A STUDY ON E-WASTE MARKET IN KARNATAKA

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Abstract:

With the increase in youth population with significant buying power, India offers significant potential for electronic goods consumption. With the increased consumption and the reduced end of life period for electronic goods, it is very logical to comprehend that; e-waste is going to be a colossal problem which needs to be managed effectively. India currently produces 1.85 million tons of e waste every year. Although the per capita generation of e-waste is only around 2.25 kg per year, the total e-waste generated across India is one of the largest in the world. Also, a clear market design to control the supply of electronic goods with predefined arrangements to collect and inventorize after the end of effective life is missing. The current paper evaluates the existing market design and thus proposes the requirements of a sustainable market by taking to consideration the various stakeholders in the e-waste management sector.

Research Methodology includes both primary as well as secondary research. Information related to various rules, policies and guidelines are obtained from various articles and websites. Primary research is carried out by visiting various governmental organizations like Karnataka State pollution control board, KEONICS etc. and by conducting survey on organizations and households to collect relevant information. The result of this research would be to identify the gaps in the existing E-waste market and its management. The research paper would propose a model to explain a new market design that is more efficient and sustainable.

Key words: *E-waste, Market-design, Stakeholders, Management*

Introduction:

With the onset of the economic reforms, India has transformed itself into one the fast growing economies in the world. It has made significant gains in key economic sectors like Information technology; IT enabled services, Services etc. Although, the economic growth has resulted in development, but it has also brought in many externalities to fore. One of the externalities is the management of

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e-waste which has become a major area of concern.

Karnataka has been at the center of development and Urbanization, which has resulted in significant degradation of the ecological parameters like soil, water and air in Karnataka. This effect is drastically accentuated in cities like Bangalore because of drastic Industrialization. The soil, water and air are getting polluted by mixing up of toxic chemicals like Lead, Arsenic, Mercury, Beryllium, Cadmium etc. High levels of lead causes lead poisoning which may distort brain development, causing damage to nervous system. High levels of mercury may create skin and respiratory disorder and may also cause brain damage. Beryllium can cause skin diseases and dangerous allergies. These elements are getting mixed with water bodies and lakes and thus have contaminated them. A survey conducted by Lake Development Authority to understand the degree of pollution in various lakes in Bangalore has revealed that, the mercury level in lakes in Bangalore is around 1.18 mg / liter, which is way beyond the acceptable limit of 0.01 mg/ liter. One of the main reasons for this type of chemical pollutions can be attributed to incorrect disposal and dismantling of e-waste. Today, e-waste is one of the main sources of harmful chemicals especially Lead and Mercury that pollute soil, water and air. It has to be noted that, because most of the electronic waste gets disposed into landfills, elements like Mercury and Lead has leached into ground water. Because of the incineration of the non-recyclable e-waste, vapors of mercury and lead have mixed up with the air, polluting it substantially.

What is E –Waste ?:

According to E-waste monitor 2014, by United Nations University, E-waste is a term used to cover all items of electrical equipment and its parts that have been discarded by its owners as waste without the intent of reuse. It is also referred to as WEEE (Waste Electrical and Electronic equipment).

E-waste can be classified into following six categories:

1. Temperature exchange equipment: Eg: Refrigeration, Freezers, Air conditioners, heat pumps.
2. Screen monitors: Eg: TV, laptops, Notebooks etc.
3. Lamps: Eg:- FL, CFL, LED lamps etc.
4. Large equipment Eg: Washing Machines, Cloth dryers, large printing machines, copying equipments etc.
5. Small equipments: Eg:-Vacuum cleaners, microwaves, toaster, electric kettle, calculators, radios, video cameras, electrical and electric toys, small electric and electronic tools.

6. Small IT & Telecommunication equipments: Mobile phones, GPS, Pocket calculators, routers, personal computers, GPS, routers etc.

E waste has a combination of toxic chemicals like lead, cadmium, beryllium, arsenic, mercury, chromium and copper which can cause chronic diseases and irreversible damage to human body if they enter.

