

## **REVERSE SUPPLY CHAIN AND E-WASTE (MANAGEMENT) RULES, 2016 – A STUDY ON CELLULAR PHONES IN INDIA**

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### **ABSTRACT**

Electronic Wastes or e-wastes are now becoming a serious environmental problem for the world especially for developing countries if not managed properly. Reverse supply chain which is the process of removing new or used products from their initial point in a supply chain, plays an important role to control e-waste. This study explored the role of reverse supply chain as a new environmental issue in context of E-Waste Management Rules, 2016 and gave an outline of activities from take-back to awareness program adopted by MNCs as a part of Extended Producer Responsibility to tackle cellular phone generated e-waste in India.

**Keywords-** reverse supply chain, e-waste, cellular phone, E-Waste Management Rules, 2016, India

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## INTRODUCTION

With the advancement of technology and the rising ‘throwaway culture’ among the users, the electronic wastes or e-wastes are now becoming a major environmental problem for the world especially for the developing countries if not handled and recycled properly. As per, Basel Action Network (Puckett, 2002) "E-waste encompasses a broad and growing range of electronic devices ranging from large household devices such as refrigerators, air conditioners, cell phones, personal stereos, and consumer electronics to computers which have been discarded by their users." According to StEP white paper 2014, E-waste is defined as—“a term use to cover items of all types of electric and electronic equipment (EEE) and its part that have been discarded by the owner as waste without the intension of re-use”. E-waste or electronic waste, therefore, broadly described as “discarded, surplus, obsolete, broken, electrical or electronic devices” (Rajya Sabha, 2011).

The ASSOCHAM-Frost & Sullivan study (2016) said that India's electronic waste is likely to reach 30 lakh metric tonnes (MT) per year by 2018 from the present level of 18.5 lakh metric tonnes (MT) with a CAGR of 27.34%. Another study by ASSOCHAM-cKinetics (June 2016) also revealed that India is emerging as one of the world's major electronic waste generators and likely to generate 52 lakh metric tonnes (MT) per annum by 2020. Due to lack of number of formal sector and awareness among people, the informal sector dominates the sector of e-waste management in terms of collection and dismantling and plays a crucial role in e-waste management in India. Only 2% of India’s e-waste India is managed by the formal sector (ASSOCHAM-KPMG study, 2017).

UNEP report 2005 revealed that —“every year 20-50 million tons of electrical and electronic scrap generated worldwide” which could bring serious risk to human health and the environment as the e-waste typically coming from hardware comprises of aluminium, cadmium, mercury, brominated flame-retardants, complex plastic blends and lead. Due to the lack of governmental legislations on e-waste, standards for disposal and proper mechanism for handling these toxic hi-tech products, either generated internally or imported illegally, mostly end up in landfills or partly thrown into waste streams and partly recycled in a unhygienic conditions in informal recycling yards in developing countries like India, China and African countries (UNEP report-

2010), where poorly-protected workers dismantle them, often by hand, in appalling conditions. This unscientific system of recycling by informal sector is releasing large amounts of toxic substances and polluting the local environment. On the other hand e-wastes contain valuable materials like gold as well as components that can be reused (for example, components of cellular phones). Thus management of e-waste requires a scientific way to extract these materials or to reuse the components without any adverse effect on the environment.

To tackle the problem of e-wastes and to manage them soundly the responsibilities of government includes the framing, implementing and regulating E-waste policy and legislation and also to encourage organised system of recycling. Up to 2003 there were no specific Environmental Laws or Guidelines for e-waste even from the Indian Central Pollution Control Board (CPCB). However from the existing laws of CBCP, the e-waste fall under the category of 'Hazardous' waste and covered under the purview of the 'National Hazardous Waste Management Rules 2003' (revised Rules-2008) and the 'Municipal Solid Wastes Management and Handling Rules 2000'. With the introduction of E-Waste Management and Handling Rules-2011, the country got a comprehensive Rules to manage e-waste and the Rules were applied to every producer(s), dealer(s), collection centre(s), refurbisher(s), dismantler(s), recycler(s), auctioneer(s) consumer(s) or bulk consumer(s) involved in the manufacture, sale, purchase and processing of electrical and electronic equipment or components as specified in schedule-I including collection centre, dismantler and recyclers of e-wastes. The Rules disclosed the 'extended producer responsibility'(EPR) which means responsibility of any producer of electrical or electronic equipment, for their products beyond manufacturing until environmentally sound management of their end-of-life products.

