Myths of Extended Producer Responsibility (EPR) in E-Waste Management in India

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Abstract

In 2015, UN member adopted sustainable development goals with 17 folds for people and planet. The 4th industrial revolution increased interconnectivity and smart automation resulting in rapid change of technologies, industries and societal patterns and processes. Post Covid-19, this revolution further made us dependent on electrical equipment & gadgets. This opportunity increased risk for the environment and economy through E-Waste.

Extended Producer Responsibility (EPR) is one of the key protocols imposed by the Indian Ministry of Environment, Forest, and climate change (MoEF-CC) on electronic equipment manufacturing units. This attempt is clearly intended to develop sustainability through 'Urban Mining.' Such exercise not only safeguards the health of ecosystem but also increases economic transactions. Increased investment in waste recycling enlarges job opportunities to help social demand.

Quantum of E-Waste generated by individual or bulk consumers totally depends on the application of electronic gadgets, its estimated life duration, related advancement in technologies and marketing strategies. Quality of E-Waste is solely dependents on manufacturers thereby, Indian regulations in E-Waste not only encompasses waste recycling but also restricts the use of hazardous substances.

Unfortunately, the ground reality of E-waste management is totally different. Some myths and practices make it only 'Matter of debate'. A few obstacles like informal sector, disturbed circular economy, smart legal compliance, lack of technological assistance and unimpressed investment make concern for 'Sustainable Development Goals'. Mismanagement of E-Waste impacting Environmental quality, Safety of Society and health of people is a big concern for Indian economy.

This paper is an attempt to highlight facts of E-Waste management and its associated myths. It ponders upon backyard recycling and its effect on 'Circular Economy'. Such studies will be useful for geographers, environmentalists, finance investors and governing bodies to understand the depth of the problems, with integrated approaches contributing to sustainable growth.

Keywords: E-Waste Management, Extended Producer Responsibility (EPR), Sustainable Development Goals, Circular Economy.

1 Introduction:

We, all people, are part of "Data" and our information is stored on hard disk through physical drive or through web cloud. Advanced communication systems integrate our information and decode it quickly, through application of the current. This current is blood of any electrical equipment, without it, equipment is Inert. Truly, this flowing tendency of current is dependent on conductivity of metals which are extracted from Earth.

Gadgets like mobile phones, laptops, watches, air conditioning, fridges and lighting bulbs have changed our lifestyle drastically. Starting from home, offices, schools, colleges, railway station, banks and with vehicles, we are surrounded by life easing electronic instruments. In Covid-19 pandemic, we were physically isolated from each other, but we remained closed due to high internet connectivity and that too through electric gadgets. But, for the last decade, we have been concerned about its waste management.

As per Indian regulation, 'E-waste' means electrical and electronic equipment, whole or in part discarded as waste by the consumer or bulk consumer as well as rejects from manufacturing, refurbishment and repair processes.(Ministry of Environment, 2016) The Global E-Waste Monitor 2020 reports that the world generated around 53.6 million metric tons (Mt) of e-waste in 2019 (Forti V., 2020), whereas around 3.23 million metric tons (Mt) of waste generated from India. Bulk consumers are users of electrical and electronic equipment such as Governmental and non-governmental agencies, private sectors, banks, education institutes etc. Their collection, segregation and recycling can easy task in e-waste management, as they can be pointing source of waste generation. Whereas waste collection from individual consumer is quite challenging activity, specially populated country like India. It means, the potential of waste accumulation in the informal sector is quietly large.

The Ministry of Environment and Forest, climate change (MoEF-CC) adopted the policy of Extended Producer Responsibility (EPR) to overcome this issue. EPR made responsible to any producer of electrical and electronic equipment, for channelization of e-waste to ensure environmentally sound management. According to the E-Waste management rule 2016, EPR proposes target-based take back system of e-waste before producing new electric gadgets. Opportunity was given in said rule for establishment of collection centers, dismantlers, and recyclers through process of 'Authorization'. EPR-Authorization is given by Central Pollution Control Board (CPCB) based on protocols and competency in environment sound management skills.

As per schedule-III of the E-Waste Management rule 2016, collection targets under EPR-authorization were set from 30% to 70% on yearly basis. After amendment in 2018, the manufacturer, producer, importer, transporter, refurbisher, dismantler and recycler were made liable to pay 'Environmental Compensation' under the Environmental Protection Act 1986, for violation of any rule there under.

