system.
- Government along with the PRO and civil societies should launch an awareness campaign to provide information to the consumers on the collection system and a website can be uploaded giving details of the recycling process and the related environmental and health aspects.
- The individual companies can provide information on product recycling, toxicity in the equipments, the health hazards and the take back schemes.