E-waste Management landscape in Karnataka:

According to Karnataka state pollution control board (KSPCB), the amount of e- waste produced across Karnataka is not correctly inventoried and quantified. Hence, the actual data about how much of e waste is created in Karnataka is ascertained incorrectly. However, according to KEONICS, Karnataka ranks 3rd in e-waste generation in India in 2016 and Bangalore ranks 3rd in the list of cities for e waste generation with approximately 90,000 Metric Tons.

Gold and silver is extracted from the shredded Printed Circuit Boards (PCBs). If the PCBs have precious metals that cannot be recovered, then the recyclers export the shredding to UMICORE, Belgium. Apparent gold and apparent silver which are extracted during processing are used in electroplating and are picked up by the electroplaters. Also, copper that is extracted by processing e waste is utilized by Agricultural product manufacturers, Chemical reagent manufacturers etc. The glass cullets are normally purchased by Television manufacturers. For example, Videocon purchases glass cullets to manufacture CRT. The recyclers dispose the non recyclable waste like batteries to Treatment storage plant. Other non recyclable wastes which does not have hazardous impact are sent to land fill.

Output	Selling Price Rs/ Kg	Purchaser
Shredded Plastics	8-10	Plastic Granule Manufacturer
Scrap Metallic Parts	14-22	Metal Scrap Trader
Aluminum Parts	70-80	Aluminum Scrap Traders
CRT glass cullets	1-2	TV manufacturers

Table 1: Purchasers of dismantled e-waste out

When PCBs are dismantled, normally, Gold, Palladium, Silver, Copper etc are extracted. Table 2 explains the value of the extracted precious metal after dismantling and processing of PCBs per ton.

Value of PGM per ton of PCB*			
	Weigh (g or kg)	Cost (/ g or kg)	Value (Rs)
Gold (g)	390	3000	1,170,000
Palladium (g)	90	1200	108,000
Silver (kg)	1.5	47047	70,571
Copper (kg)	190	435	82,650
Lead & Tin (kg)	31	233	7,223
Aluminium (kg)	145	103	14,935
Other	(assumption)		10,000
Total (Rs)			1,463,379

Table 2: Value of precious metals per ton of PCB

KSPCB has identified 84 recyclers and e waste dismantlers across Karnataka. Out of the 84 recyclers only 54 are currently operational with a total capacity of around 44600 M T. and 30 others are yet to commence operations. The total capacity of all the recyclers and dismantlers (all the 84 recyclers) is around 75000 MT as per the information from KSPCB. According to the list released by KSPCB, most of the recyclers and dismantlers are located in Bangalore urban and Bangalore rural.

At present, nearly 90% of the e-waste is processed by the informal sector which does not have any formal training about e-waste dismantling and recycling without having any significant impact on the environment. The Indo-German-Swiss e-waste initiative is currently involved in providing formal training for e-waste recyclers and empowers them towards becoming formal, technology driven recyclers. E-parisara is one such initiative which got developed by the efforts of Indo-German-Swiss e-initiative. Saahas pvt ltd which is a NGO in Bangalore is associating with Indo-German Swiss initiative to creative awareness and to train the informal recyclers. Saahas has been working closely with several partners including the Karnataka State Pollution Control Board, GIZ (formerly GTZ or German Technical Cooperation) and EMPA (Swiss Federal Laboratories for Materials Science and Technology) to study various issues related to generation of e-Waste; its flow through the system, recycling and final disposal.

Saahas is also the implementing partner for 'Establishing e-waste Channels to Enhance Environment Friendly Recycling (WEEE-Recycle) programme. The WEEE Recycle programme is a GIZ-ASEM initiative with partners Adelphi, Toxic Links, and MAIT. It is implemented across four cities Bangalore, Kolkata, Delhi, and Pune. In Bangalore, the programme supports small scale authorized e-waste recyclers (who earlier worked in the informal sector) to strengthen their capacities.

E – waste Industry Analysis in Karnataka:

New Entrants:

Government Policies:

Government has formulated rules and regulatory guidelines in 2016 which give direction towards overall e-waste management. The rules and guidelines are mostly directed towards the various stake holders of the e-waste value chain (i.e., electronic goods producers, e-waste collectors, e-waste recyclers, dismantlers, refurbishers etc).