In further amendment, a concept of Producer Responsibility organization (PRO) was introduced for ease of manufacturers. PRO means professional responsibility organization, authorized or financed collectively or individually by producers, which can take the responsibility for collection and channelization of e-waste generated from the 'end-of-life' of their products to ensure environmental sound management of such e-waste.(CPCB,

Guidelines for Producer Responsiblity Organisation (PRO), 2018) Looking to statistics of CPCB, there are around 2,156 PROs registered from October 2018 till September 2022.

This condor initiative of Indian government shows interest in Environmental sustainability, better economy, and a step towards "Atmanirbhar Bharat". But looking to heterogeneous quality of e-waste, there is need of extended waste recycling technologies which can substitute to earth mining. Waste accumulated in informal sector, Municipal Solid waste yard and at open dumping ground also need to be channelized through proper in-depth planning. Active participation from industries, societies, research institutes and by individuals is key set for success of 'Sustainability'.

This paper is highlighting to some common myths on EPR concept, so that every stake holder encompasses knowledge of e-waste, understand pitfalls of waste recycling, and make dynamic actions in terms of true legal compliances, better economic stability, and environmental sustainability.

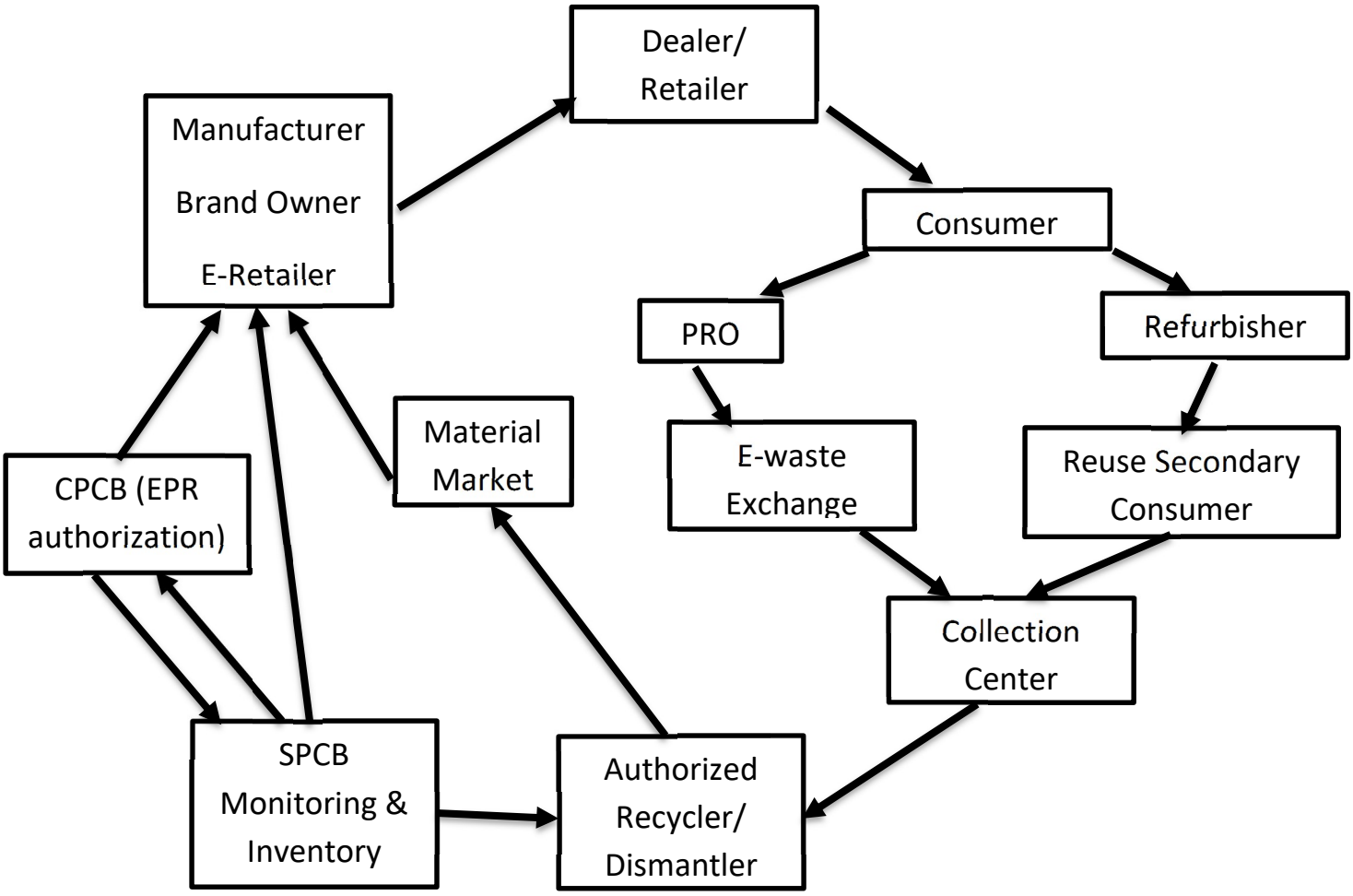
Background:

