

Integrating the Activities of Informal and Formal Sector in E-Waste Management: Potential Benefits and Challenges

Japneet Dhillon¹, Dr. Vikram Sandhu²

¹Research Scholar, University Business School, Guru Nanak Dev University, Amritsar, Punjab, India

²Assistant Professor, University Business School, Guru Nanak Dev University, Amritsar, Punjab, India

Abstract:- The usage of electronics has increased exponentially with the growth of information and communication technology which in turn have led to an abrupt rise in the volumes of e-waste generated globally. In developing countries, formal and informal recycling systems exist simultaneously. But the major portion of e-waste is processed by the informal sector using primitive methods. The workers in the informal sector do not have proper machinery, protective equipments and also lack training in handling e-waste efficiently. This necessitates the integration of informal waste sector into their formal counterparts to lessen the negative effects. The paper presents an overview of the issues associated with processing of e-waste by the informal sector and examines the relation between the informal and formal sector. It also investigates the potential benefits and key challenges of integrating the informal sector into formal systems so as to increase the recycling capacity thus decreasing the amount of e-waste polluting the environment and imperiling the human health.

Index terms: Informal sector, Recycling, Formal sector, Developing countries, E-waste.

I. INTRODUCTION

The rapid growth in technology, high obsolescence rate of products and increasing demand for new electronic products have led to the exponential growth of Waste Electrical and Electronic Equipment (WEEE) also called "e-waste" in countries around the world (Pinto, 2008). Solving the e-waste problem (StEP) defines E-waste as "a term used to cover items of all types of electrical and electronic equipment (EEE) and its parts that have been discarded by the owner as waste without the intention of re-use" (StEP, 2014). E-waste contains a multitude of components both hazardous constituents and valuable resources. E-waste has become a growing global concern due to increasing mountains of e-waste and improper recycling and disposal of toxic elements like lead, cadmium, plastic, chromium, mercury present in it that have an adverse impact on the health and environment. Most of the metals like gold, silver, selenium, platinum, and other rare metals present in e-waste can be used in making new products (Pinto, 2008).

Table1: Concentration of heavy economical metals in electronics

No	Electronic Equipment	Copper	Silver(ppm)	Gold(ppm)	Palladium(ppm)
1	Television (TV)	10%	280	20	10
2	Computer	20%	1000	250	110
3	Mobile Phone	13%	3500	340	130
4	Portable Audio Scrap	21%	150	10	4
5	DVD Player	5%	115	15	4

(Source: Department of information technology & Umicore Precious Metals Refining. Geneva)

1 million cell phones when recycled can recover roughly 24 kg of gold, 250 kg of silver 250 kg, palladium 9 kg and more than 9,000 kg of copper (U.S. Environmental Protection Agency, 2012).

There is not very clear information on how much e-waste is collected, treated and disposed of annually. According to the E-waste report of United Nations University, around 41.8 million metric tons of e-waste was produced globally in the year 2014 and projected to increase to 49.8 million metric tons by the year 2018 (Baldé, 2015). A study conducted by ASSOCHAM-cKinetics in 2016 report that India generates about 18 lakh metric tonnes (MT) of e-waste per annum and is expected to generate 52 lakh metric tonnes (MT) per annum by the year 2020. In India, E-waste is increasing at a compound annual growth rate of approximately 30%. (ASSOCHAM-cKinetics study, 2016). E-waste generated in developed countries is dumped into developing countries which further exaggerates the problems associated with management of e-waste (Borthakur & Sinha, 2013). In developed countries like USA or Europe, waste traders have to spend US \$20 for recycling a computer safely in their countries while they can hand over it at half the cost to the informal waste traders in developing countries like India (Secretariat, 2011). A study reveals that out of the total e-waste produced in India, 60% e-waste remain in warehouses or storages and only 40% of it is made available for recycling purpose. (MAIT-GTZ, 2007).

In developing countries like India, there is a large presence of unorganized and informal sector for processing e-waste. A large quantity (95 %) of e-waste is treated by informal recyclers and only a small quantity (5%) reaches to formal recyclers in the country (MAIT-GTZ, 2007). Majority of the e-waste is treated by untrained workers employing primitive methods without using protective equipments which is detrimental not only to the health of the workers but also to the environment. There is a growing consensus that the informal sector cannot be overlooked in an attempt to improve e-waste management systems in developing countries (Velis et.al, 2012). The informal collectors collect majority of e-waste due to which formal recyclers face extensive supply deficiency (Chi, 2011).

II. RESEARCH OBJECTIVES

The study aims to achieve the following objectives:

1. To gain a better understanding of the issues associated with processing of e-waste by the informal sector.
2. To examine the interconnectedness of the informal and formal e-waste sector.
3. To investigate the potential benefits and key challenges of integrating the informal sector into formal systems.

