

Producer Responsible Organisation: A Guiding Principles For EEE Producers

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ABSTRACT

Purpose: In an attempt to reduce, reuse and recycle of end-of-life equipment there is a paradigm shift to circular economy from linear economy. The polluter-pays principle (PPP) is one of those attempt in manage WEEE in an environment friendly manner by the producers. The Extended Producer Responsibility held accountable producers of electrical and electronic equipment for environmental impact on life-cycle impact of the products. Producer Responsible Organisation (PRO) are professional organization which can take the responsibility of collection and channelization of e-waste generated from end-of-life equipment to ensure environmentally sound management of WEEE. They are financed individually or collectively by the producers to meet their EPR targets. PRO setup collection centres and ensures traceability of WEEE in accordance with the guidelines issued by Central Pollution Control Board (CPCB). They act as specialized compliance service providers which organize e-waste management on behalf of producers in line with legal targets. the purpose of this study is To investigate the effectiveness of PROs in managing WEEE and to examines the role of PRO in meeting collection targets set by CPCB.

Design/Methodology/Approach: A List of PRO was retrieved from the website of Central Pollution Control Board (CPCB) from the link (<https://cpcb.nic.in/e-waste/>). 50 Producers Responsible Organisation were contacted through scheduled interview and information was ascertained. To achieve the objective of the study questionnaire were prepared, compiled, and pre-tested. The questionnaire was classified into three sections and responses were recorded accordingly. Convenience sampling technique applied as the population elements are purposely selected based on the convenience of the researcher. To examine the significance of effectiveness of PRO in collection of e-waste simple regression analysis technique has been employed.

Findings: The paper aims to examine the role of PRO in effective managing WEEE and meeting collection targets set by CPCB. The simple regression analysis revealed that result reveals that there is a significant relation between effective of PRO in managing e-waste and number of years of expertise of PRO. The higher the years of expertise of the PRO higher is the effective of PRO in collection and meeting targets of EPR. Thus, the initiative taken by the CPCB by authorising PRO in successfully managing of WEEE is a positive step.

Originality/Value: This paper is a descriptive study attempting to investigate the efficacy of PRO in managing WEEE. Further, it attempts to gauge leverage of partnership between formal-informal sectors in e-waste management. It would enable to understand the bottleneck in e-waste management and provide solutions for its effective management.

Paper Type: Empirical Research Paper

KEYWORDS Electrical and Electronic Equipment (EEE) | Waste Electrical & Electronic Equipment (WEEE)

Central Pollution Control Board (CPCB) | End-of-Life (EOL) | PRO (Producer Responsible Organisation) | EPR (Extended Producer Responsibility)

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Introduction

Continuous innovation, advancement in technology, abundance production, easy availability, and affordability in the field of Electrical & Electronic Equipments (EEEs) has spurred in demand for these goods. The average life span of these electrical and electronic equipment (EEE) is decreasing day by day with the innovation. When a user discards a device, it becomes waste electrical and electronic equipment (WEEE) which is one of the world's fastest growing waste streams with an annual growth rate between 4 to 5 per cent (Awasthi et al., 2017). Preliminary research has estimated that waste electrical and electronic equipment (WEEE) composed of 1000 hazardous components which make it different from other wastes both physically and chemically (Khanna et al., 2018; Lim et al., 2017; Liu et al., 2006). The presence of hazardous materials poses a serious challenge in e-waste management. Developing countries including India faced with rising problem of e-waste stemming from both domestic generation and illegal import from developed (Manomaivibool et al., 2012) Recycling of e-waste is an incredibly important issue on regulators' agendas as it has an adverse impact on the environment and public health if improperly disposed. In response, regulators in different part of the world have enacted law for the management of end-of-life equipment. Product take-back, which is based on the concept of extended producer responsibility (EPR), is a popular form of such legislation. Under EPR-based take-back laws, producers are physically or financially responsible for the collection of end-of-life electronics (typically from designated collection points such as municipal junkyards) and their recovery (e.g., recycling materials or reusing components), so as to divert hazardous materials away from landfills (Atasu, A., & Subramanian, R. 2012).