E-Waste generated from developed countries is transported to developing countries, because of availability of open space for dumping and low-cost labor for recycling. In developing countries, most e-waste is handled improperly through unscientific methods, commonly termed as 'Backyard Recycling' or 'Informal Recycling'. In Germany, 17.4% of total e-waste is recycled by the formal sector, the rest remaining undocumented and thus either stored, traded, dumped, or recycled under lower standards. Urban mining and recycling have potential to improve the country's economy and to decrease pollution and global warming. It includes physical pretreatment, followed by pyro-metallurgy, hydro metallurgy, electrometallurgy, and bio-hydrometallurgy.(Deblina Dutta, 2022)

E-Waste in the India will always a matter of concern as average life of electronic gadgets based on its application and technological advancement. Biggest challenge of e-waste in the India is lack of funds and investment to finance profitability improvements in e-scrap recycling. There is loss of resources, energy wastage and environmental pollution because of the crude 'backyard recycling' activities.(R. Nivedha, 2020)

Extended Producer Responsibilities (EPR) has 3 basic approaches, viz: Product Take Back, Regulatory Approaches and Economic Instruments. The issue of Environmentally Sound Management (ESM) of e-waste is a global problem arising from trans-boundary movement among all countries and regions and thus requires global solutions. (Herat, 2012). India already adopted restriction of transboundary movement through E-Waste regulation under The Environmental Protection Act 1986. However, due to complex marketing competition and import based economy, e-waste generated by imported electronic equipment is unaccounted for in total quantum of waste. Its quality, weight and size were unknown to regulatory agencies. Due to this, manipulation of recycling records can be expected by authorized recyclers with magnified quantities. This becomes a gap in understanding actual recycled waste quantity.

EPR theme shown in Figure 1:



Myth No. 1 - EPR is sufficient to tackle E-Waste Management

The current electronic era is coupled with attractive designs with the use of quick responding precious metals. This becomes a challenge in recovery of components. We are fast in manufacturing new electric equipment, but comparatively slow in recovery technologies. Technology transfer on global platform has its own limitations. Many recycling technologies are designed on certain climatic conditions, financial investment, energy utilization through robotics and acute SCADA system for environmental protection. Technology adopted by certain developed country will not be useful for developing countries like India, where investment is adjusted against manpower utilization. This further question is about environmental pollution and human health, as it can manipulated against standard.

Table: 1 – Showing number of dismantlers/ recyclers and producers registered under EPR authorization. Data Source: CPCB website.

State	Number of Dismantler/ Recyclers	Number of Producers received EPR Authorization
Andhra Pradesh	8	8
Assam	1	3
Chhattisgarh	2	0
Delhi	3	607
Gujarat	33	87
Goa	1	3
Haryana	42	199
Himachal Pradesh	2	9
Jammu & Kashmir	3	0
Jharkhand	2	1
Karnataka	71	176
Kerala	1	69
Maharashtra	116	519
Madhya Pradesh	2	15
Orissa	5	9
Punjab	7	12
Rajasthan	24	29
Tamil Nadu	32	124
Telangana	17	47
Uttar Pradesh	89	177
Uttarakhand	6	4
West Bengal	4	84

In India, there are 472 units are engaged in dismantling & recycling of waste; mostly they are in urban areas. (CPCB, https://cpcb.nic.in/epr-authorization/, n.d.)Around 2171 units are registered for EPR authorization. (CPCB, www.cpcb.nic.in, n.d.)Referring to Table: 1, it seems that in every state, electronic manufacturers are comparatively more than dismantler and recyclers. Chhattisgarh and Jammu & Kashmir are having dismantling or recycling units, without having manufacturing units. It means, either both states are not aware of EPR benefits or they are importing waste from other states.