The recent guidelines and rules for e waste management (2016) emphasizes on the roles and responsibilities of producers specifically concentrating on Extended producer Responsibility (EPR). This holds the manufacturer of the product liable for recycling and disposal of the waste.

The state government considers the e-waste recycling and dismantling enterprises as MSMEs and therefore, Government of Karnataka in its Industrial policy for 2014-2019 has mentioned that, a subsidy amount limited to Rs 10 lakhs may be given to companies (that are operating in Zone 4) which are involved in e-waste dismantling and recycling.

Since, collection of e-waste is one of the major problems; government has made a significant move by making post offices as collection points. Since, government offices and government departments come under category of bulk consumers of electronic products; government has allocated the responsibility of managing e-waste to KEONICS. KEONICS is given the responsibility to float tenders for e-waste and then identify the recyclers to process the waste.

Governmental policies have been very supportive towards new companies and new entrants can enter the industry by complying with the formal guidelines established by the government.

Technology & Economies of scale: Some Players who are already in the business of e-waste recycling are technology driven and use high end technologies to separate and process e-waste. However, most of the technologies are well documented and pervasive. So, new entrants can get the same or higher technologies as compared to the existing players. Technological superiority may not be a barrier for the new entrants. In-fact, most of the recyclers in Karnataka has recycling capacity per year. E- Parisara pvt limited with 8800 MT, K G Nandini Enterprises 7200 MT and M/s TES-AMM pvt ltd with 12000 MT are the top recyclers of e-waste. Recently, Cerebra technologies have started a recycling plant near Kolar with significant capacity. Therefore, the issue of Economies of scale might not be a barrier if new entrants enter with new technology and processing capacity.

Substitutes: The most easily available substitute for e-waste recycling and processing is land fill disposal. Switching to landfills almost cost zero but would significantly affect the environment.

Buyers Bargaining Power: Prior to dismantling and recycling, the collectors of e-waste will collect from the households. Organization / Institutions with multiple units collect the e-waste and auction the e-waste once in 3 months or 6 months. The collectors of e-waste take the secondary sellers position and can sell / auction the e-waste to recyclers / dismantler (who buy the e-waste) with the highest bid value. Also, post dismantling and processing of e-waste, the extracted material will be bought by manufacturers of goods and electronics.

Here, these buyers are manufacturers and OEMs. They will buy the product at the market price. The Switching cost for Buyers is low as they can buy the e-waste from any supplier and without incurring any cost. Buyers (recyclers) in this industry can actually set up their own collection points to collect the e-waste. The Bargaining power of the Buyers is moderate.

Suppliers: The Primary suppliers in this industry are the households who generate the e-waste. They do not have any bargaining power as the e-waste that they have is of zero / less value to them and the households at times will have to pay the e-waste collectors for picking up the e-waste towards logistics. The households will have to settle for the price set for the e-waste by the e-waste collectors at the time of collection. However, the secondary sellers (e-waste collection) sell or Auction the e-waste to the highest bidder. In this industry, the tertiary suppliers are the e-waste recyclers who recycle and sell the extracted materials to manufacturers and OEMs. These tertiary suppliers (recyclers) have less Bargaining power as most of the manufacturers &OEMs will buy at the market price. The primary and secondary sellers of e-waste may establish their one recycling units and set up their own supply network to supply the extracted materials.

Market Competition: The market is a competitive market with more and more number of players entering every year. The market size pan India is around 13 billion US dollars. With the increase in the consumer base, the market is expected to grow at around 30% annually. The market competition is high. However, market share cannot be defined clearly because most of the e-waste is dismantled by unorganized recyclers.

Market Design: According the market design concept, a well designed market is free from the clutter that happens on the supply side / the demand side and thus behaves efficiently. However the e-waste market seems to be significantly cluttered on both supply and demand side. There are significant gaps in the market design.

