

# **Environment and Livelihood**

## Hand in Hand



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Informal Sector Integration in E-waste Recycling

**Study by:** Toxics Link, New Delhi



Toxics Link for a toxics-free world

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Toxics Link has unique experience in the areas of hazardous, medical and municipal wastes, as well as in specific issues such as the international waste trade and the emerging issues of pesticides and POPs. It has implemented various best practices models based on pilot projects in some of these areas. It is responding to demands to share its experiences of these projects, upscale some of them and to apply its past experience to larger and more significant campaigns.

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## Table of Contents

1.	Introduction	
2.	Objective and	Methodology9
	2.1	Rationale of the study9
	2.2	Objective
	2.3	Methodology 10
3.	Informal Sector	or and E-waste12
	3.1.	Informal- Different Interpretations and Roles 12
	3.2.	Waste business and informal sector 13
	3.3	Informal waste business in India15
	3.4	Informal sector in e-waste in India 17
	3.5	Changing landscape
4.	Informal Sector	or and Clean Channel27
	4.1	Socio-economic implications of integrating informal e-waste management activities
	4.2	Potential contributions to the resource economy
	4.3	Regulatory framework
	4.4	Organising the unorganised: Proposed models
	4.5	Forming an Organisation41
	4.6	Role of civil society organisations
5.	Conclusion	
6.	References	

## List of tables

# List of figures

Figure 1: Waste hierarchy in the informal sector	15
Figure 2: Informal sector economics	17
Figure 3: Women employed in wire stripping	18
Figure 4: Waste flow in the informal sector	. 19

Figure 5: Material flow	. 21
Figure 6: Informal sector players and integration	. 32
Figure 7: Linking the waste collectors	. 33
Figure 8: Material flow in Model A	. 35
Figure 9: Model B- Collection agency and the material flow	. 36
Figure 10: Civil society and the informal sector linkage	. 38
Figure 11: Dismantlers getting together	. 39
Figure 12: Linking the dismantling groups	. 40
Figure 13: Refurbishers	. 41

## 1. Introduction

E-waste is one of the fastest growing waste streams today and is growing almost three times the rate of municipal waste, globally. As per current estimates, the global e-waste market is forecasted to reach 53 million tonnes by 2012. E-waste generation in India has also witnessed a significant growth and the current volume of waste is staggering 8 lakh metric tonnes. The main sources of electrical and electronic waste generation in the country are government institutions and business houses, accounting for around 70% of the total waste, while contribution of individual household is on the increase. This highly toxic waste poses serious concerns, as significantly large volumes of this waste is handled in the informal sector located in bylanes of the cities and processed in the most rudimentary manner leading to release of these toxins into environment thereby seriously compromising human health and environment. Toxics Link has led a long and sustained campaign for safe management of e-waste since 2003, supported by various other agencies, finally resulting in the announcement of a new regime for management of this complex waste stream.

E-waste (Management & Handling Rules), 2011 were notified by the Ministry of Environment and Forests, Government of India, and came into force in May 2012. These rules were framed with the clear objectives of safeguarding environment and promoting safe and efficient recycling of electronic waste in India. The new legislation brings e-waste collection, dismantling, recycling and disposal within the purview of the regulatory authorities with a clear set of responsibilities for all the stakeholders in the value chain.

These rules are expected to usher in a new environment for the safe management of e-waste and change the current practices. With Extended Producer Responsibility at the core of the Rules, producers, manufacturers and sellers of electronic and electrical equipments are now responsible for proper collection and recycling of their end-of-life products. The producers or brands are mandated to create new systems for collection of post-consumer waste and ensure safe disposal by application of appropriate and suitable technologies for protecting environment and human health.

With the metal prices going up internationally e-waste recycling is now seen as a lucrative business with some established global recycling companies and new entrepreneurs entering the e-waste recycling market and competing for their share of the waste in the Indian waste market. It is encouraging to note that there has been a significant growth in the number of e-waste recyclers in the country, who are engaged in diverse recycling practices. As per the current data, approximately 70 recycling companies in operation are registered with the Central Pollution Control Board (CPCB). These developments clearly suggest increase in waste flows with these recyclers and growth of a new clean e-waste channel.

Since the informal sector handles and recycles most of the e-waste generated in India, the new laws have far-reaching implications for this sector. The informal sector, which was estimated to deal with around 95% of the e-waste being recycled in the country, may suddenly find materials drying up as the new rules do not permit waste flows into informal settings. This can pose serious implication for the urban poor as change in waste flow patterns will result in loss of livelihood in the informal e-waste recycling sector, who have since long been engaged in e-waste trade and recycling. Although this could potentially result in loss of livelihood, it should also be seized as an opportunity for utilising this trained human resource and their skills in management of e-waste. It is not only on account of loss of livelihoods, but also their capacities gained over many years of operation that

needs to be channelised and mainstreamed as it will not be appropriate to lay off such large population of workers. In this context, it becomes critical to examine all possibilities to engage with this large work force and find suitable options within the framework of the current set of rules for their active engagement on e- waste management.

If the informal sector is to be mainstreamed into the 'clean' channel of e-waste recycling, it has to be provided with appropriate guidance and technical support. However, the policy framework does not pay enough attention to these issues, leaving an undesired gap which needs to be addressed. This study aims at a comprehensive review of the issues related to informal e-waste recycling in India and examines possible models and linkages that can be created for mainstreaming the informal recyclers within the existing legal framework. It also looks at the necessity of training and capacity building that supports their mainstreaming process.



## 2. Objective and Methodology

## 2.1 Rationale of the study

The E-waste (Management & Handling Rules), 2011 came into force in May 2012 and the rules clearly stipulate the requirement of seeking due permissions from the State Pollution Control Boards (SPCBs) for engaging in various processes of recycling electronic waste. The units engaged in handling e-waste are mandated to maintain annual records of the e-waste collected and disposed, and submit these records to the regulators. The process of authorisation from the SPCBs for undertaking collection of waste and recycling requires clear description of the techniques and equipments for handling, processing and disposal of waste, and has provisions of systematic monitoring thereafter.

Although the effective implementation of the rules and monitoring will take time, some of the stakeholders have already shown a degree of seriousness in complying with the rules. In some of the large cities, bulk generators are channelising their waste to the formal e-waste recycling sector. With the increase in compliance levels and issuance of operational guidelines, the recycling infrastructure is set to grow and the quantity of e-waste flowing to formal recyclers is expected to increase in coming years.

The informal sector, which has been actively engaged in recycling for a long time, has a challenge ahead. The formalisation of e-waste recycling may render thousands, who earn their livelihood by collecting and processing e-waste, unemployed. The importance of the informal sector is enhanced because it employs a number of urban poor who work with little or no social security. They stand the risk of losing their livelihoods and their chances of relocation in other industries are poor given their stereotyped and rudimentary skills.

However, this may not be a loss just for the informal sector, as the whole recycling chain will stand to lose. The informal sector has great collection skills and strong networks which help it in procuring e-waste, especially from small and peripheral sources. It is impossible to duplicate such networks, as this may require huge investment and effective management. The manual dismantling skills of the labour force also make them very valuable. It is important to involve this skilled labour force in the emerging system. It is thus crucial to understand the exact role of the informal sector in the recycling of electrical and electronics waste stream in India, and suggest ways to mainstream and enhance the capacities of the labour force involved.

## 2.2 Objective

The study aims at examining the current role of the informal sector in e-waste recycling in India, and find ways to integrate the labour force involved.

The main objectives of this study are as follows:

1. To describe the scale of the informal sector involvement in e-waste collection and processing in India;

- 2. To explain the waste flows and processes in the e-waste recycling sector;
- 3. To examine the possible health and environmental impacts of the operations of the informal sector;
- 4. To suggest models to integrate the informal sector in the formal sector; and
- 5. To find the training and capacity building needs of the informal sector.

## 2.3 Methodology

*Objective 1* : To describe the scale of the informal sector involvement in e-waste collection and processing in India

- To review literature on the role and involvement of the informal sector in India
- To document the involvement of the informal sector in India through information available in published reports and journals.

A comprehensive review of the existing literature was done to document the role of informal sector in recycling, especially e-waste recycling. The review included articles from scientific journals and reports published by leading multilateral organisations, non-profit organisations, research institutes, industry bodies and regulatory agencies on the e-waste recycling from 2003 to 2012.

Objective 2: To explain the waste flows and processes in the e-waste recycling sector

- To review literature on the waste flows and processes in the e-waste recycling sector
- To document the findings of the literature review
- To conduct semi-structured interviews with e-waste collectors, dismantlers and recyclers for understanding the emerging material flow chain in India.