E-waste generated from rural areas is still a matter of concern. Open dumping and open burning pollute water reservoirs and atmospheric air, which results in impact on agricultural productivity. Secondly, transportation of this e-waste to urban recycling unit is quite challenging due to their size or volumes. This leads to backyard recycling in rural areas with unscientific reprocessing steps. Many times, it becomes difficult to oppose these activities, as it is associated with earning source of poor peoples.

CPCB given guidelines for recyclers in 2016, in which specified minimum area requirement is 500m² for 1 Ton/Day e-waste recycling capacity.(CPCB, Guidelines on Implementation of E-Waste (Management) Rules, 2016, 2016) Land cost, equipment cost and supply chain expenses makes it unattractive investment in recycling activities. This becomes a challenge in EPR sustainability. On the other hand, regulation agencies have limited manpower to monitor the processes of EPR activities. These limitations make selective screening of manufacturers, recyclers, and collection centers. At the same time, sales records of electronic gadgets by domestic manufacturers and import traders are assessed by different agencies. Such gap of monitoring will result in statistical limitation for assessment of effectiveness of policy decisions.

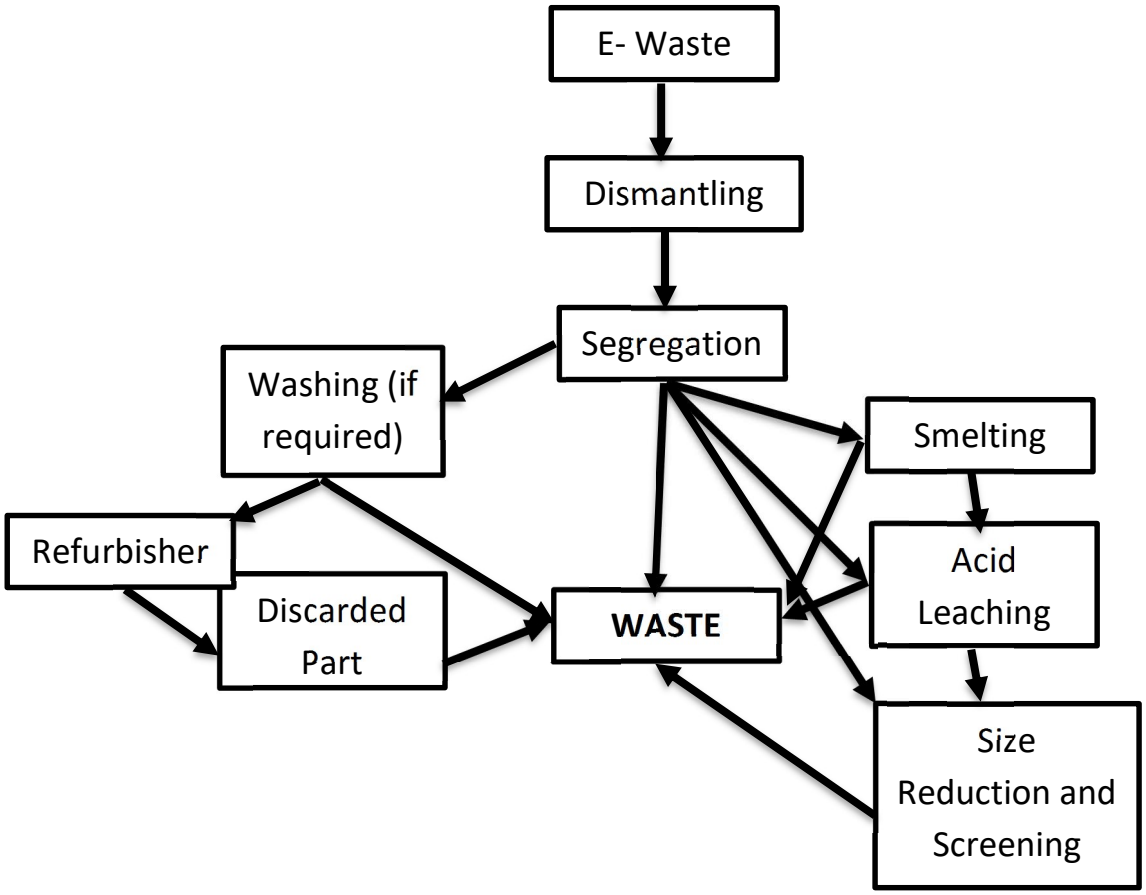
Discussion:

EPR is intended to restrict use of hazardous chemicals and make most probable ways of recycling approaches. Indian regulation has given target-based system for manufacturer, where opportunities given to recycler, collection centers and together PROs. But looking to obstacles like technology transfer, funding and investment, lack of legal monitoring and ease of earning; EPR will not contribute efficiently towards sustainability growth. An integrated approach by different sectors is required with in-depth planning. Self-responsibility and accountability will accelerate this drive.