The European Commission have enacted take-back regulation like WEEE Directive in EU adopted in 2002 (Europa-Environment, 2012), the SHAR Law in Japan adopted in 1998 (Japanese Ministry of the Environment, 2001), and several state recycling laws in the US (ETBC, 2012), based on the Extended Producer Responsibility (EPR) principle (Lifset, 1993; OECD, 2001). In India, the Ministry of Environment, Forest and Climate Change, has enforced the specific rules and regulation 'E-waste (Management and Handling), May 2011' (Central Pollution Control Board, 2011), which is based on extended producer responsibility (EPR) (Suja et al., 2014; Awasthi, A. K., 2018).

What is EPR?

Based on the polluter-pays principle (PPP), EPR emphasize on life-cycle impact of the products. Organization for Economic Co-operation and Development ('OECD') defines EPR as 'an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle including its final

disposal'. It is an environmental protection strategy that makes the manufacturer of the product responsible for the entire life cycle of the product and especially for the take back, recycling and final disposal of the product (Lindhqvist, 2000).

Evolution of EPR

Sometimes known as manufacturer take back or product stewardship (Lifset, 1993), EPR was first instigated by Thomas Lindhqvist in 1990. The concept of EPR was derived by him after analyzing Swedish and foreign recycling and waste management schemes. Traditionally, after end-of-life of EEE, consumer and authorities were assigned responsibility of managing it. But, for the first time accountability of proper management was shifted to producer of the product. EPR is an environment protection strategy wherein producer of the product are responsible for managing end-of-life product like take-back, recycling and final disposal of the product. The fundamental assumption behind EPR is collecting and treating e-waste has a net cost, and unless regulated, such hazardous waste ends up in landfills (Esenduran et al., 2019). Under EPR regime producers are shouldered with significant responsibility of physically or financially treating end-of-life equipment. This prevents wastes at the source, promotes product design, and supports public recycling & materials management goals. EPR usher producer to take back their products or manage it through reuse, recycling, remanufacturing, or delegate this responsibility to the third party, a so-called producer responsibility organization (PRO), which is paid by the producer for spent-product management. According to OECD, EPR has four principal goals.

- i. Source reduction (natural resource conservation/ materials conservation).
- ii. Waste prevention.
- iii. Design of more environmentally compatible products.
- iv. Closure of material loops to promote sustainable development.

Thus, collection, recovery and recycling of e-waste would assists in diversion of such e-waste from landfills and reduce their environmental impact. Figure 1 states the models for Extended Producer Responsibility.

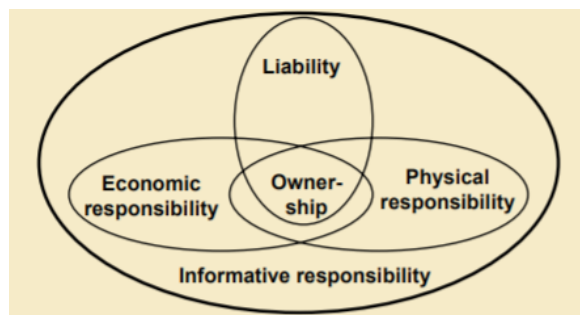


Figure 1: Models for Extended Producer

*Source: (Lindhqvist, 2000)



- **Liability:** The producer is liable for the environmental damages caused by the product in question and they bear the responsibility for the damages.
- **Economic Responsibility:** Collection expenses, recycling fee, or final disposal of the products has to borne by the manufacturer partially or fully.
- **Physical responsibility:** Producer is physically responsible for product or it effects.
- **Ownership:** Producers retain the ownership of the product throughout the life cycle of the product and they are responsible for environmental damages.
- **Informative responsibility:** The producer should provide environmental properties of the product.

Status of EPR in India

High consumption of EEE coupled with continuous up-gradation has resulted in faster obsolescence of WEEE. The compound annual growth rate (CAGR) of WEEE is about 30 per cent in India (DowntoEarth). This rapid growth of e-waste is creating environmental as well health problem. In this context, the Ministry of Environment, Forest and Climate Change (MoEF&CC), for its effective management

has enforced EPR in its clause in e-waste management rule 2011. The rule specify for strengthening the Extended Producer Responsibility (EPR), which is the global practice to ensure the take-back of the end-of-life equipment. But the ground reality that nothing much has changed. In consultation with various stakeholders amendment was made in e-waste management rule 2016. The amended legislation aimed at tackling the issue including safe disposal, proper channelization and sustainable recycling of WEEE. EPR was introduced for information technology & telecommunication equipment and consumer electronics. Many countries have made EPR target oriented and producers of these WEEE have to meet the collection targets determined by the regulating agency. In Europe, the Commission of WEEE directive requires for collection of 45% of e-waste, and increased this target to 65% till 2019 (Europa-Environment, 2012). Similarly, narrative of India is not different from other western countries. In 2018, the Ministry has advocated for phase-wise collection targets for e-waste. Beginning from 10% of collection target in 2017-18, it would increase by 10% every year and will reach to 60% by 2023. Post 2023 target would be fixed at 70% of the quantity of waste generation. Comparison of collection target in India and other countries are depicted in Table 1