A detailed study was undertaken to understand the material flow in the e-waste recycling sector. Interviews with the informal workers and unit owners gave insights on the huge networks, which are across state borders. Although there is existing literature documenting some of the dismantling and recycling processes, field visits were conducted to understand and also observe any change in them.

Objective 3: To examine the possible health and environmental impacts of the operations of the informal sector

- To review literature on environmental and health impacts of the informal recycling operations
- To document the findings of the literature review
- To observe the processes and assess the possible risks.

In the absence of any comprehensive study to assess health and environmental impacts of the informal operations in India, we focused on possible risks with reference to similar studies done outside India.

Objective 4: To suggest models to integrate the informal sector in the formal sector

- To study the current models, if any
- To look at the existing models to integrate informal sector in other sectors
- To analyse the situation and suggest feasible models.

The secondary literature focused on documenting any existing attempts to integrate the informal sector and understand their strengths and weaknesses. Since e-waste is relatively a new waste stream, attempts were made to study the other sectors. Some of these learnings were analysed to come up with possible models.

Objective 5: To find the training and capacity building needs of the informal sector

Several studies over the years on this sector have highlighted the hazardous processes employed by the informal sector in processing e-waste, which is a serious concern. Hence, any attempts to integrate this huge sector will have to be accompanied by training and capacity building. The existing operations and the risks were evaluated to understand the needs.

## 3. Informal Sector and E-waste

Waste and informal sector are very closely linked, especially in developing countries where change in consumption patterns has led to a sudden surge in the quantity of waste being disposed. The informal sector consists of women and men, mostly adolescents and children, who play an important role in extracting the value contained in waste. Several studies have shown that these informal recycling activities have some positive effects on the environment by virtue of reducing the waste destined for landfills and thereby reducing the costs of waste management systems. Such activities also provide income opportunities for the poor.

E-waste is one of the most critical waste streams globally, due to the burgeoning volume and the toxicity concerns. In India, the informal sector is estimated to be handling around 95% of the e-waste recycled. Due to its wide reach, the informal sector is able to collect e-waste from numerous sources, covering almost all segments of consumers. The operations of the sector also prevented lot of this toxic waste from being dumped into landfills at a time when the formal recycling infrastructure was nonexistent in the country.

Despite some of the above positives of the informal sector operations in the e-waste stream, there are certain drawbacks such as the precarious working conditions, lack of social security for the workers and the environmental risks caused by the unscientific processes. The downsides of unorganised e-waste management have triggered various debate and changes, especially at the policy level. As waste management matures, and mechanisation have become common strategies, leaving out the huge informal sector and completely ignoring its skills.

## 3.1. Informal- Different Interpretations and Roles

Many workers are employed in 'formal' workplaces such as factories or offices or units which are registered with the state. There are certain laws governing their employment and they usually have a contract of work. They are more likely to be organised, and benefit from this collective bargaining force.

There are other workers whose status is vague. These include workers who work in units which may not have a legal status or who may be individual workers employed on a daily basis. They also include migrant workers who are used as cheap labour in the unorganised sector. Most workers in the cities are a part of this informal or the unorganised sector such as the daily wage workers in markets, rickshaw pullers, domestic helps, rag pickers, etc. This is often called the 'informal sector', which represents the large and growing proportion of the world's workforce.

The term 'informality' means different things to different people, but has a certain baggage associated with it: unprotected workers, low productivity and unfair competition, evasion of the rule of law, nonpayment of taxes and being 'underground'. The first recognition of the informal sector came after the 1972 ILO Report on Kenya, inspired by a previous contribution. It highlighted that the problem of employment in less-developed countries is not one of unemployment but rather of employed workers who do not earn enough money to make a living. They are the **'working poor'**. Independent of the interpretations adopted, the

characteristics of the informal sector are similar---small, unsophisticated technologies, low capital costs, and no health and safety norms in place. Moreover, it is the sector wherein majority of waged workers toil without contracts and protection.

According to some, informal sector activities are the result of pressure exerted due to the current labour scenario when good jobs, usually in the formal sectors, are scarce. The result is that people seek low-productivity, low-income solutions by producing or selling anything that may provide for their survival. There is also growing presence of new activities generated by the concept of decentralisation, particularly in a context of rapid economic change. Subcontracting and decentralisation of production and work processes to reduce costs have contributed to the enlargement of the informal sector.

Different stakeholders have also, over the years, taken differing stances on the informal economy: some view informal workers as a nuisance to be eliminated or regulated; others see them as a vulnerable group to be assisted through social policies; still others see them as entrepreneurs to be freed from government regulations. Another perspective sees the informal workforce as comprising unprotected workers who need to be covered by labour legislation.

The informal sector in the urban areas is characterised by low wages, excessively long hours of work and social security almost not existing. Since migrants earn less than what is required to sustain a decent living in urban areas, they lead a life of low quality, presumably reflected in their low human development. They live in deplorable conditions and have extremely poor health status. Women migrants are the worst hit in such a scenario as they are paid lesser than their male counterparts and they do not enjoy basic health benefits like maternity leave, etc.

Today, there is renewed interest in the informal economy worldwide. This interest stems from two basic facts. First, the informal economy has grown in many countries and has emerged in new guises and in unexpected sectors. Second, despite continuing debates about its defining features, supporting informal enterprises and improving informal jobs are increasingly recognised as key pathways to promoting growth and reducing poverty.

## 3.2. Waste business and informal sector

Waste is one of the most discussed environmental issues, especially in developing countries. where there is a sudden surge in consumption and hence in waste quantities. This increased attention has been due to the continuous mismanagement of waste and resulting issues of public health and environment damage, in spite of governments' huge budgetary interventions. In many developing countries, the infrastructure and organisational system of waste management are insufficient. Municipalities and formal service providers can thus neither provide collection service to all households, nor guarantee an effective recycling or disposal of wastes.

In times of decreasing availability and increasing prices for raw materials, the 'anthropogenic resources' contained in waste, become economically interesting. Private enterprises increasingly see waste as a commodity to which they seek to secure access.

Meanwhile, for most urban poor, waste collection and recycling is a common means to eke out a living. Waste management systems in cities of many developing countries cannot be managed without the informal sector: waste pickers, scrap collectors, traders and recyclers. Waste management activities like collecting, sorting, trading and sometimes even processing waste materials serve as income opportunities for large numbers of uneducated poor and also provide a solution for waste management woes in developing countries. In many of these countries, informal waste pickers contribute significantly to waste management. The informal sector activities are highly adaptable, flexible and able to respond quickly to demand-driven forces. This also means looking at new waste streams like e-waste and finding ways to recycle them. These activities not only provide an income opportunity for the huge workforce involved, but are also a great source for resource recovery. It will be apt to say that informal sector plays a significant role in diverting recyclable materials from waste landfills or dumps.

Even though the income and living conditions of informal waste workers differ significantly according to their main activities, majority of them are confronted with extremely hazardous working and living conditions. They generally lack sanitary services, health care and social benefits. Child labour is frequent, and life expectancy is low.

Some crucial reasons why the informal sector plays such a huge role in waste management in developing countries:

- Increasing waste volumes and complexity
- Differing composition and characteristics
- Urban-centric problem
- Poor recognition of the economic value of waste
- Inadequate waste management infrastructure
- Capacity constraints of local authorities.

Yet, this potential for improving waste management by involving the informal sector appears untapped by the authorities. Despite its significant contribution to waste management, this sector is often not officially recognised and acknowledged. In spite of the basic knowledge and equipments of the informal workers, despite their basic knowledge and equipments, they often are more effective when we look at the waste hierarchy of reduce, reuse, recycle, and recover energy and disposal of waste.

However, their recycling rates are low, mainly due to lack of better know-how and application of technology. Also, we cannot ignore the negative environmental impacts by informal recovery activities. Informal recycling activities often do not respect environmental standards and might contribute to pollution. The unsound processing practices in the informal waste sector are a cause for concern and need to be regulated. This sector, though, can develop its full potential for recovering resources from waste if it is recognised, integrated and supported to establish more efficient processes. One significant advantage of doing so, besides improving the social conditions of millions of labour force, is that by recovering more resources from waste and disposing of less waste, environmental harm can be reduced. Improved equipment and processes can also reduce health risks to which informal workers and the surrounding populations are routinely exposed. Thus, proper integration of the sector into the existing waste

management policies can lead to sustainable management practices and possibly help alleviate poverty.

## 3.3 Informal waste business in India

For India, the informal sector is nothing new. Unorganised or informal sector constitutes a pivotal part of the Indian economy. A high proportion of socially and economically underprivileged sections of society are concentrated in the informal economic activities. As per the Economic Survey 2007--08, 93% of India's workforce include the self-employed and employed in the unorganised sector. The report of the National Sample Survey Organisation (NSSO) in May 2011 about the casual workers in India between 2004-05 and 2009-10, compared between 1999–2000 and 2004-05, very clearly reflects the significant increase in the number of casual workers and the decline in the number of regular workers.