In order to understand the gap and various factors that affected the market design, primary as well as secondary researches were carried out as mentioned:

Secondary research:

Information from various web sites including KSPCB, KEONICS were taken to understand the various governmental rules and regulations related to e-waste management. Articles from various news papers like The mirror and Times of India, were taken to understand the current situation. Article published by Harvard Business Review on Market design was taken as a basis to understand the concept of Market Design.

Primary research:

Survey to understanding the awareness towards e-waste: A survey was conducted along with ER3 solutions in Bangalore to understand the awareness about

e-waste management in Corporates and educational institutions. The sampling size taken for this was around 30. the strata. The scope of the study was to understand the level of awareness among Corporates and institutions regarding electronic wastes in Bangalore. The survey showed that, 70% of the organizations do not have a policy or strategy for the management of e-waste. The research also found that 23% of the organizations dispose e-waste through Authorized recycler. Around 20% of the organizations dispose off their e-waste by giving it to the local scrap dealers (Kabadiwallahs). The survey also found that, organizations do not have a set time period to dispose off their obsolete electronic assets. They dispose off when required or when e-waste is generated and needs to be disposed off.

Primary data was collected from KSPCB (by having a interview with the official of KSPCB) about the governmental actions and policies to regulate the e-waste recycling and processing Industry as a whole. KSPCB has identified / Permitted 84 recyclers and e waste dismantlers across Karnataka. Out of the 84 recyclers only 54 are currently operational with a total capacity of around 44600 M T. and 30 others are yet to commence operations. The total capacity of all the recyclers and dismantlers (all the 84 recyclers) is around 75000 MT as per the information from KSPCB. According to KSPCB, the amount of e- waste produced across Karnataka is not correctly inventoried and quantified. Hence, the actual data about how much of e waste is created in Karnataka is ascertained incorrectly. KSPCB is currently in the process of inventorizing the amount of e-waste generated in Karnataka. KSPCB has listed 6 incinerators for incinerating the e-waste that cannot be recycled.

Currently, government has identified KEONICS to manage the e-waste produced by Government offices and departments.

Another Survey was conducted to understand the role of the major Electronic / Electrical goods retail chains in e-waste management. The retailers taken for this survey are Croma, Reliance digital, E-zone, Girias, Pai electronics, Samsung , Sangeeta Mobiles, Poorvika mobiles, HP service centre, Micromax Service centre. According to the survey, most of the electronic / Electrical goods sellers do not have clear e-waste management policy within their chain. Also the survey revealed that, most of the retailers do not explain the harmful effects of the electronic /electrical goods when they lose their effective life. Only Croma is involved in creating awareness to students at various campuses about the ill effects of e-waste. This is a part of their CSR drive.

Almost all the electronic / electrical retailers have a buy back policy through a vendor who fixes up the price for the e waste and collects the e-waste from the customers. The retailers do not have any role other than sending the vendor to the customers. As part of the Extended

Producer Responsibility, almost all of the retailers have Buyback policy through e-waste vendors. However, Deposit Refund scheme is not followed by any of the retailers. Most of the retailers (80%) mentioned that, most of the customers opt for new electronics for up gradation because of advancement in technology (like 3G to 4G etc) and thus opt for buyback.

The secondary research and Primary research revealed significant gaps in the existing market mechanism for e-waste management. The collection and inventorization of the e-waste seems to be a major problem as most of the e-waste is processed by unorganized sector. Since unorganized sector holds the major control over collection of the e-waste, proper system and regulation needs to made so that, the activities of unorganized recyclers and dismantlers are monitored.

Although KSPCB has given permission to around 84 recyclers, the currently operational recyclers and dismantlers are mostly concentrated in and around Bangalore. The central and northern Karnataka has less concentration of recyclers and dismantlers. These areas are mostly covered by unorganized waste collectors. New start up opportunity exists in these areas in organized e-waste recycling and dismantling. However, most of the incinerators and composite effluent treatment plants are located in and around Bangalore urban and rural district which is an indication of the fact that, the unrecyclable solid waste and effluent waste cannot be properly handled in other parts of Karnataka.