Myth No. 2 - EPR can provide "Zero Waste Based System."

Any electronic equipment comprises of plastic (Polymer), metals & heavy metals (like Si, Fe, Cu, Hg, Pb, Pt etc.) and inert/ reactive gases (like Nitrogen, Argon, Refrigerant gases etc.). Recycling technologies and extent of ethics decide the recycling opportunities.

The ideal approach of e-waste process is shown in figure 2.



At every stage of recycling step, a certain quantum of waste is generated. Processes like acid leaching and smelting are assisted by the application of other chemicals or energies. These results in generation of 'Hazardous Waste', whose quality remains heterogeneous in nature along with its hazardous characteristics.

Investment area and profitability decides ease of recovery for selective elements. This results in transformation of waste to the next level. Every recycling unit engages its own cost in recycling processes and expects profit. In India, disposal cost is very less as compared to process or handling cost of recyclable material. Thus, any component that has less potential of profit will easily transfer to waste landfills.

Dismantled organic waste, especially plastic and foam is easily transferred to municipal solid waste. Informal sectors are the biggest contributing to this concept. Secondly, application of pyrolysis or gasification attracts financial investment, isolated and environmentally sound land, technological advancement, and ultimately legal approvals.

Considering the hazardous waste management rule 2016(MINISTRY OF ENVIRONMENT, 2016), any hazardous waste having calorific value more than 2,500 Kcal/Kg is disposed through 'Incineration'. Average cost of incineration in India is Rs. 35-45/ Kg, depending on air pollutants actively present in waste. Whereas landfill disposal cost ranges from Rs. 0.8-4.0/ Kg. This large difference manipulates the quality of waste

and dilutes recoverable elements. Municipal waste landfills are best chosen destination for informal sectors in these scenarios.

In the process of EPR, as a component of circular economy, E-Waste is sold by individual to next levels of recycler. When recycler purchases it in competitive market and when becomes nonviable to recycle, entire quantum gets accumulated in waste landfills.

As compliance part of EPR regulation and subsequent flow of recycler, waste arises from processes is smartly channelized to hazardous waste landfills. It will not be surprising if entire waste can accumulate in hazardous waste landfill instead of recycling.

Discussion:

Due to the complex and heterogeneous quality of e-waste, it cannot be recycled fully. Few fractions will escape through air pollutants and solid waste, where they can impact our environment. EPR has given opportunities to recyclers and refurbishes. But not created 'Waste Exchange Bank'. Rather restriction of compliance in EPR and subsequent investment in process may result in smart environmental pollution.

Myth No. 3 – EPR provides sufficiency based circular economy.

Sufficiency has been defined as having enough to live well without excess, satisfying essential needs necessary to live and function comfortably, while prioritizing quality of life in work, education, and leisure, but not needlessly striving to satisfy infinite human material wants(Bocken NMP, 2022). Circular economy is widely viewed as a pathway to sustainability, presenting a counterforce to the conventional take-make-dispose linear model seen in much modern economy. The circular economy has been presented as a future paradigm effectively combining resource saving and economic growth (Bocken NMP, 2022).

In simple words, sufficiency based circular economy is integrated approach make towards waste recycling, through resource recovery. The recovered mass or energy is utilized for fulfilling the needs of society with increasing earning capacity with reduced commodity cost. This conceptual framework will not only help society at glance but also restrict ancient mining resulting environmental sustainability.