As per the latest estimation of the Sub-committee of the National Commission for Enterprises in the Unorganised Sector (NCEUS), the contribution of unorganised sector to GDP is about 50% (NCEUS, 2008).



Figure 1: Waste hierarchy in the informal sector

Waste is becoming a huge problem in India. The per capita waste generation rate in the country has increased from 0.44 kg/day in 2001 to 0.5 kg/day in 2011, fuelled by changing lifestyles and increased purchasing power of urban Indians. Urban population growth and increase in per capita waste generation have resulted in a 50% increase in the waste generated by Indian cities in a decade since 2001. There are 53 cities in India with a million plus population, which together generate 86,000 TPD (31.5 million tonnes per year) of Municipal Solid Waste (MSW) at a per capita waste generation rate of 500 grams/day. The total MSW generated in urban India is estimated to be 68.8 million tonnes per year (TPY) or 188,500 tonnes per day (TPD) of MSW.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup> Sustainable Solid Waste Management in India by Ranjith Kharvel Annepu

The informal sector has a historic role in waste management and recycling in India, partly because of the notion of waste being a fringe commodity, and not a resource. As a result, this commodity was left to be handled by the fringes of society – the informal sector.

The informal sector is well-structured and has a huge presence, especially in mega cities. This sector is responsible for the recycling of around 70% of plastic waste and up to 56% of all recyclable waste generated in the country. It recycles about 10 million tonnes of recyclable waste per year according to a report.<sup>2</sup> Large populations of waste pickers are estimated to be involved in waste business in the major cities like Delhi, Mumbai, Kolkata and Chennai. Women and children form a significant part of this informal workforce in India.

In India, like most developing countries, the informal waste sector is structured like a pyramid (Figure 1). At the bottom of the waste trade pyramid are the waste pickers who engage in the free collection of waste from municipal garbage bins, streets and dumps. Above them are the itinerant scrap buyers who purchase small quantities of waste (plastic, paper, glass, metals, etc.) from households. The majority of these are former waste pickers who have managed to assemble some capital and to take up another activity. Between the waste collectors and the reprocessors are various levels of traders. The trade gets more specialised as it moves up the pyramid. At every successive level, waste is sorted more specifically; the better the segregation, the more value is added. In this chain, some of the players may be missing or combined at times.

Materials recovered by the informal sector are sold into the industrial value chain, thereby ploughing back some of the natural materials into the production cycle. This recycled material helps in reducing mining for new material. Recycling sector in Delhi alone accounts for estimated net greenhouse gas reductions of above 9.5 lakh tonnes of carbon dioxide equivalents (TCO2e) each year. This equates roughly to removing around 1.8 lakh passenger vehicles from the roads annually.<sup>3</sup>

From several research findings and information, two facts emerge very clearly about the informal economy, especially in the waste sector in India. The first fact is that there are significant gaps in earnings within the informal economy: On an average, traders have the highest earnings; followed by the own business employers, their employees and regular informal wage workers; casual informal wage workers; and outworkers. The second is that men tend to be over-represented in the top segment; women tend to be over-represented in the bottom segments. The net result is a significant gender gap in earnings within the informal economy, with women earning less on average than men (Figure 2).

An additional fact is that there is further segmentation and earning gaps within these broad status categories. Women tend to work in different types of activities, associated with different levels of earning, than men—with the result that they typically earn lesser. For example, in waste management, women tend to get jobs of sorting, cleaning, and never seen in the actual recycling processes which are dominated by men.

<sup>&</sup>lt;sup>2</sup> Sustainable Solid Waste Management in India by Ranjith Kharvel Annepu.

<sup>&</sup>lt;sup>3</sup> An Assessment of Municipal Solid Waste Compost Quality Produced in Different Cities of India with the Perspective of Developing Quality Control Indices. J. K. Saha, N. Panwar, M. V. Singh. 2, Bhopal: Waste Management, 2010, Vol. 30.



**Figure 2: Informal sector economics** 

## 3.4 Informal sector in e-waste in India

Most recycling activities in India are carried out in the informal or the unorganised sector and ewaste recycling is no exception. Infact, reports suggest that 95% of the e-waste is segregated, dismantled and recycled in the informal sector. This sector includes waste pickers, collectors, small *kabaris* (small middlemen) and big *kabaris* (larger middlemen), who accepts scrap from many sources including households and businesses. The sector also includes the processorsdismantlers and recyclers.

The widespread and active network of informal sector enables them to reach out to most ewaste generators and also connects them to markets where there is demand for extracted material. The skill sets of the workers have been acquired over many years of hands on engagement with these products and materials which are subsequently passed down to the next set of workers. These acquired skills of workers in these informal units help in reuse of many usable components and in resources being recovered. But this large workforce, based mainly in urban slums and neighbouring areas, use primitive and highly polluting backyard operations with low or non-existent risk awareness, thereby polluting ambient air, water and soil and affecting the health of workers. Children and women, the susceptible group, are also routinely involved in these operations.

Due to the illegal nature of their work, the sector does not find any support from government or financial companies. Since most of these shops are located in residential or non-industrial areas, they often are subjected to threats and have to bribe the local bodies.



Figure 3: Women employed in wire stripping

Some of the challenges faced by the informal sector involved in e-waste recycling are as follows:

- Lack of education, training and professional skills
- Lack of access to technology
- Lack of government support
- Limited access to finance
- Volatility of the waste market
- Threats/demand for bribery by local administration.

## Size and nature of the e-waste in informal sector

Although there have been various studies conducted to assess the quantities of e-waste generated in India, very little work has been done to assess the involvement of informal sector in e-waste recycling. Hence, there is hardly any reliable information available to understand the number of people involved in this industry. This is not just a problem in e-waste, but also a challenge faced in trying to account for the informal sector in any industry in India. The sector is spread in urban centres and accounting for every worker is a complicated task. It is also not easy as the informal sector is not very willing to be identified, because of the risk of closure. Another reason is that e-waste is a mixed material, with components containing plastic, glass, metals, etc., and most of these materials move out and merge into the specialised sectors, thereby encompassing a large recycling workforce.

Until a few years back, most of these informal recycling centres were in major metro cities such as Delhi, Mumbai, Bengaluru, Chennai and Kolkata, but they are quickly spreading as many such centres grow in smaller towns. Some of the more toxic and dangerous practices and activities are increasingly moving to the smaller towns far away from large cities and are tucked away deeply to avoid regulators' scrutiny.



Figure 4: Waste flow in the informal sector

The current model in the informal sector is entrepreneurial-based infrastructure that permits a large population to have its own business. Value is added at each stage creating employment at different levels, thereby sustaining the system. The micro or small informal enterprises could be family owned, where family members also double up as workers or could be enterprises which employ people on daily/monthly wage or contract labour. The initial investment required in starting a unit is low which makes the business very attractive for small entrepreneurs.

As most processes in the informal sector are manual, the sector employs many unskilled or semiskilled workers. The small enterprises are numerous, widespread and difficult to regulate; they take advantage of low labour costs due to high unemployment rates and availability of migrant labourers. Most dismantling and recycling units are owned by individuals who make good profit, but the workers employed in these facilities earn less than minimum wages (as mandated under the Minimum Wages Act).

## Strengths of the informal e-waste recyclers

The informal recycling sector is highly dispersed; operates as small units each engaged in specialised functions or processes. It is this specialisation of processes that creates a niche and highly developed skills to deal with any product and operation. Every unit could be engaged in a special process and within the unit each worker could also be undertaking one specialised task. It is due to this process of specialised work areas in the informal sector that there is a very large pool of trained human resource available in the country.

The informal sector, though is dispersed across the country and into individual specialisation, is extremely well networked and operates as a well-oiled machine. It is able to manage an informal association within itself and has acquired knowledge of material inflows, economics, supply chain and processes.

It is interesting to understand that the informal sector operates on smaller margins of profit keeping their overheads low and optimising on volumes, thus making their units economically viable and effective.

The informal sector also enjoys another great advantage of being able to reach out to almost any part of the country and be linked to each other in such a manner that it creates a perfect reverse supply chain process for the post-consumer waste. It is this existing informal network and infrastructure with its ability to access every household or office in the country that needs to be recognised and mainstreamed into the formal process.