With the E-waste (Management) Rules (2016), which came into effect from 1st Oct 2016, the Government of India introduced a revised and elaborated Rules of Extended Producers Responsibility (EPR) which makes producers liable to collect 30 per cent to 70 per cent (over seven years) of the e-waste they produce. As collection is the main pillar of e-waste management, the new rules make the producers of electronic goods to become responsible to collect all the discarded e-goods from the marginal customer or from the bulk customer in the form of reverse supply chain to manage e-waste efficiently and effectively.

## RESEARCH PROBLEM

While global market for electrical and electronic products continues to expand and accelerate, the life- span of the product is becoming limited. The notable fact is that India is the fifth largest producer of e-waste in the world which is seriously a matter of concern (ASSOCHAM-KPMG study, 2016). Thus we need a proper and scientific system to manage these toxic wastes and the role of the producers cannot be ignored.

## OBJECTIVES

The objectives of this paper are classified under the following sub-headings-

1. To explore the role of reverse supply chain as a new environmental issue in context of E-Waste Management Rules, 2016 for the management of e-waste.
2. To construct a diagram to show the channels by which reverse supply chain of discarded cellular phone is done effectively to comply with E-Waste Management Rules, 2016.
3. To give an outline of activities adopted by the different MNCs in India to tackle e-waste generated from cellular phones through reverse supply chain.

## LITERATURE REVIEW

Some of the major works done in this area are noted below-

Fleischmann (2000) saw that the 'reverse' goods flows are typically managed by the receiving party and hence that Reverse Supply chain is a form of inbound supply chain. He also observed that the overall reverse supply chain task that companies face in this context is about bridging the gap between a former owner, releasing a product and another future owner. StEP (2005) refers E-waste as "...the reverse supply chain which collects products no longer desired by a given consumer and refurbishes for other consumers, recycles, or otherwise processes wastes." Nagurney and Toyasakitake (2005) took a perspective of supply chain analysis and management for the collection, recycling, and processing of electronic waste, which may ultimately be converted into products demanded by the consumers. Ahluwalia (2006) identified that that with reverse supply chain it is possible to reduce the environmental risk significantly by a marginal increase in the available cost. Li (2012) highlights that a way to handle e-waste and the problems brought about by it is through reverse supply chain or more specifically through extended producer responsibility Molinari (2012) said that Reverse supply chain as well as forward supply

chain of devices in the consumer electronics industry can be a complex business. Setting up a program to outsource these functions for a manufacturer or retailer involves many areas of the 3PL to collaborate and formulate a solution. Kang'ethe (2013) demonstrated that the return process management, as a supply chain management process, can contribute immensely if the consideration of closed loop supply chain process management is put in place whereby design and measures to undertake product returns is appreciated from the initial stages of product processing as a deliberate value added even after being consumed by end users. SelcukKilic (2015) said that the recovery of WEEE is very important both from environmental and economic aspects. The network structure of reverse logistics system plays an important role in the total cost of the recovery system and those structures mainly include the locations of facilities and the flows between the related points. Demajorovic (2016) revealed that most of the interviewed stakeholders agreed to implement reverse supply chain model and special emphasis should be given to the conflicts inside the reverse supply chain itself and to increase the willingness of manufacturers, wholesalers and retailers to work cooperatively, mainly in terms of costs sharing. Udhayakumar et. al. (2017) found that if the reverse supply logistics system is installed by the firms, the value of the products essentially increases and ensures the provision of quality products by satisfying the end-consumers. With such an environment friendly implementation, the landfills can also be reduced to the significant level.

## **METHODS**

The present study is descriptive in nature and is based on secondary data collected from various sources i.e. books, journals, reports, as well as relevant websites. Due to high rate of obsolescence, the study is restricted on waste generated from cellular phones. A diagram is formed to find out the channels of reverse supply chain to comply with E-Waste Management Rules, 2016 in management of cellular phone generated e-waste.