Table 1: Annual comparison of EPR in India with different countries

Year	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025- onward
Existing Producers	10%(*)	20%(*)	30%(*)	40%(*)	50%(*)	60%	70%		
New Producers	-	5%**)	5%**)	10%**)	10%**)	15%**)	15%**)	20%**)	20%**)
EU(***)									
weight wise	45%	45%	65%	65%	65%	65%	65%	65%	65%
generation wise	45%	45%	85%	85%	85%	85%	85%	85%	85%
China	<i>No regulation at present, EPR framework to be finalised by 2020 and EPR Rule to be finalised by2025</i>								
Japan	Refrigerators/washing :50%, Air conditioners: 60%, TVs: 55%			-	-	-	-	-	-
South Korea	3.9 kg / capita	6.0 kg/ capita	-	-	-	-	-	-	-

*Source: Porwal, et al., 2018

*Target assigned for Existing Producer by CPCB

**Target assigned for New Producer CPCB

***Target assigned by EU

Producer Responsible Organisation

PRO are professional organization which can take the responsibility of collection and channelization of e-waste generated from end-of-life equipment to ensure environmentally sound management of WEEE. They are financed individually or collectively by the producers to meet their EPR targets. PRO setup collection centres and ensures traceability of WEEE in accordance with the guidelines issued by Central Pollution Control Board (CPCB). These act as specialized compliance service providers which organize e-waste management on behalf of producers in line with legal targets. However, in order to meet these targets, they must have access to sufficient quantities of e-waste (StEP, 2020). They conducted awareness campaign among consumer's/bulk consumers/producers for collection and channelization e-waste. In India there are 34 authorized PROs providing compliance services, including the collection and channelization of e-waste to formal recycling facilities, as well as the administration of awareness campaigns. Schematic diagram of for effective implementation of EPR is given in figure 1. Thus, this paper is a descriptive study attempted to investigate the efficacy of PRO in managing WEEE. Further, it attempts to gauge leverage of partnership between formal-informal sectors in e-waste management. It would enable to understand the bottleneck in e-waste management and provide solution for its effective management.

Review of Literature

The paper is a descriptive research which aims to review the effectiveness of PRO in management of WEEE. It seeks to ascertain the result of partnership between formal and informal sector in achieving the collection target of PRO and prevent landfill of WEEE. The key feature of EPR is to refocus on sustainable production of products with the shifting of responsibility for the treatment or disposal of post-consumer products from the government and consumers to the producer (economically and physically) and shifting towards environmentally friendly product designs (Agamuthu et al., 2011). As one of the main goals of EPR is to divert e-waste from landfills to environmentally-friendly treatment options such as recycling (OECD, 2001). Slow adoption of collection and recycling, externalities –such as the consumption of resources, the emission of greenhouse gases, and the release of toxic substances during informal recycling procedures– illustrate the problem to remain within sustainable limits (Global E-Waste Monitor., 2020). WEEE have emerged both as a global concern due to its massively high volume and health hazards associated with its improper handling, disposal, or recycling, the e-waste collected outside the formal system by individual waste companies or dealers is mostly processed and recycled under sub-optimal conditions with primitive techniques and usually without any provisions to reduce the emission of hazardous chemicals into the environment informal recycling. E-waste dumped into landfills or sold to peddlers often end up by polluting the environment through leaching into soil and groundwater, and via emission into the surrounding air, soil, and surface water.

Gap Analysis

The CPCB (Central Pollution Control Board) has mandate the producers to collect WEEE manufactured by them. The board has setup collection targets to ensure they manage their product after reaching end-of-life (EOL). In managing the WEEE they can do it either individually or by PRO or by authorized dismantler. PRO plays pivotal role for safe disposal, channelization and environmentally sound recycling of e-waste value chain. So, the paper intended to measure the effectiveness of PROs in collection of e-waste. Further, it examines the efficacy of formal-informal partnership in managing the e-waste and proposes for collaboration of both the sectors.