## Material and process flow

The informal sector, though unorganised, is part of a well-oiled machinery and well-defined hierarchy and structure, as pointed out in various reports in India. It is interesting to view this structure and understand the waste flows. The waste collectors or (kabadiwalas) are the most important link in this waste flow and are responsible for the collection of waste from all consumers and manufactures. There is another set of operators, in parallel, who are essentially waste traders with better financial capacity and bid for larger volumes of waste being discarded by companies and organisations through auctions. The waste from both these sources flows to scrap dealers, who at the first stage cannibalise the functional components, reuse them, and also engage in refurbishing some of the discarded electrical and electronic equipments (EEE). The remaining part is dismantled or sold off to dismantlers. It is here that the waste is further separated as monitors, CPU and other parts and then broken down to individual components and materials. The waste then finally is sent to recyclers for material recovery. The recycler tries to recover as much as possible and sells the recovered material back to the industry to be consumed in the production cycle. The recyclers in a particular cluster are generally engaged in a specific set of activities and operation. The unused and unsold component and material, both at dismantling and recycling levels, ends up at the landfill.



Figure 5: Material flow

## Economics

There are significant economic potentials if valuable materials in e-waste are recovered. Recycling of e-waste is a market-driven and growing industry in India. The economics of e-waste in the country is very different from developed countries. The waste collectors pay consumers a positive price for their obsolete appliances unlike in the developed countries where consumers are charged a fee for disposal (Advance Recycling Fee or Disposal Fee). The small collectors in turn sell their collections to traders who aggregate and sort different kinds of waste and then sell it to recyclers, who recover the metals. The reusable equipments and components are segregated and attract a higher price in the market.

According to a report from ELCINA, it was estimated that the total annual turnover in e-waste processing by the unorganised sector in 2007--08 was around Rs 430 million.

In case of e-waste discards from large companies and Public Sector Undertakings (PSU), the financial transactions may be a little different. As the quantities are large and they are auctioned through tenders to the highest bidders, only waste dealers with large financial capacities can participate in this. At times the dealers jointly bid for the scrap and share the total waste among them for further processing.



The formal recycling companies are faced with one of the biggest challenges of material supply as they are in direct competition with the informal sector, which usually outbid the formal operators due to its very low operating costs.

## Health and environment

When e-waste is disposed off or recycled without any controls, there are predictable negative impacts on human health and the environment. Presently, the informal processing of e-waste in India is not under any environmental monitoring, and as a result the crude methods used to reclaim materials may cause pollution, creating serious problems to human health and environmental ecology. The biggest drawback of the unregulated processes in informal e-waste recycling system in the country is the uncontrolled emission of toxics that are going into the air, water and soil. E-waste contains more than 1000 different substances, many of which are toxic, such as lead, mercury, arsenic, cadmium, selenium, hexavalent chromium, and brominated flame retardants (BFRs). The recovery process being rudimentary has limited efficiency of material recovery resulting in loss of significant amount of precious metals and disposal of residues of toxic materials into water bodies and soil creating serious issues of water and soil pollution. There are also issues of cross-contamination of materials as plastics containing BFR is recycled and mixed with virgin materials and other plastics for manufacture of new plastic products.

One major challenge of the e-waste recycling in the informal sector, which employs underpaid men, women and children and does not follow any safety standards, is the occupational health and safety. Health hazards stems from all kinds of operations performed by them, like desoldering, dismantling, breaking, shredding, acid processing and open burning. Workers in ewaste disposal sector are poorly protected against the risk of it. They dismantle e-waste, often by hand, in appalling conditions. Working in poorly-ventilated enclosed areas, without masks and technical expertise, leads to exposure to dangerous and slow-poisoning chemicals. Due to lack of awareness, workers continue to risk their health. They use crude and highly hazardous

techniques for processing the e-waste. Many workers function from homes to reprocess waste, further exposing themselves, their families and the environment to dangerous toxins.

The workers routinely have physical injuries and cuts during breaking the equipments. There are no mechanisms in place to capture the dust particles (which may contain toxic materials) or other emissions, and most times the workers inhale these directly. The workers also handle concentrated acids (finally thrown into drains or neighbouring fields) to strip circuit

#### **Occupational concerns**

- Inadequate working space
- Poor lighting and ventilation, straining the eyes and breathing polluted air
- No work bench, hence sitting cramped on the ground for long hours
- Inhaling toxic fumes
- Exposure of body parts to fire, acid and other chemicals
- Unavailability of clean drinking water and toilets.

boards of copper, use mercury for recovering gold from microprocessors, or burn PVC plastic wires to recover aluminum and copper, etc. PCBs in older capacitors and transformers and BFRs on printed circuit boards, plastic casings, cables and PVC cable insulation can release highly toxic dioxins and furans during these operations and can cause long-term, even inter-

generational health problems, including neurological, reproductive, excretory and endocrinal disorders, or cancer.

The workers, mostly, are unaware of the hazards associated with such operations. Thus, the process safety is completely ignored. The workers are also engaged for long periods of the day on daily basis, with no sanitation facilities.

The environmental impacts of the operations in the informal sector are also well known and documented. Primitive recycling or indiscriminate disposal of e-waste cause irreversible environmental damage by polluting air, water and soil. Extracting metals like copper in open acid baths releases toxins such as dioxins, heavy metals, lead, cadmium, mercury and BFRs. Wires are often burnt to retrieve the copper. Processes like plastic recycling, cathode ray tube regunning

#### Some critical environmental concerns

- Emissions of dioxins and heavy metals like lead, cadmium, mercury in air;
- Release of BFR;
- Indiscriminate dumping of spent fluids/chemicals (contaminating soils);groundwater contamination (through leachate); and
- Land filling of non-recyclables.

and recovery of gold through mercury amalgamation add to the hazardous burden of the e-waste recycling in the informal sector. Waste components which do not have any resale or reuse value are openly burnt or disposed off in open dumps, leading to contamination in the surrounding areas. A study conducted by Greenpeace in 2005 on electronic recycling yards in Delhi indicated the presence of high levels of hazardous chemicals including deadly dioxins and furans in the areas where this primitive recycling takes place.

End-of-life process	Occupational risks	Environmental risks
Collection and dismantling	Dust containing various compounds during dismantling activities, e.g., Pb and Ba-oxide from broken CRTs. Cuts from CRT glass. Volatile compounds (incl. Hg) from broken components.	Emission of dust and fumes containing various metals (e.g. Pb, Zn, Cu, Sn, Sb, Cd, Ni, Hg) and organic compounds (e.g. BFRs) to the local environment.
PC-board heating	Exposure to fumes of various compounds from solder and PC-board components (e.g. Pb, Sn, BFRs and dioxins).	Leakage of various compounds from dumped PC-board residues.
Toner sweeping	Exposure to toner dust including carbon black.	Leakage of various compounds from emptied and dumped toner cartridges.
Acid extraction	Exposure to acidic fumes containing various hazardous compounds.	Leakage of various metals (e.g. Pb, Sn, Cu, Sb, Ni, Hg, Ba, Cd) and organic compounds (BFRs, phthalates, TPP, dioxins) from dumped residues of the extraction process.
Shredding	Dust and fumes of various metals and organic compounds present in the plastics (e.g. BFRs, phthalates, TPP, Cd, etc.)	Emissions of dust containing various plastics components to the local environment.

#### Table 1: Occupation and environmental risks in the informal recycling

Plastics and waste burning	Exposure to a wide range of metals (incl. Cd, Cu, Pb, Zn, Sb) and organic compounds (incl. PBDEs, PAHs, PCBs, dioxins) via the smoke.	Emissions of a wide range of metals (incl. Cd, Cu, Pb, Zn, Sb) and organic compounds (incl. PBDEs, PAHs, PCBs, dioxins) to the local, regional and global environment.
Dumping of residual materials	Exposure to dust and fumes, containing various compounds from dumped materials. Secondary exposure via contaminated drinking water and food.	Leakage of various metals and organic compounds to the ground and water reservoirs in the surroundings.

Some of the key concerns in the processes identified are:

- The process of dismantling is carried out in unventilated rooms
- Blowtorches and heaters are used to loosen solders to remove the components attached to the circuit boards
- Open burning of PVC cables releases toxins into the environment
- Printed circuit boards are placed directly above the heaters, allowing the solder to melt and drop
- Most material recovery processes consist of acid bath for recovery of copper from circuit boards
- Flame retardant-laden plastic is processed through crushers and extruders to create recycled plastic pellets
- Cathode ray tubes are handled by bare hands and broken with hammers in an open environment to separate glass, which is used in small furnaces
- Use of mercury (a known neurotoxin) for recovery of gold releases mercury into the environment
- Concentrated acids are thrown on to open land. Residues can lead to leaching of toxins into land and surface water
- The workers do not have any protective clothing. They inhale all poisonous gases and fumes of acids released during the processes
- Many workers are women and children who work with bare hands and constantly use caustic soda and acids for washing and cleaning of boards

## 3.5 Changing landscape

E-waste, in addition to the cocktail of harmful chemicals, also contains various valuable metals and materials. In the increasing consumption-driven world, these materials are becoming very important; especially the metals as we have fixed reserve of them. It is estimated that with the current usage pattern in the electronic industry, we may run out of many of these materials in the coming years. Hence, it is important to use this secondary source (e-waste) to recover useful materials and put them back in the production cycle.