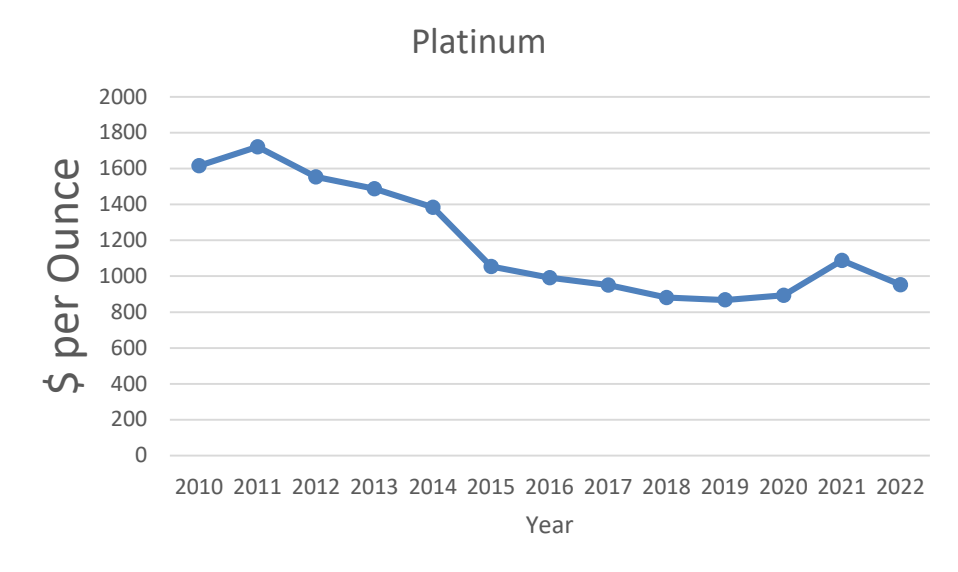
Our environment is adapted to market requirements. Any commodity when gets popular, its sale increases with decrease in price. More utilization results in large quantum of waste generation. Technological advancement excites us for replacement of old electronic gadgets. A shiny marketing scheme assists our decisions. A situation like COVID-19 makes it more dependable and a necessary part of our livelihood.

Looking to another fraction of market and environment, if any commodity is cheaper in price, people will buy it unnecessarily as part of 'Fashion'. Irrespective of its life or application, it will remain haphazardly at our home, whose raw material is extracted from earth's mining. In both scenarios, understanding sufficiency level by individual is important to develop better societal approach.

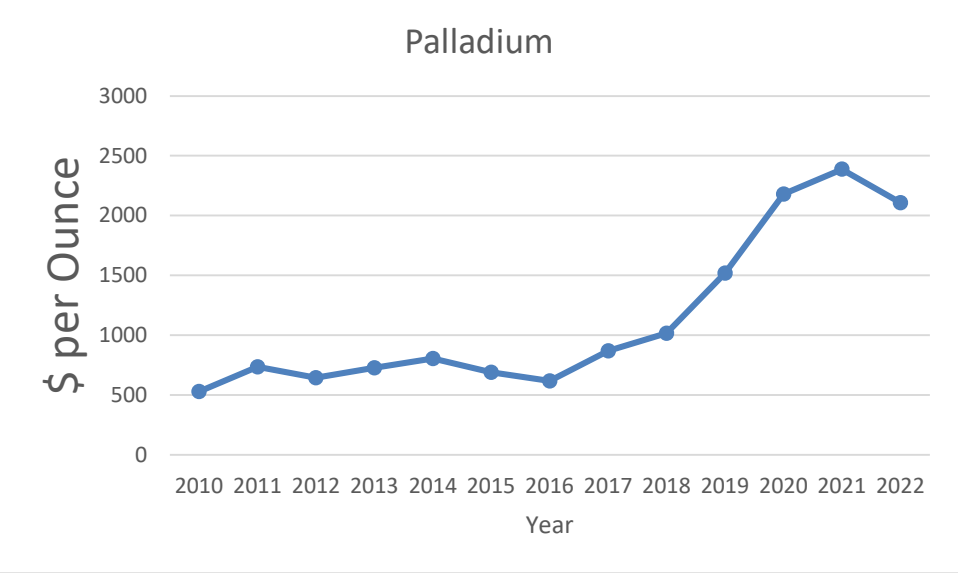
Every producer of electronic gadgets is associated with 4 folds in its product valuation, viz: Raw material price, energy and utility price, manpower price and brand's profit. EPR gives opportunity for circular economy by making available raw material through competitive market price. The commodities manufactured by this recycled material are expected to be less priced as the recycled element is supplied by the recycler with minimum trading in place.