## **RESULTS and DISCUSSION**

### ***Section A- Reverse Supply chain and management of E-Waste as per E- Waste Management Rules, 2016***

Reverse supply chain is the supply chain process of removing new or used products from their initial point in a supply chain, such as outdated merchandise and redistributing them using

disposition management rules that will result in maximised value at the end of the items original useful life (Gattuso, 2005). Another definition of reverse logistic is given by Fleischmann et al., as - reverse logistics includes the logistics activities all the way from used products no longer required by the user to products again usable in the market. For the management of the hazardous e-waste in a sound environmental way, the reverse logistic or reverse supply chain can play a very important role in our country.

Management of e-waste consists of three main steps:

i) collection, ii) sorting/dismantling and pre-processing (including sorting, dismantling, mechanical treatment) and iii) end-processing (including refining and disposal). The efficiency of the entire system depends on the efficiency of each step and on how well the interfaces between these interdependent steps are managed. To establish a formal system of e-waste management, we require a proper extended producers' responsibility (EPR) system in the form Reverse Supply Chain as by EPR the producers of electronic goods will be able to take back their end-life products for proper handling and disposal.

The total users of cellular phone in India (upto 31<sup>st</sup> July, 2017) stood as 1186.79 million which is 92.03% of country's population (TRAI, September, 2017). On the other hand India is the second largest market of smartphone of the world in terms of users. It could be easily understood that e-wastes generated from cellular phones must need a solution to manage. Here comes the concept of EPR as the right solution of e-waste management including cellular phone generated e-waste in our country.

The newly framed 'E-waste (Management) Rules, 2016' (EWM Rules,2016) is based on Extended Producer Responsibility (EPR), which is the responsibility of every producer of electrical and electronic equipment (EEE) for channelization of e-waste to an authorized dismantler / recycler to ensure environmentally sound management of such waste ([www.cpcb.nic.in](http://www.cpcb.nic.in)). The producers have to submit an EPR Plan to take EPR Authorisation from Central Pollution Control Board (CPCB), India for managing EPR with implementation plans and targets outlined in such authorisation including detail of Producer Responsibility Organisation (PRO) and e-waste exchange. 'Extended Producer Responsibility Plan' means a

plan submitted by a producer to CPCB, at the time of applying for Extended Producer Responsibility - Authorisation in which a producer shall provide details of e-waste channelisation system for targeted collection including detail of PRO and e-waste exchange. Chapter II of this act describes EPR Authorisation should comprise of general scheme for collection of waste Electrical and Electronic Equipment from the Electrical and Electronic Equipment placed on the market earlier, such as through dealer, collection centres, PRO, through buy-back arrangement, exchange scheme, Deposit Refund System, etc. whether directly or through any authorised agency and channelising the items so collected to authorised recyclers.

As per the Rules, 'collection centre' means a centre or a collection point or both established by producer individually or as association jointly to collect e-waste for channelising the e-waste to recycler and play such role as indicated in the authorisation for Extended Producer Responsibility granted to the producer and having facilities as per the guidelines of Central Pollution Control Board, including the collection centre established by the dismantler or refurbisher or recycler which should be a part of their authorisation issued by the State Pollution Control Board where the facility exists;( Chapter I, pg 2 'E-waste (Management) Rules, 2016').

Thus producer of electronic goods has to establish a 'collection centre' individually or collectively (Producers Responsibility Organisation/PRO) to collect e-waste from individual customer. 'PRO' is a professional organisation authorised or financed collectively or individually by producers, which can take the responsibility for collection and channelisation of e-waste generated from the 'end-of-life' of their products to ensure environmentally sound management of such e-waste.

For 'bulk customer' who are the 'bulk users of electrical and electronic equipment such as Central Government or State Government Departments, public sector undertakings, banks, educational institutions, multinational organisations, international agencies, partnership and public or private companies that are registered under the Factories Act, 1948 (63 of 1948) and the Companies Act, 2013 (18 of 2013) and health care facilities which have turnover of more than one crore or have more than twenty employees', they can appoint an authorized dealer or e-retailer in the form of "take back scheme". The Rules define 'Dealer' as any individual or firm that buys or receives electrical and electronic equipment as listed in Schedule I of these Rules and their components or consumables or parts or spares from producers for sale and E-retailer

means an individual or company or business entity that uses an electronic network such as internet, telephone, to sell its goods.