Informal sector in India has been doing this for a while by collecting, dismantling, refurbishing and recycling. But this scenario is far from perfect, as there are serious concerns related to health and environmental damage caused by the rudimentary processes employed.

In the last few years, since e-waste has been discovered as a resource by the formal world, globally e-waste recycling is emerging as big business with many large and small players vying for this waste pile. In India too, in the last 5 years, more than 70 formal (authorised) dismantling and recycling companies have set up shops. The E-waste (Management & Handling) Rules, 2011, which came into force in May 2012, have added to this changing landscape. With the hope of e-waste disposal getting more streamlined and the consumers (especially bulk) mandated to discard their end-of-life equipments in a clean channel, the e-waste pile moving to the formal recycling sector is set to grow.

The big question is its impact on the informal sector. The shift of waste to clean channel is important, as the environmental and health impacts on the existing channel is evident. But what about the livelihood of thousands of people employed currently? Where does this changing landscape leave them? The role of informal sector in collection, segregation and dismantling is very important, both environmentally and socially. The environmental benefits stem from cannibalisation as well as manual dismantling which increase the level of efficiency in secondary processing. The social benefits stem from retaining and creating jobs and ensuring that the occupational health risks are minimised.

The implementation of Rules is always seen as a big bottleneck in India. The E-waste (Management & Handling) Rules, 2011 has been able to trigger augmentation of formal recycling industry, but it has failed to put a curb on the informal operations. Informal sector, whose costs are minimal, are able to offer consumers much better price for the end-of-life equipment than their formal counterpart---which means that the formal sector is still fighting to get their hands on e-waste. Hence, it is important to create systems to form linkages between these two sectors and avoid competition.

This implies that it is important to look at the possibilities of integrating the informal sector in the emerging regulated system.

## 4. Informal Sector and Clean Channel

In India, informal waste pickers contribute significantly to e-waste management and resource efficiency by collecting, sorting, trading and sometimes even processing waste materials. These activities also provide an income opportunity for large number of poor people. The workers here have great potential to organise door-to-door collection, cannibalise material, reduce waste destined for disposal, and generate employment potential that could be tapped by organising and formalising their activities.

The informal sector, despite their marginalised position and their simple equipments, often recover a lot of material, but their recovery rates are still not very efficient. On the other hand, the formal sector often loses out because of its limited reach and mechanised processes. In the formal sector, service providers exist, but its outreach is limited mainly to corporate clients, whereas the informal sector has grown its own system down to household level. However, its operation is not meeting health and environmental safety standards, thereby creating negative impacts. One way to improve this is the informal sector integration. The formalisation of the informal e-waste recycling sector into a transparent system is crucial to better control its environmental and human health impacts. This sector can only develop its full potential for recovering resources from e-waste by recognising, integrating and supporting it to establish more efficient processes.

Hence, bridging the formal and informal sectors to create a more effective and proper e-waste management infrastructure is the need of the hour. It is important to determine the factors for successful informal sector integration in e-waste management systems, in order to design measures for integration of the informal workers in management strategies. The success seems to depend on the capacities of the informal sector to organise, to manage their businesses efficiently and on the political will to integrate the informal sector and on the possibilities for collaboration with the formal private sector and other actors. It is also important for the formal recycling sector to appreciate and recognise the strengths of the informal sector and find mechanisms of making the informal sector a part of the value chain and ensuring mutual benefits.

The overall goal for such integration should be to build a better functioning, more inclusive, healthier and socially sustainable management system. Given the heterogeneity of the informal economy, it is difficult to look at just one way of integrating them; there may be several possibilities. This section of the report looks at different possibilities/models of integrating the informal sector in e-waste management and also suggests possible conditions for such integration.

# 4.1 Socio-economic implications of integrating informal e-waste management activities

The service provided by informal e-waste collectors, recyclers and enterprises has several important impacts. The informal sector has a highly sophisticated collection network which, in addition to reaching bulk generators, can also collect from households through a door-to-door collection network. They are able to reach out to a large number, where the brands and the formal recycling companies are currently unable to access. The formal sector under the new waste rules is mandated and expected to comply with the standards and environmental norms for waste processing. However, it seriously lacks the system for creating a sound collection

infrastructure to access individual consumers and reaching out to other generators. Setting up of such large and highly networked collection mechanism across the country can be cost-intensive and might not prove to be beneficial. In this context, it will be most appropriate to link up with the current informal network of collectors and effectively use the existing system for collection. The existing system can be altered to make it more effective and transparent ensuring a closed waste loop.

The informal sector is also able to provide some financial incentives to the consumers to return the end-of-life goods. The cost structure of the formal recycling units does not allow them to pay comparable prices for the collection of materials. Studies and opinions indicate that the Indian consumer looks at waste in a very different way and does expects some financial exchange when he/she is discarding waste. Most brands which have set up some take back infrastructure in the last few months have been facing this hurdle, as the consumers are not too keen to dispose of waste for free.

The formal recycling industry has also been cherrypicking, collecting e-waste with positive value only. This leaves the negative factions or goods uncollected and filling up the landfills. The informal sector, on the other hand, is able to recover material from most goods, with only a small faction destined for disposal.

The most important aspect of this integration is obviously the livelihood of a huge marginalised sector. Informal processing is a direct economic benefit to workers in the informal sector, many of whom would otherwise have no work. Organising and integrating the informal workers into the existing e-waste management systems can secure employment and improve their income opportunities. The transparency of a formal system will also force better safety, both health and environment, standards.

## 4.2 **Potential contributions to the resource economy**

Skills of informal sector to cannibalise and refurbish are huge positives. They not only extend the life of EEE, but also ensure reuse of components. The aggregators and segregators have skills to extend the product's life cycle by reusing the components. By extending the life of old electronics, they prevent pollution by saving the amount of energy required to make new products, reduce carbon footprints, reducing the depletion of raw materials, natural resources and enhance the penetration of IT and consumer durables among the economically disadvantaged people.

The growing scarcity of primary resources, and therefore their increasing prices, means that the use of e-waste as a recyclable material holds considerable economic and ecological potential. These high and unstable prices constrain political and economical stakeholders to look for possibilities in improving the efficiency of resource use. In this context, the optimisation of the relation between raw material (input) and products (output), as well as the reduction of byproducts play an important role. Higher material and energy efficiencies mean improvements in the competitiveness of enterprises and national economies, for which the concept of circular economy delivers good solutions. It also creates positive externalities for municipal authorities by reducing the amount of materials requiring disposal, diminishing the CO2 footprint of the waste system, and improving the performance of disposal facilities.



## 4.3 Regulatory framework

Given that the informal economy is here to stay and that the informal and formal economies are intrinsically linked, what is needed is an appropriate policy response that promotes more equitable linkages between them that balances the relative costs and benefits of working formally and informally. While the focus here is on the role of government, there is a role for all stakeholders, including for formal companies.

The starting point is recognition of the inability of informal entrepreneurs to comply with legal requirements and to shoulder the costs of becoming formal. However, this is not to suggest that the informal sector can make compromises in complying with the regulatory framework and environmental standards as this essentially is the core issue attempting to be addressed by these rules. Regardless of the various factors involved, this situation shows an unbalanced relationship between the requirements and the possibilities, and calls for a different approach if the goal is to advance the formalisation process as a tool to achieve integration in the modern sector. Question arises on the need for a differentiated set of regulations responding to the specific characteristics and capabilities of this economic sector and its different segments. The current regulatory framework, however, does not support a differentiated approach, thus throwing up serious challenges.

Toxics Link has attempted mainstreaming of the informal sector in one of the cities and the experience suggest that capacity building of the informal sector and facilitation by NGOs and support of the regulators are some key elements of mainstreaming. It might be difficult to find answers to all complexities in this report as some of them will eventually emerge out of experience and working out various options.

## Financial aid to informal e-waste workers

Due to the limited access of the informal sector to financial resources, financial incentives need to be considered to allow informal sector stakeholders to formalise the financing/investment process and improve their practices. Specific allocation of funds for environmental surveillance and Public-Private Partnership (PPP) model-based systems could be introduced. Additionally, financial aid or access to credit, incentives, subsidies and insurance schemes are further measures that need to be made available. There are some discussions and developments in this direction as the Government of India is considering insurance for the workers in the unorganised sector.