By understanding this concept, we can surely say that the recycled element shall be available at lower cost than the market price. Following is the price range of Platinum, Palladium, Gold, and Silver from 2010 to 2022. (Data sourced from www.macrotrends.net)

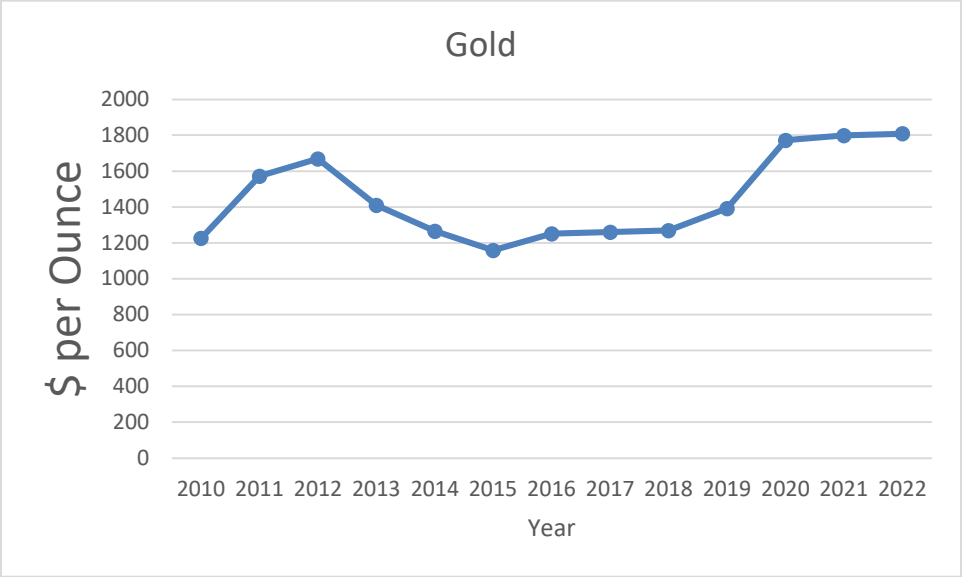
Graph No. 1: Showing Price Range of Platinum from 2010 to 2022



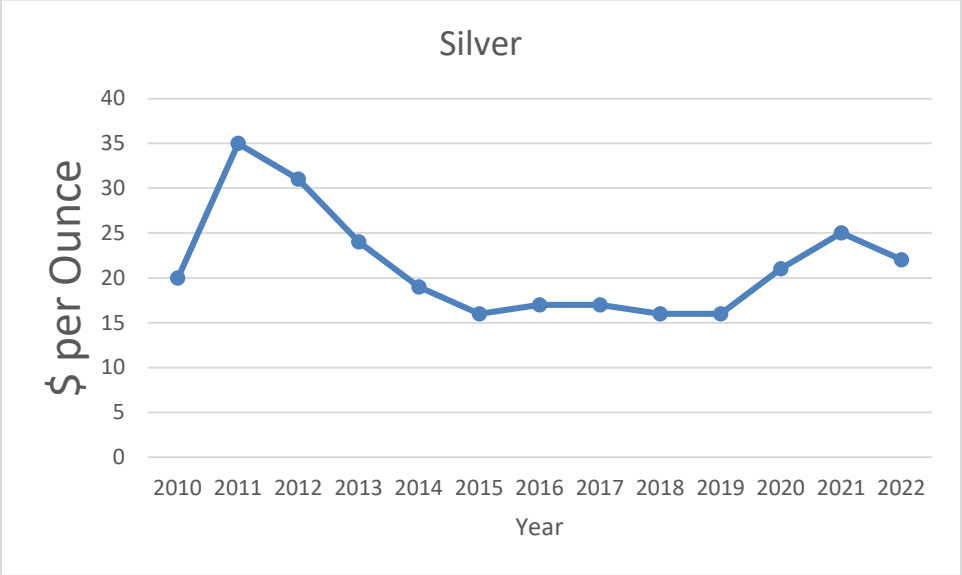
Graph No. 2: Showing Price Range of Palladium from 2010 to 2022



Graph No. 3: Showing Price Range of Gold from 2010 to 2022



Graph No. 4: Showing Price Range of Silver from 2010 to 2022



The above data shows that Platinum rates decreased in the last 12 years by around 37%. Palladium rates increased by almost 300%. Gold and Silver rates were almost stable. These interpretation shows that even we recycled various elements through 472 dismantlers and recyclers from India, price of these elements is almost stable or not gained much reduction. Following assumptions can set based on facts:

1. The number and capacity of recycling units are insufficient.
2. Manufacturer is extracting comparatively large brand profit from consumers or having multiple traders.

3. E-Waste recycling is developing a grey market, where extracted precious elements are exchanged at regular market prices.