II. CURRENT SCENARIO OF INFORMAL WASTE SECTOR

The International Labor Organization (ILO) defines informal sector as individuals or small enterprises that is involved in waste management and are neither registered nor being formally charged with rendering waste management activities (ILO, 2002). Though this sector is not officially recognized, sponsored, financed and acknowledged, yet its members play a substantial role in e-waste management by collecting, segregating, dismantling and processing e-scrap (Gupta, 2012). Informal sector comprises itinerant collectors (Kabadiwallas) who collect and barter waste materials directly from households, shops and offices; street pickers involved in collecting waste from street bins; dump pickers (scavengers) collect waste from surrounding dump areas (Snel, 1999). These workers are hired at very low wages (GTZ-MAIT, 2007). An assessment study carried by GTZ and MAIT in 2007 estimates that 95 percent of the e-scrap is recycled through the informal sector. A large group of poor people is dependent on informal sector for their livelihood. A Delhi based study reports that approximately 25000 workers are employed at scrap yards in the city (Bibhu Ranjan Mishra, 2006).

The informal sector is greatly involved in the extraction of precious metals from e-waste. This sector employ crude and highly polluting methods for separating the reusable

components and recovering the metals contained in e-waste. Some crude techniques employed by the sector are extracting metals from printed circuit boards by heating over coal-fired grills, melting and chipping of plastics without proper ventilation, metals are stripped in open-pit acid baths in order to recover gold and other metals, tools such as hammers, chisels, screw drivers and bare hands are used for physical dismantling, cables are burned in the open air to recover copper and unsalvageable materials are disposed of in riverbanks and fields. (Borthakur & Sinha, 2013). Workers are unaware of the risks associated with the processing of e-waste. These workers do not use any protective equipment like gloves, facemasks and extract metals from e-scrap with bare hands. Therefore the workers are directly exposed to harmful chemicals as well as other hazards causing physical injuries. The extraction of precious metals emit dangerous and toxic fumes such as mercury, lead, dioxins, nondegradable plastics etc. which raises occupational safety and health concerns as well as environmental threats. Processing of e-waste also releases smudges and discharges which contaminates the soil and water bodies (Raghupathy et al., 2010). A study in India reveals that approximately two third of informal e-waste workers are subject to respiratory ailments like difficulties in breathing, irritation, and choking, coughing, tremors due to improper dismantling workshops. (The Assocham-cKinetics study). The prevailing large scales of operations and the economics of recycling are the major factors that make the informal sector attractive (Raghupathy et al., 2010).

III. LINKING INFORMAL AND FORMAL WASTE SECTOR: OPPORTUNITIES AND CHALLENGES

Informal sector is currently the prevalent e-waste practice in developing countries. The reasons underlying the existence of informal sectors in the developing countries are : (1) Reluctance on part of the consumers to pay for disposal of their e-waste (2) illegal import of a large quantity of e-waste as second-hand devices (3) lack of awareness among the consumers, informal collectors and recyclers of the potential hazards of e-waste (4) lack of investments and funds to finance developments in e-waste recycling (5) lack of recycling infrastructure for appropriate management of e-waste, (6) absence of effective take-back programs for end-of-life electronics (7) lack of incentives in e-waste management and (8) lax implementation of legislations related to e-waste (Bhaskar and Turaga, 2017).

Due to the potential economic and environmental benefits of e-waste processing, Formal recyclers are paving their way into e-waste recycling at a fast pace. As of 29 December, 2016, a total of 178 e-waste recyclers/dismantlers are registered with CPCB (Central Pollution Control Board). These formal recyclers have a total handling capacity of 438085.62 metric ton per annum (MTA) for managing e-waste in an environmentally sound manner. It is expected that the formal

recyclers treat e-waste in an environmentally friendly manner using Best Available Technologies which will result in enhanced resource recovery and efficient processing of e-waste. But the formal sector lack access to e-waste due to informal collectors or scrap dealers who are involved in door-to-door collection. These informal collectors pay a fair prices

for the collected e-waste as compared to formal recyclers (Gunsilius, 2010). Formal sector demands huge investment in machinery and are more cost-intensive. This sector faces tough competition from the informal sector. The e-waste management system in India has been illustrated in the Figure 1.