One of the best methods to improve recycling practices is to offer incentives to those complying with environmental and health norms and also promote marketing of such products through a certification mechanism or any other measure as found appropriate, such as public procurement policy endorsing preference for recycled products produced or refurbished from informal enterprises. Further, the criteria for providing incentives could also be linked to the integration of the informal sector in the activities of the formal sector.

Access to finance is crucial to continuation of the formalisation process; indeed, access to credit and financial gain should be one important outcome. The most likely sources of finance for ewaste recyclers identified to date include private investment and local credit mechanisms such as microfinance schemes, though little work has been done to evaluate experience with such schemes.

The proposed models would also need awareness and strengthening of local capacities and require regulatory authorities to change their mindset and adapt the partnerships between the informal-formal sectors. This would require legal recognition and allotting responsibilities to the formalised 'informal' associations for authorised collection from households and businesses.

## 4.4 Organising the unorganised: Proposed models

The National Environment Policy (NEP) 2006 recognises the efforts of informal sector in waste segment and lists this as part of the action plan- 'Give legal recognition to, and strengthen the informal sector systems of collection and recycling of various materials. In particular enhance their access to institutional finance and relevant technologies'. In accordance with the mandate of the NEP, 2006 and E-Waste (Management & Handling) Rules, 2011, there is a need to identify the activities and contributions of the informal sector and provide it opportunity to be part of the emerging clean channel.

In India, 95% of the e-waste recycled is being handled by the informal sector, where thousands earn their livelihood through processing this waste stream. These benefits are now threatened by modernisation, especially when the new-age entrepreneurs have started believing that they can get rich off of 'the gold in the garbage'. The result is conflict over resources and access to the waste materials. Instead of a virtuous circle of increasing economic and environmental benefits, modernisation may create a vicious circle of competition for resources, conflicts between the formal and informal sectors, and a decline in resource recovery and its associated benefits. Hence, there is a need to create harmony and find linkages. While defining the roles and responsibilities of the existing informal and formal sectors in the recycling chain, there is a need to make sure that the solutions are socially acceptable, economically feasible and environmentally responsible workable models.

The economic sustainability of such models is of prime importance. Examples of some integration in solid waste streams, where well-meaning interventions aimed at helping pickers have been singularly ineffective in leveraging sustainable change, need to be kept in mind. At times, the external support can initiate the process and make it work for some time, but in the long term, business models and profitability need to be considered. Thus, it is important that the solutions do not result in net economic loss for the informal sector as a result of the 'solution' offered to it.

The process of integrating the informal sector, however, is a challenging one. The informal sector is very diverse and comprises multiple stakeholders, and hence requires a multi-level approach to develop a path forward to their inclusion in the formal recycling market. We need to look at different solutions also because of their different skill levels, their economic capacity and their diverse entrepreneurial skills. For possible models, we need to first look at the different levels of players which need integration. It is important to keep in mind that though there are some waste players who work for someone else, most waste players in the informal economy

have created their own jobs, and work for themselves; in other words, they are self-employed. They are:

- Waste collectors (*kabadiwalas*)
- Workers in dismantling units
- Workers in recycling units
- Dismantling unit owners
- Recycling unit owners.



Figure 6: Informal sector players and integration

All of the above may not fit in the 'formal' model which is emerging, where individuals set up a dismantling or recycling company and invest a minimum sum to start the operations. The workers engaged in the dismantling or recycling operations may have the skill to dismantle and recycle, but may not have either the entrepreneurial skills or the capital to start a business of this nature. In the next level, most unit owners may have the business acumen to start and operate a venture like this, but may not have the required finances. They also may, at times, lack the marketing and operating skills which are required to survive in cut throat competition regime. Similarly, waste collectors have a very different skill set and unlike the units, mostly work individually.

To integrate these diverse players, we probably need to look at organising new relationships between the collectors, workers, unit owners, formal recycling companies and producers (EEE brand owners)- different people who have a stake to this waste pile.

There have been a few experiences towards mainstreaming the informal e-waste recyclers in India and work in this direction is ongoing. It is perhaps quiet early to suggest that all such initiatives are complete success, however it is important to state that some of these efforts have surived the market and business dynamics for over three to four years. The success of all these interventions can only be judged by their financial sustainability which requires more time.

Toxics Link has also been engaged in mainstreaming process in the city of Kolkata and new models are under trial in this city. Some of these experiences have been captured and are presented in the models below.

## Model A: Kabaddiwalas as collection agents

In India, the issue of identity cards for waste pickers was a striking landmark in the process of informal sector integration. It was first taken up by the Municipal Corporation of Pune (PMC), where the first identity cards for solid waste collectors were endorsed in 1996. The endorsement procedure was simple. Every member of the cooperative (formed by waste pickers) filled out a registration form and was issued a photo-identity card confirming his/her identity as a scrap collector. The members paid the cost of the card, which was essentially a membership card and had no legal backing. The terms of their endorsement specified that the card holders were selfemployed waste pickers and authorised them to collect scrap in the city, that the holders were not employees of the PMC and that the card was issued merely for identification purposes. The card was not transferable and children below the age of 18 years were prohibited from involvement. Although the PMC-endorsed identity cards had no legal basis, cooperative members used them for various official purposes, one important part being accepted by police as proof of gainful occupation. The endorsement of identity cards had an effect at various levels. Waste pickers began to see themselves as workers, not scavengers, increasing their sense of dignity and their self-assertiveness. Moreover, harassment from the police and municipal workers progressively decreased and waste pickers became much more socially accepted.



Figure 7: Linking the waste collectors

This successful model can be applied to the waste collectors from the informal sector. Under the E-Waste (Management and Handling) Rules, e-waste collection is producers' responsibility. In addition, collection agencies, dismantlers and recyclers are also allowed to collect end-of-life equipments from individual as well as bulk consumers.

These individual waste collectors could be issued identity cards by the producers or their collective, collection agencies and recyclers and dismantlers for whom they can act as collection agents. For producers, who are struggling to reach to individual consumers and small businesses, this would mean expanding their reach and getting back e-waste from the remotest and the smallest of consumers. They could issue identification cards to the collectors who could use it to collect e-waste legally and hand it over to the producers. The collected material can then be transferred to registered dismantlers or recyclers. For other agencies (collection, dismantling and recycling), who have been facing competition from informal sector and are operating at much below their capacities, this would mean access to more raw material.

It may not be feasible for the brands or the processing companies to associate with individual collectors, and hence there will be requirement for cooperatives. The cooperative form will allow the waste collectors to function as individuals and earn according to the waste they collect.

The waste collectors stand to gain as this would give them a chance to be associated with a brand, giving them recognition and saving them from harassment from police or local administration. This would also ensure regular income and fair price for the material collected. The model also retains the sector informality to a large extent. For consumers, especially the individual consumers or consumers who have little waste to dispose off, this would mean huge convenience. The brands or other agencies collecting e-waste expect the consumers to drop off their e-waste at their centres as the logistics cost for going to each individual would be huge for them. Studies across Europe have shown that consumers want convenience and are not willing to travel distances to dispose off e-waste. This door-to-door collection through the waste collectors would address some of these challenges. A variation of this model is under trial in Kolkata by Toxics Link.



Figure 8: Material flow in Model A

The key concerns of this model would be transparency and the need to ensure that the material does not flow out of the clean channel. There could be ways to prevent that. For example, the consumers may be asked to fill a form, which is serialised, that needs to be submitted to the brands or the involved agency. Another solution could be registration on the company website. The consumers may be asked to register their disposal quantities which could be counterchecked through the website. Some of these methods could be used to prevent leakage and ensure that material stay within the clean channel. Adoption of appropriate tracking technology by the waste collectors could also help in improving transparency and accountability of the waste flows and all waste collected could be tracked till their final disposal. This would require some capacity building and awareness among the generators and the waste collectors.

## Model B: Waste collectors as collection agency

This is a model similar to the earlier one, with only a slight modification. While the Model A suggested the waste collectors to become collection agents for other companies, in this model the waste collectors could set up their own collection agency. This could be in the form of a cooperative or a profit-making company with many partners. The group would then need to get authorisation from the concerned authorities (State Pollution Control Boards) for collection. This would allow them to collect waste from various sources, including individuals, small and large offices or government agencies. The collected material could then be auctioned or sold to any authorised agency for the agreed sum.



Figure 9: Model B- Collection agency and the material flow

This approach is different from the earlier one also because it formalises the informal sector. Once they apply for a licence, they are competing against any and every player in the market, i.e., the existing formal companies, at the same level. There have been some examples of such integration in e-waste. Couple of informal sector groups have formed companies and set up collection agencies in Delhi in last one year. It has been a difficult process for them, since they have to go through the difficult process of finding space in recommended areas, waiting for the required permissions and licences from the regulators. This means large investment at the beginning with no income, which was a serious road block. Even after the required authorisations, the units have been struggling to get material, and hence sustainability of this form of integration is still to be tested.