Discussion:

Technological advancement and market competition can distract 'Sufficiency based Consumption'. The concept of circular economy is based on EPR regulation. It has its own limitations due to increasing consumption of electronic gadgets and ease of channelization in re-manufacturing. Sufficient recycling capacity against equally electronic manufacturing can lead to sufficiency of circular economy. Life Cycle Assessment is essential in designing new products. Globally channelization with 'Take back- recycle-remanufacture' will assist in commodity price reduction. Micro level vigilance on activity of EPR based circular economy can avoid chances of 'Grey Marketing'. Such attempts on a mutually agreed international level can gain advantages over economic crisis. It can be benefited by different geological locations by avoiding unscientific urban mining with reduction of 'Carbon Footprint'.

Myth No. 4 – PRO will accelerate circular economy and recycling.

Producer responsible organizations (PROs) are introduced for easy collection and recycling of E-waste on behalf of manufacturer. Proper functioning of PRO will result in reduced carbon emission. In India, there are 2171units received EPR authorization, 472 units engaged in dismantling and recycling and 77 units are working as PROs. E-waste collected from authorized source is traced by manifest form number 6, as per E-Waste Management Rule 2016(Ministry of Environment, 2016). This form includes information of collection, quantity, vehicle description and defined destination. This evidence-based record boost ease of management and ability to market sell to every brand owner.

In general, the State Pollution Control Board (SPCB) issues authorization numbers under consent mechanism for waste generators, collection centers, recyclers, and disposal agencies. Such authorization numbers not only make traceable records of waste transaction but also accounts for quantum of waste channelization. Mechanism of authorization under consent requirement is based on 'Application to SPCB'.

Since every transaction of waste channelization is based on purchase mechanism, it attracts 'Goods and Service Tax (GST)' with applicable rates. Collected tax is solely for proper functioning and growth of National development. Such attempt of the Indian regulation not only restricted environmental pollution but also benefited in overall economy of country. In this entire mechanism, manufacturers solely define environmental liability through documentary evidence provided by PROs.

In the process of smart compliance, there are chances of repetitive transactions for the same set of electronic waste. These repetitive documentary transactions can be issued by PROs to different manufacturers to gain profit. Such attempts will reflect the best circular economy, but never address actual waste recycling on the ground. These all efforts are still

unable to answer questions about waste processing in the informal sector through unscientific ways.

Discussion:

Single window transaction through web based manifest system on National Portal will help in accountability for performance of manufacturer and PROs. Geographical Positioning System (GPS) based movement through designated transportation will enhance traceability and accountability. In depth mass-balancing for waste material and its recoverable element will summarize consented quantities and its associated pollution load. Taxation mechanism at every stage of transaction will accelerate the economy at national level. Less or nil taxation levied on informal sector waste will attract authorized recyclers in gaining profit. PROs can become a single attractive element in course of circular economy and recycling subject to extended and integrated monitoring system through attractive taxation mechanisms.

Conclusion:

The new era of industrialization and ease of human life is now solely dependent on electronic gadgets. This equipment consists of hazardous chemicals in heterogeneous quantities. Its unattended waste can emit dangerous exposure to the environment and people. Success of E-waste recycling is solely dependent on ability of extraction and technology adopted. E-waste regulation in the India is framed not only considering environmental management but also provided attraction for circular economy. The environmental performance monitoring and its success depends on regulations framed with policy decisions.

Technology adaptation on global platforms has limitations due to variable geological and environmental conditions. It also varies by capital investment ability. Concept of EPR is not sufficient to tackle E-Waste management in India, as it concentrates on ‘Producers’. Thus, it will never address waste accumulated in informal sector whose urban mining can cause hidden pollution.

E-waste collection and processing generates a certain quantity of hazardous waste. So, the Indian regulatory body need to provide scientific based procedure to minimize waste quantum. Creating ‘Waste Exchange Bank’ on national portal will give opportunity in economical exchange. It will also provide tracking and tracing of waste flow through in-depth mass balancing of waste components.

EPR can provide sufficiency based circular economy by motivating investors in E-waste recycling. ‘Life Cycle Assessment’ needs to be thoroughly judged and declared on national portal by every producer. This will increase awareness in people and enhance proper functioning of PROs. Single window regulation cum information portal will increase efficiency of PROs. Ultimately PROs will not only accelerate circular economy but also able to sustain environmental quality.

Concepts of 'Industrial Sustainability, Environment-Social-Governance (ESG) and Zero Waste' are needed of today. Making it essential in 'Regulation' for every set of trader/ manufacturer/ service sector will focus narrow target towards Environmentally Sustainable Development Growth (ESDG).

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