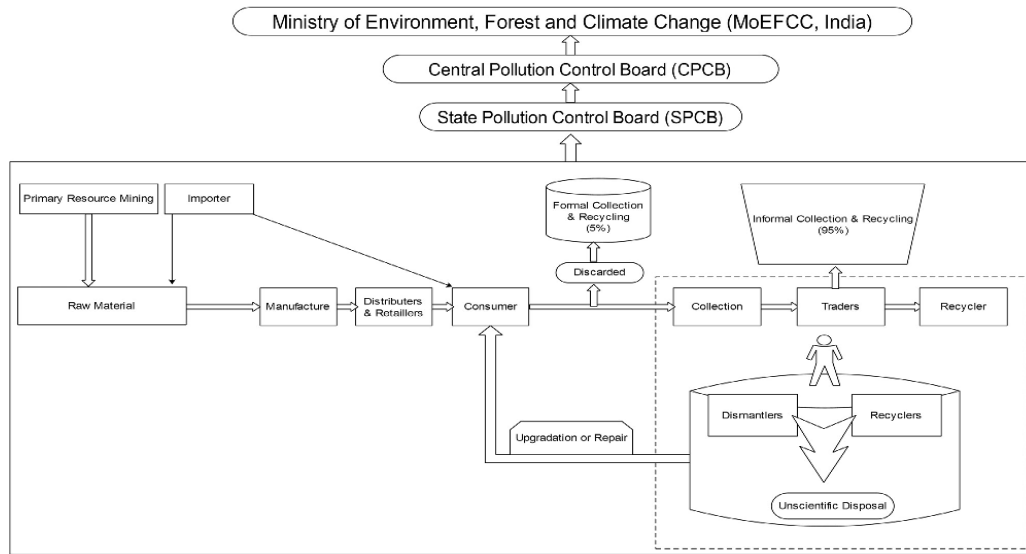


Figure 1. E-waste management in India. (Source: Adapted from Awasthi & Li, 2017).

Informal sector continues to play an important role in e-waste value chain due to its potential to generate employment to a large section of poor people. From household perspective, Informal sector offer several advantages in comparison to formal collection systems in terms of accessibility, door-to-door service which is a favorable option for consumers, quick transaction without involving any formal procedure (Li et al., 2012). Despite the higher rate of e-waste collection and recycling in the informal sector, there are also several disadvantages. Unregulated and improper disposal and processing of e-waste using rudimentary methods not only results in low recovery of materials but also adversely impact the health of workers as well as the environment (Pinto, 2008). Suppressing the entire Informal waste sector will result in problems like higher unemployment, and on the other hand, if this sector is left to run an ongoing business it will expose the workers to the more acute health situations.

It necessitates the need to dovetail the activities of informal and informal sector for providing mutual benefits. The informal sector attains higher collection and recycling rates in comparison to their counterparts. The formal sector possesses the proper facility and standards for handling e-waste but it lacks in terms of its outreach down to the household level (Chi et.al, 2011). Instead of starting from scratch and competing with the informal sector, the formal sector can utilize the already existing structure of the informal sector or modernize

it to meet the collection and recycling targets in a cost effective manner.

Integrating informal recovery into the formal e-waste management system would not only enhance collection and recyclable recovery rates but also reduce overall e-waste management costs. A rise in the rate of material recovery from e-waste will drop the disposal rates (Gupta, 2012). There are various mutual benefits resulting from integration of formal and informal sectors which include decrease in pollution, better management of resources, social welfare and generation of green jobs in the e- waste sector (Raghupathy, 2010 & Lundgren, 2012).

The integration of informal e-waste sector with informal sector is a challenge faced by many developing countries. It is essential that the work carried out by the informal workers should be acknowledged. To officially recognize the role and contribution of the informal sector from environmental and economic perspectives as an invaluable part in the formal sector is an important issue in linking informal and formal sector (Gerdes and Gunsilius, 2010). Informal waste workers are vulnerable to social stigma which prove to be problematic. They are still perceived as untrustworthy, irresponsible and unruly street people. There is need of social acceptance by the communities in regard to waste pickers for the success of the integration (Snel, 1999). It is possible through a positive attitude and support from all stakeholders. Conflicts between informal recyclers, the municipality and private waste

management companies are common in the inclusion of informal sector in the formal waste sector. Informal workers are regarded as unhygienic, backward, troublesome and misfits in a waste management system and their role is completely neglected by the municipal authorities (Wilson et al., 2006). Formal-informal sector integration aspiring for economic efficiency does not inevitably result in social welfare synergies. Power imbalances, diverging interests leading to exploitation, and undermining of informal worker organizations are the difficulties with the integration.

IV. CONCLUDING REMARKS

The informal waste sector inevitably plays a significant role in the management of e-waste of many developing countries. From the study, it can be concluded that it is possible to create a win-win situation by integration of activities in the formal and informal sectors. Informal sector have attractive advantages in handling e-waste, particularly their strong presence, high collection rates, high recovery rates, convenience to consumers, time saving, reduced cost etc. The major challenge confronting the e-waste management is how to harness the strengths of the informal sector and incorporate it into a formal sector to achieve optimal and sustainable e-waste management solutions without compromising the human health and environment.

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