The advantage for the informal sector is that it makes their operations completely legal, and hence dissipates most shortcomings of operating in the informal regime. Being part of a group helps waste pickers to be in a position to bargain better prices when selling the material. But this form of integration makes them lose the advantages of informal sector, since they are now in competition with other formal sector companies and they need to improve their standards and operating norms adding up to their costs. Hence, the advantage of being able to pay the consumers more for their waste might get lost. The informal sector operators also face a degree of difficulty in marketing their companies and products.

Moreover, transparency or keeping the material in the clean channel could prove to be a challenge, since the company will be made up of individual members or partners. Another challenge in these arrangements could be the profit sharing between partners.

The two forms of association are also of importance. If, for example, a group of waste pickers wanted to operate individually, and only wanted an organisation that could negotiate with the local authority and others in order to establish their right to do so and the like, the objective would not be to operate as a business or enterprise. On the other hand, where waste pickers intend to work together and perhaps tender for contracts with the local authority, the objective

would be to operate as a business. This would of course not prevent them from negotiating with the local authority, or having other (secondary) objectives.

Both the above models have some challenges, but they are being tried out and tested in the field. During the process, they were able to address some of these challenges by receiving support and handholding from other agencies. Formal recycling companies are also willing to provide support as they believe that collaboration will eventually reduce competition and bring value to all the players.

## Model C: NGO+Waste collectors' alliance

In Philippines, there has been an initiative to link NGO and waste collectors in solid waste management. This alliance between community and small-scale private actors was a community-based initiative in Manila to address the issue of the increased quantities of waste and inadequate servicing. The Metro Manila Council of Women Balikatan Movement (MMWBM), an NGO, implemented a recycling programme by forming cooperatives of itinerant waste buyers and junkshops, providing loans and searching for suppliers and markets. It has provided the cooperatives with more bargaining power in relation to large recycling industries. MMWBM has started a source separation project in Metro Manila. Households are encouraged to separate their solid waste into wet and dry components. Protective equipment is provided to waste pickers and itinerant buyers, who are recruited and supervised by dealers. Collection carts are funded jointly by dealers and through small grants from the project. Buyers pay households for recyclables, using money received from waste dealers. MMWBM organises the routes and schedules for buyers to collect garbage and promotes source separation through campaigns. The local government is not involved in the NGO project.

A similar initiative was also taken in Chennai where Exnora International, a community-based voluntary organisation, created a community-private alliance. When the Corporation introduced neighbourhood waste containers for residents, Exnora took the responsibility of making the system works. They incorporated local ragpickers for sweeping and collecting and named them Street Beautifiers. Exnora obtained a bank loan, bought a tricycle cart for their activities, and provided protective clothing and equipment. The collected garbage is segregated and all the materials are sold to dealers for recycling. The households pay the minimal amounts per month required for the service, and a street unit collects funds for the Street Beautifiers' salaries, repayment of the bank loan, and to build reserve fund against defaults.



Figure 10: Civil society and the informal sector linkage

Replication of this in e-waste management in India could be one model for integrating the waste collectors, wherein the waste collectors are linked to a community based organisation. There have been some attempts of this nature in Bengaluru and in Delhi, where there is an alliance between NGO and door-to-door collectors. In Bengaluru, under this alliance, e-waste is collected from apartments and individuals by waste collectors and then sold off to authorised dismantlers.

There are many advantages of this form of alliance, the biggest being focus on health and environment. Involvement of a community based organisation also ensures more credibility, especially when one is approaching larger companies or offices for waste.

## Model D: Dismantling associations

Successful integration of the informal sector dismantling units may require establishment of stable organisational structures, as dismantling process includes processes where there are possibilities of environmental and health risks. However, it may be difficult for individual units to establish such structures, because of the costs involved and management resources required. Hence, cooperatives and small enterprises created by some of these unit owners and other forms of associations may be the right way out for this segment involved in e-waste pre-processing. Building of such formal structures can help them move out of the social marginalisation, improve their economic efficiency and thus their position in the economic value chain, and help make possible partnerships with other stakeholders. The way forward involves formalising the informal sector e-waste dismantling units through means of forming associations (various possibilities---some discussed below), register them and professionalise their businesses.



Figure 11: Dismantlers getting together

This kind of formalisation process itself requires the members of this group (and supporting stakeholders) to design an institutional and financial setup that will allow this group to function as one business entity in future. Considering that the group still consists of various individuals who themselves are used to act as SME-like enterprises, new mechanisms are required to integrate the different needs and priorities of these individual stakeholders on the way to their formalisation as a group. The focus on entrepreneurial spirit and strengthening the informal sector as an economic actor are the key factors to be kept in mind while looking at such integration.

The creation of an association or small business that comprises different informal e-waste dismantlers is one possibility towards achieving formalisation of the informal sector stakeholders. In this model, some of the dismantling unit owners or small establishments (depending on geographical proximity or operational similarity) can come together to form alliances and establish the desired structure. The advantage of having many of them together is that they can pool in resources, both financial and human, to kick start such initiative. The group then needs to go through the usual procedure of registering the alliance and getting proper permissions. Coming together also means that they have the capacity to deal with large quantities and approach bulk users/generators. Dismantling activity in India is hugely manual and such alliances can also help in creating jobs.

These formalised units can also absorb many dismantling workers, who are linked with them informally. This linkage will mean skilled labour for the dismantling units and secure jobs with safe conditions for the workers. Many women workers can also find livelihood in these associations.



Figure 12: Linking the dismantling groups

The major attraction in the e-waste business is the economics of metal recovery. Hence, it does not appeal to the informal sector to divert waste materials to professional recyclers. Apart from the health and environment concerns of recycling in the informal sector, the recovery yield of the precious metals is very poor due to the lack of knowledge, and, thereby, substantial percentage of the metals like copper, gold, silver, and other precious metals (palladium, tantalum, platinum, etc.) are lost.

The model suggests that the collection, segregation and primary dismantling of e-waste be focused in the informal sector, while the other higher order processes can be concentrated in the formal sector. The models suggested in this report keeps the processing or metal and material extraction out, as some of these operations require huge investment and technology which may not be feasible for these groups to have at this point. Hence, these groups will need to be linked to authorised recyclers for final processing of the waste dismantled by them. This would require building trust, relationship and identifying and strengthening the linkages between the two sectors for its holistic management. The formal recyclers could support this integration process by building the capacity of informal sector associations on dismantling as well as jointly developing the norms for trade of material between the two sectors. This will ensure greater efficiency and long-term partnerships.

The integration of the activities of the informal and formal sectors would also require specific allocation of funds for environmental surveillance by the formalised informal sector units. The cost structure of the informal sector would change radically with the introduction of certain processes which were not a part of their earlier value chain. This would require the support of the government in terms of provision of financial aid, easing access to credit and provision of financial incentives such as subsidies and introduction of insurance schemes. These would probably be short term, as in the longer run efficient recycling process may be able to offset these costs.

The model provides the interaction between the formal and informal sectors taking the interests of both into account in a rational choice framework. It shows that there are mutual gains to be obtained from the trade of material from the informal and formal sectors because of their comparative advantages. We also show that the social welfare is enhanced by this interaction between them and it results in reduced pollution, better resource management and creation of green jobs in the recycling sector.

## Model E: Refurbishment business

Various studies on e-waste have shown that the informal sector is able to generate larger profit because of the reuse and refurbish component of its business. For example, a refurbished CRT monitor or CRT reused to make a new television is often able to get higher revenues, than breaking it to recover the metals and other materials. Also, there is a huge market for used or refurbished goods in India because of the geographical spread and economic disparities. A smart phone, discarded by an urban Indian just because of the availability of newer models or versions, is still a desired commodity in the semi-urban or rural regions.

Reuse of components and refurbishment, if done in proper way, is environmentally sound as it increases the life of a product and also cuts down the energy required to make a new product. The informal sector has the skills to carry out such operations in large scale. This could be one area where a large population of dismantling workers or involved units can come together. Currently, under the E-Waste Rules, there is no mention of refurbishment. However, this could also be a possible model for integrating the sector.