At the time of collection from bulk customer or direct deposit of e-waste by individual consumer two questions arise as 'by whose cost the wastes are collected' and 'whether depositing of e-wastes are cost-effective for its consumers'. The concept of 'Advanced Recovery Fee' (ARF) is the answer. In the newly formed Rules, the ARF is the "Deposit Fund Scheme" (DFS). At the time of take back in the collection centre the customers irrespective of individual or bulk will enjoy a returned price of end-of-life e-goods with DFS. The Rules said that 'deposit refund scheme' means a scheme whereby the producer charges an additional amount as a deposit at the time of sale of the electrical and electronic equipment and returns it to the consumer along with interest when the end- of- life electrical and electronic equipment is returned.

The targets for collecting of e-waste under extended producer responsibility as reverse supply chain are-

- During first 2 year of implementation of rules, 30% of the quantity of waste generation,
- during 3rd and 4th years, 40% of the quantity of waste generation,
- during Fifth and Sixth years of 50% of the quantity of waste generation, and
- seventh year onward of 70% of the quantity of waste generation as indicated in Extended Producer Responsibility Plan.

After collection/ take back, the dealer should deposit the 'end of life' products in the collection centre from where goods are transferred/channelized to 'authorised dismantler/ recyclers/ refurbisher through 'transporter'. The Rules said that 'channelisation' means to direct the path for movement of e-wastes except fluorescent and other mercury containing lamps, from collection onwards to authorised dismantler or recycler. The 'dismantler' means any person or organisation engaged in dismantling of used electrical and electronic equipment into their components and having facilities as per the guidelines of CPCB and having authorisation from concerned State Pollution Control Board. On the other hand 'transporter' is a person or company or entity engaged in the off-site transportation of e-waste by air, rail, road or water carrying a manifest system issued by the person or company or entity who has handed over the e-waste to the transporter, giving the origin, destination and quantity of the e-waste being transported (EWM Rules, 2016).



At any point of Reverse Supply Chain, the storage period of e-wastes must not exceed 180 days and the producer must maintain a record of collection, sale, transfer and storage of such wastes. After receiving the e-wastes the duty of the refurbisher is to repair the discarded e-goods for extending its working life for its originally intended use and to sell the same in the market or returning to owner. If repair or resale is not possible then the e-waste is to be transfer to the dismantler. The dismantler can be a person or organisation engaged in dismantling of used electrical and electronic equipment into their components. During dismantling the responsibility of the dismantler is to ensure that no damage is caused to the environment during storage and transportation of e-waste, dismantled e-waste are segregated and sent to the authorized recycler to recover materials and ensure that non-recyclable or non-recoverable components are sent to authorised treatment storage plant for an environmental sound management. After dismantling the usable components are transported to the recycler to recycle and reprocess or to assemble. The residue or non recycled materials in the recycling process are sent to the authorised recyclers to dispose of in an authorised treatment storage disposal facility without harming health and environment.