With the given start up policy and Industrial Policy, Government of Karnataka has not come up with substantial steps that provide impetus to e-waste recycling and processing enterprises. Although, e-waste management rules of 2016 and the guidelines of 2016 propose "Extended Producer Responsibility", in reality it has not come to effect fully even after one year of its proposal.

E-waste management model:

The primary and secondary research revealed major factors which would play a significant role in the e-waste market. The factors are 1. Governmental Regulations and policies, 2. Awareness 3. Consumer Base 4. Carrying capacity. All these factors will have significant impact on the value chain in the e-waste market. According to this model (Figure 1), each factor will have influence on the other and thus on the value chain.

The Governmental regulations and policies: will have to be formulated and executed so that, the customer base is managed and compelled to manage the e-waste. The policies and regulations should adequately facilitate for awareness creation about the impact of e-waste on the environment and on Human beings.The governmental policies and regulations should be directed not only towards the customers but also towards the e-waste recyclers and processers.

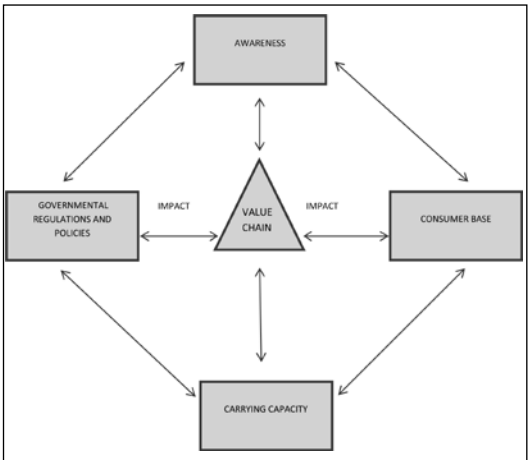


Fig 1: E-waste management model

An incentive mechanism needs to be instituted by the government to bring about a market mechanism towards e-waste Management. Government will also have to bring about the policies and regulatory mechanism towards collaborating government authorities, private partners to create awareness, training and development etc towards e-waste management.

The carrying capacity: Carrying capacity is the capacity of any region or system to support certain population size without the further addition of any external agents / pollutants. The carrying capacity gets reduced when the level of pollutants rise in the basic factors (soil, air and water) of the environment. There is a limit till which the carrying capacity does not get affected because of the pollutants. However, it would get irreversibly damaged if the pollutants continuously add up. In order to maintain the carrying capacity, the governmental rules should regulate the system so that pollutants are not added. Pollution of hazardous waste needs to be measured and assessment of the carrying capacity needs to be done. Proper awareness should be provided to the consumers so that, they use the electronic products in a way that does not harm the carrying capacity. Technological intervention normally increases the carrying capacity of the area. Therefore, such options need to be explored through research. The consumers should be compelled by regulations by the government to dispose the e-waste properly once the effective life is finished. Proper research needs to be instituted to understand the carrying capacity.

Awareness about the impact of e-waste on the environment needs to be explained to the customers. Government will have to make it mandatory, the requirement of creating awareness about the e-waste and its harmful effects. Some of the policies like "Extended Producer Responsibility" and the role of the "bulk consumers"are not fully understood by the electronic goods sellers and also the users. Therefore the awareness about these is very essential. The awareness about the harmful effects of e-waste needs to be explained to recyclers and dismantlers in the unorganized sector.

Customer Base: The rate of e-waste creation is defined by the consumer concentration in an area. Also, the consumption rate of the consumer base is also a factor in e-waste generation. The behavior of the customer base depends

on the incentive that they get for safe disposal of the e-waste. Their behavior is also influenced by the awareness level of the consumer base. Therefore the consumers / customers should be regulated and managed to have a shift towards an economy of Reduce, Reuse and Recycle. Customers should be given awareness about the long term impact of e-waste. A clear responsibility needs to be fixed on the customer base to dispose off the e-waste systematically.

Given the fact that, e-waste generation is going to increase multiple times in future, a clear market system with proper regulatory mechanism needs to be defined, so that, managing it becomes effective and efficient. The e-waste management model proposes for an efficient market model taking into consideration all the factors that impact the value chain in e-waste management and thus provides for a basis for efficient market design towards e-waste management.

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