Figure 13: Refurbishers

## 4.5 Forming an Organisation

The starting point of forming an organisation is usually when someone has the idea of forming an organisation, and identifies other individuals who might be interested in being members or when a civil society group may get a few individuals together. The civil society group or NGO is expected to take lead in this process and start conversation among the interested members on the objective of such association and the kind of business interest they can collectively take forward. On the basis of these discussions, a plan is required to be developed on the ways of operation of the organisation and on the most suitable nature of association. Further meetings may be necessary to achieve some consensus on the constitution of the organisation and its founding members. At this stage it may also be necessary to approach an outside person or agency to assist with drawing up a constitution or similar document. However, organisations and groups do also operate without a formal constitution or similar document. The more discussions that take place prior to launching the organisation the better. It will help the future members to know each other, and to identify and resolve possible problems or disagreements.

During the discussion stage, it is also important to identify the various processes within these groups. The group may require hands-on trainings on skill upgradation, process efficiency and dos and don'ts.

If the objective of an organisation or group is to operate as a business, the different options are as follows: a partnership, a close corporation, a company and a cooperative. The best option for the group will depend on many factors, mainly related to the objective of the group and the scale of the operations. Two such forms are discussed in brief below:

## Cooperatives

A membership-based cooperative of informal e-waste sector can lead to successful integration. The cooperative will aim to establish and assert informal e-waste workers' contribution to the environment, their status as workers and their crucial role in the e-waste management. This would bring together e-waste collectors, dismantlers and recyclers of informal sector. The members will recover, collect, categorise and sell scrap materials for recycling to the formal recycler. The members will be self-employed workers.

The cooperative can be run by the monthly membership fees and can also start its own shop for purchasing the materials from their members by paying the market price and sell those to formal recyclers. This process will eliminate middlemen and bring in more profit for the individual members. As the cooperative grows, it can also start some initiatives for the benefits of its members, like educational support for the children of the members, health care, financial support (e.g., loans, etc.) for the members, etc.

## Business

## Partnership

A partnership exists where two or more people agree to work together, and share their profits and losses. It is thus the simplest way in which people can work together. It is generally advisable to put agreements in writing, and especially where there are assets involved, or where there are more than two or three partners. This is because decisions in a partnership are by consensus, and the more partners there are, the more difficult it is to reach consensus. In ewaste informal groups, especially when the numbers are large, partnership would not be a suitable form to adopt. There is also a legal clause to limit the number of partners in a partnership.

## Companies

A company is an entity registered in terms of the Companies Act. The individual player from the informal sector can become share holders in the company. A share gives the holder a right to an interest in the company, its assets and dividends. The number of shares a member may hold in such a company will be specified in a document called a Memorandum of Association (MoA). This is submitted upon application for registration of the company, with details of the structure and Board of Directors.

Currently, the Act requires that in addition to the MoA a company also adopt Articles of Association (AoA). This is the equivalent of a constitution of an association or cooperative, and would apply to the conduct of meetings of the Board of Directors, decision-making in Annual General Body Meetings (AGMs) and the like.

## Advantages

There are many advantages in forming an association (whichever form) and working together, such as:

• The capacity to take on bigger jobs will develop

• By working together, dismantlers will be able to pool resources to buy machinery that will help them get higher prices for their materials

• Able to negotiate better terms and conditions with buyers and local authorities

• Helps to mobilise for changes in legislation affecting them and self-employed workers more generally

• Help to provide for their social protection through medical coverage, pension fund, etc.

• Less vulnerability to the risks that an individual who is self-employed faces.

However, there are also challenges associated with working with others collectively. An organisation cannot be managed in the same way as when they were independent owners, and the unit owners would need to develop collective ways of dealing with issues such as discipline. Decision-making in an organisation is obviously more complex than when decisions have to be taken by a single boss. Hence, there is always a risk that disagreements or disputes may arise. The constitution or equivalent document should provide guidance on the ways to deal with disagreements or disputes.

## 4.6 Role of civil society organisations

Civil Society Organisations (or NGOs) have been working with this marginalised sector for a long time in various countries across continents. It has helped improve their systems and has also helped them raise their collective voice. There have been a few examples where the NGOs have been able to get the informal sector right to the waste material. In e-waste as well, the civil society organizations have been very active and have been trying to get a place for this voiceless sector in the emerging clean channel. They have been working towards organising the groups, helping them to cross over and also provide adequate training on health and environment issues.

The informal sector operations are rudimentary causing heath risks, exposing them to the cocktails of chemicals present in e-waste and the raw materials they use to recover metals and other materials. They are, most times, unaware of the long-term impact of exposure to such toxicity and also the environmental damage that their operations and methods cause. The civil society organizations have a vital role to play in making them aware of these issues and building their capacity to avoid such risks.

NGOs can help out in the training and capacity building as well. Due to their low social status and low education, the informal groups are not well versed with many aspects involved in running a formal company or entity. They need training and information on issues related to the methods and technical expertise to upgrade their activities and be able to conclude business contracts. And hence support activities by NGOs or other stakeholders should not be limited to improve the social conditions of informal waste workers, but should also be aimed at establishing business activities and imparting management skills that improve the group's economic viability. This is important to prevent informal workers' groups to cease operation once the external support comes to an end and disintegrate.

## 5. Conclusion

The move to empower informal sector involved in waste is gaining momentum worldwide. In some countries, governments have launched programmes to support this formalisation, while the civil society organizations are also making efforts to build an inclusive system. International donors are also increasingly integrating waste pickers into programmes to foster urban development, promote a cleaner environment and increase recycling activities.

The integration of the informal sector in e-waste management is a relatively new initiative in developing countries. There are no existing norms and conventions and not much experience to draw on. The huge informal sector, workers as well as unit owners, have been dealing with this waste streams for couple of decades now, the formal sector having joined the bandwagon only recently. These workers stand the risk of losing their livelihood in the wake of the new rules and mushrooming of formal entrepreneurs. Although it is important to have big investment recycling infrastructure in the country for e-waste recycling, it is equally important to safeguard livelihood of thousands who survive on this waste. In the current scenario, incorporating informal sector workers into e-waste management in India can be socially desirable, economically viable, and environmentally sound. But to do so, decision makers need to recognise that the informal sector can be an asset and make frameworks which make it easier for the informal sector to join the system. Some important leanings from our experience in working with the informal e-waste recycling are:

- Role of NGOs: NGO can play very critical role in building capacity of the recyclers and also in bridging the gap between the regulator and informal sector.
- Finance: The availability of finance can be critical in mainstreaming the informal sector. This could be achieved through a separate directive or initiative of the financial institution for making relatively small capital available at easy interest rates. The Ministry of Environment and Forests (MoEF) also could allocate separate funds to be accessed by this economic group for setting up recycling facilities.
- Facilitation at State Pollution Control Boards (SPCBs): The SPCB could create a help desk and ease out the process for informal sector operators. They should appoint one lead NGO in every state to support the informal sector.

The integration of the informal sector can contribute to reduce overall system costs. It can also reduce negative environmental and climate impacts through improved reuse and refurbishment by reducing the waste headed for disposal. And finally, it can help to generate income and improve working conditions of poor population who often do not have other economic opportunities.

The informal sector players have already started to organise themselves using different business models. But there are many obstacles on the way and some of them can be negotiated through support from various stakeholders, specially the government, producers, civil society organizations and the recyclers. Different form of alliances between the informal players, producers and recyclers is the way forward and the civil society organizations have a big role to play in initiating this. The beginning of this can be through implementation of pilot projects, paving the way for further developments and replication. Finding proactive leaders, highlighting the field of opportunities, building trust, and such efforts at local level can be a powerful inspiration and trendsetters. These can demonstrate that change is possible and value can be created in many ways. The models can, thus,



act as catalysts for further integration efforts. These models also need to be closely evaluated to understand the sustainability of such initiatives.

Although the informal sector has been extremely aware of the financial benefits which accrue due to the recycling of e-waste, they have paid little attention to other aspects. However, in order to mainstream them, efforts are required to enhance their understanding of environmental and health issues associated with their activities. Civil society organizations and other stakeholders have an important role in educating them and making them aware of the related issues. Another anticipated risk is that the material may flow out of the clean channel. The regulatory agencies need to establish transparent monitoring and evaluating systems to prevent leakage.

The informal sector also needs to look at these Rules as an opportunity to move forward and upgrade their workplaces and processes and also a way to ensure secure livelihood for the future. Leaders from the groups will have an important role to play in this, and hence it will be important to identify charismatic people who can keep the group together.

Raising public attention to the causes of the sector is also very crucial in the whole process. This can help in improving public attitudes towards informal sector activities and also help in establishing credibility of these groups.

This report has tried to look at some of the possible models for integrating most players in the informal sector currently engaged in e-waste management. But there might be many more variation of these, depending on the local conditions and opportunities. The models presented in this report show that the integration of informal workers in e-waste management systems is possible and that it can contribute significantly to development objectives. Therefore, it is important that stakeholders take a lead and help the sector move ahead.

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