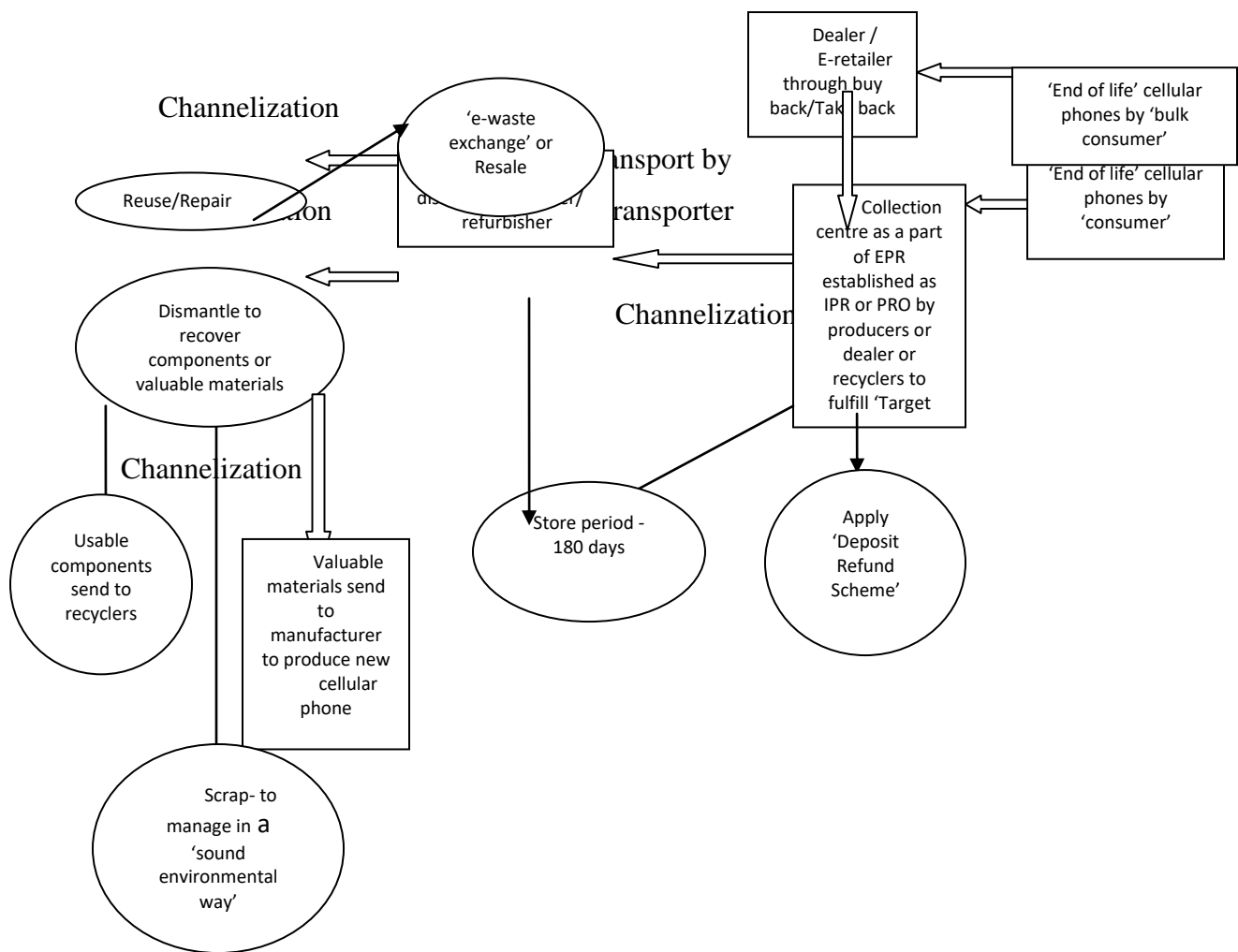
Other responsibilities of Producers to fulfill the EPR as per EWM Rules, 2016, are as follows-

- To provide contact details such as address, e-mail address, toll-free telephone numbers or helpline numbers to consumer(s) or bulk consumer(s) through website and product user documentation so as to facilitate return of end-of-life electrical and electronic equipment;
- To create awareness through media, publications, advertisements, posters, or by any other means of communication and product user documentation
- To inform the consumers about the hazardous constituents as specified in sub-Rule 1 of Rule 16 in electrical and electronic equipment and hazards due to improper handling, disposal, accidental breakage, damage or improper recycling of e-waste;
- To instruct for handling and disposal of the equipment after its use, along with the Do's and Don'ts
- To affix a visible, legible and indelible symbol given below on the products



So, the channels of Reverse supply Chain to manage e-wastes including cellular phones in the form of EPR as per the EWM Rules, 2016 are- The ‘collection centre’ is the first channel of reverse logistic of e-waste from where ‘deposit fund scheme’ is to be fulfilled. Transport through “transporter” is the second channel. In the third channel the dismantler dismantled the e-waste to recover useful component or valuable material or the recyclers/ refurbishers sold the useful components/e-goods in the secondary market for reuse/e-waste exchange. Valuable materials are to be sent to the manufacturers to produce new e-goods which are the fourth channel of reverse logistic of e-waste. Producers must ensure that no damage is caused to the environment during storage and transportation of e-waste (E-waste (Management) Rules, 2016)

**Section B- Diagram of Reverse Supply Chain as a part of EPR to Manage Discarded Cellular Phone**



**Diagram-1**

In the light of Electronic Waste (Management) Rules, 2016, the above diagram depicts the reverse supply chain of end-of-life cellular phones from the perspective of Extender Producers Responsibility.

***Section-C- Reverse Supply chain of End of Life Cellular Phone and MNCs in India***

E-waste such as discarded cellular phones contains toxic and hazardous substances and chemicals that are likely to have adverse effect on environment and health, if not handled properly. By 2020 India's e-waste from old mobiles will rise by about 1800 per cent by 2020 as compared to the levels in the year 2007 (ASSOCHAM-KPMG study, 2017). The cellular phone comes under schedule 1 (code-ITEW15) of the E-waste (Management) Rules (2016) which means a cellular phone does not contain lead, mercury, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ethers beyond a maximum concentration value of 0.1% by weight and of 0.01% by weight in homogenous materials for cadmium.

“TakeBack Blues: An Assessment of E-waste Takeback in India,”- a study conducted by Greenpeace in 2008, revealed that most of the global electronic brands have not functioning e-waste takeback i.e. reverse supply services in India despite many of these brands providing a voluntary takeback service in other countries. With the implementation of EPR, MNCs as a part of their CSR, engaging in cellular phone business in India have started taking different steps from take-back to green-product to awareness program to check the problems of e-waste. Following are the steps taken by MNCs in India as reverse supply chain to tackle cellular phone generated e-waste in the form of EPR to comply with newly implemented E-Waste (Management) Rules, 2016 -

- **Sony India Private Ltd.**

In order to promote and encourage electronic waste recycling, Sony as a part of reverse supply chain advised its consumers to deposit their electronic equipments and accessories at any of its 20 collection centre across India. A toll free contact number and addresses of the collection

centres are given in Sony's website to drop off discarded e-goods including cellular phones. ([www.sony.co.in](http://www.sony.co.in)).

- **Nokia India**

To promote recycling of electronic waste, Nokia India launched a 'Take Back' campaign from January 1, 2008 and established 'drop boxes' where customers can drop their old handset irrespective of brands in the Nokia Care Centre or to the Priority Dealers and win gift. In the second phase of collection the total quantity stood as 60 tons and over 2,000,000 pieces of phones and accessories recycled. In 2009, Nokia launched 'Planet Ke Rakhwala' take-back program in 28 Indian cities. In 2011, Nokia with the partnership with Humana People to People India, a non-profit organisation established more than 600 stores in 25 cities and towns in India to work with neighbourhood network of cellular phone stores and channel their e-wastes to authorized recycler via Nokia. Within a year Nokia recycled more than 50000 discarded cellular phones. ([www.epa.gov](http://www.epa.gov))

- **Samsung India Electronics**

Beginning in August 10, 2010, Samsung Take-back And Recycling' (STAR) program in India was an initiative towards leading a more conscious life, and taking an aware step towards conservation and optimization of resources by reusing, recycling and reinventing of its electronic products collected in this country. Samsung asks its customers to be responsible and drop their old Samsung phones at any of its 235 service centers ([www.samsung.com](http://www.samsung.com)).

- **Motorola India**

Motorola India has partnered with Trishyiraya Recycling India Pvt Ltd (TRI), India's first Government authorized electronic waste recycler, to comply with the E-Waste Management and Handling Rules, 2016 by providing drop-off centers and environmentally sound management of end of life electronics. Customers can drop their used Smartphones / Accessories in the drop-box provided at Motorola authorized exclusive service centers across India. A toll free phone number, drop box location, direct chat option and e-mail ID for further communication for the customers are given in Motorola's website. ([www.motorola.in](http://www.motorola.in))

- **Lenovo**

Lenovo has partnered with Sims Recycling Solutions India Pvt Ltd, an authorized recycling unit in India and established 1491 drop-off centers in India for environmentally sound management of its products including cellular phones at the end of life. Lenovo followed European Directive 2002/96/EC and local regulations of e-waste management. Every Lenovo product including cellular phone is labeled as per the country's law and indicates that the product is not to be thrown away with other wastes at the end of life but rather put in the established collective systems for recycling. It has also provided a toll free number and collection centre locations in its website. ([www.lenovo.com](http://www.lenovo.com))

- **Apple**

Apple has provided free recycling program for its household customers as well as for business customers. E-mail addresses for this free recycling of Apple products including cellular phones are given in Apple's website. Apple's Environmental Responsibility Report, 2016 said that during the time of recycling the company maximizes the environmental benefits of recycling by weighing the availability of local recovery technology with the impacts of shipping waste. Apple's goal is a closed looped supply chain where products are built using only renewable resources or recycled material. ([www.apple.com](http://www.apple.com)).

- **Vivo Mobile India**

As the part of e-waste recycling program, Vivo Mobile India Pvt. Ltd. has made a partnership with Attero Recycling Private Limited to collect, dismantle and dispose its e-waste which is collected from all over the country. The vision is to look e-wastes as important resources. Vivo is seeking cooperation from its customers to reduce negative environmental impact of its cellular phones and tabs. ([www.vivo.co.in](http://www.vivo.co.in))

- **Micromax**

Micromax has tied up with an authorized e-waste company, 3R Recycler, to collect, dismantle and dispose e-waste collected from all over India. The company has given relevant information in its website for its customers to recycle its product properly and effectively. Micromax

encouraged its customers to recycle their end of life cellular phones and other electronics. ([www.micromaxinfo.com](http://www.micromaxinfo.com))

- **Mi India-Xiaomi**

Mi is offering an e-waste take-back & recycling services for discarded cellular phones and other e-goods irrespective of brand to adhere with the E-Waste (Management) Rules, 2016 issued by the Ministry of Environment and Forest, Government of India. As per the website Mi's Authorised e-waste recycler will contact the customers within 7 days of pick up request to pick up e-waste from their location within 15 days or customers can also drop e-waste at any of its service centers. A discount coupon of Rs. 100 is given to the customer for every pick up. The coupon is redeemed with a minimum purchase of Rs. 1000 goods, but only on accessories. ([www.mi.com](http://www.mi.com))

- **Lava**

To comply with E-waste Management rules, 2016, Lava has partnered with 3R Recycler which is India's one of the largest recycler of e-waste, for providing environmentally sound management of its end of life electronic goods. The company established a number of collection centres all over India to collect discarded e-goods including cellular phones. ([www.lavamobiles.com](http://www.lavamobiles.com))

- **Gionee**

Gionee will seek shared responsibility and cooperation from its customers to reduce the environmental impact of their products. The company has also tied up with 3R Recycler for an environmentally sound management of end of life electronics. ([www.gionee.co.in](http://www.gionee.co.in))

## CONCLUSIONS

The changing lifestyles of people, urbanization and globalization of economy have led to increasing rates of consumption of electronic products yet the life span of the product is becoming limited. This results in corresponding increase in electronic scrap or electronic waste or simply e-waste. As E-waste is hazardous in nature, its management is a serious concern of environment and health. Reverse logistic can have a great impact on the management of e-waste. The E-waste (Management) Rules, 2016 introduced 'extended producers responsibility' (EPR)

which is a part of reverse supply chain can play a sound environmental management to reuse, recycle and dismantling of 'end of life' e-goods. The EPR in this rule is a target based approach where producers are responsible to collect 30 per cent to 70 per cent (over seven years) of the e-waste produced by the users of their goods. India is the 2<sup>nd</sup> largest country in the world in terms of smartphone users and as the lifespan of the smart phone is estimated as 5 yrs, it is easily understood that the wastes generated from such cellular phones will be very high in near future. With the implementation of EPR, MNCs, as a part of their CSR, engaging in cellular phone business in India have started take-back to awareness program to check the problems of e-waste.

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