Aims/Objectives of the Study

The proposed study aimed towards the following:

1. To investigate the effectiveness of PROs in managing WEEE
2. To examines the role of PRO in meeting collection targets set by CPCB

Materials & Methods

The objective of the study ascertain by undertaking a review of the literature. It aimed at measuring the effectiveness of PROs in managing WEEE. The study also aim at examining the role of PROs in meeting collection targets. Various search engines were used, such as Scopus, Google Scholar, Ebscohost, PubMed, to name a few. Keywords like “PRO in managing e-waste in India,” “Partnering formal and informal sector,” “Extended producer responsibility in managing e-waste” were employed as searching strategies. Articles published between the period 2018 to 2022 were selected for the study as objective was to investigate the effective of PROs after amendment made in e-waste rule 2018.

Target Group

Under Extended Producer Responsibility producers are held responsible for managing their WEEE. They can either manage it individually or can engage PRO, authorized by the CPCB with certain conditions. PRO are well equipped in managing e-waste. They ensures efficient channelization, cost-competitive in managing WEEE. So, the paper aims to measures the effectiveness of PROs in collection of e-waste. Further, it examines the efficacy of formal-informal partnership in managing the e-waste and proposes for collaboration of both the sectors. List of PRO was retrieved from the website of Central Pollution Control Board (CPCB) from the link (<https://cpcb.nic.in/e-waste/>). Producers Responsible Organisation were contacted through scheduled interview and information was ascertain. Only those PROs has been contacted which are situated in Delh-NCR for convenience.



Survey Design

To achieve the objective of the study questionnaire were prepared, compiled, and pre-tested. The questionnaire was classified into three sections and responses were recorded accordingly. A sample questionnaire attached as Annexure.

- **Section I:** It consist of basic question regarding registration, operations, categories of waste deal in, and logistic facility provided.
- **Section II:** The questions focused on determining the effectiveness of PRO. It aims to gain insight into the task of PRO in take back, meeting collection targets and proper channelization of e-waste. Likert five-point scale was used to measure the effectiveness of PRO. Respondents assigned the points for the same. Point 5 stands for maximum and point 1 for minimum effectiveness.
- **Section III:** In this section, proposal for meeting the collection target by PRO were obtained. Again, Likert five-point scale was used to collect data.

Sample Size and Sampling Technique

- **Sample Size:** 50 Producer Responsible Organization were selected for the study.
- **Sampling Technique:** Convenience sampling technique applied as the population elements are purposely selected based on the convenience of the researcher.

Pilot testing

Before surveying a large sample size, pilot testing of 10 participants undertaken to ensure the following:

- Whether the questionnaire covers the objectives of the survey
- Ease of administering the questionnaire
- To ensure that respondents were able to understand the questions
- Whether wordings of the questions reflects biasness
- Whether the flow and selection of the words and sentences were appropriate

Reliability & Validity

- **Reliability:** When the scale produces consistent results if a repeated measurement is undertaken by the researchers, then the instrument is said to be reliable. To measure the consistency of the instrument, Cronbach's Alpha (α) used. The value of the coefficient varies from 0 to 1. Value lesser than 0.6 indicates unsatisfactory reliability test, but in this study, reliability test is not required (cesaro et al., 2019)

- **Validity:** The validity of the test will be based on the expert's opinion.

Statistical Analysis

To examine the significance of effectiveness of PRO in collection of e-waste simple regression analysis technique has been employed.

Result & Discussion

In this study, PRO authorized by central pollution control board (CPCB) has been selected. List of registered PRO are available at CPCB website (<https://cpcb.nic.in/list-of-registered-pro/>). Till March, 2022 there are 50 PRO authorized by CPCB for managing e-waste were selected for the study.

Evaluating the effectiveness of PROs in collection of e-waste for meeting EPR target

Assessment of effectiveness of PRO in meeting EPR target and years of expertise of PRO in managing e-waste, simple regression analysis technique was employed. Responses from the registered PRO was obtained on likert five point scale ranging from 'strongly disagree' to 'strongly agree' (Larsen et al.,1994). Summated score of 10-item scale were obtained and effectiveness of PRO were calculated. Further, data set collected for years of expertise of PRO in managing e-waste were converted from categorical value into dummy variable and simple regression equation was applied accordingly. The equation (i) given below.

$$Y_{(Effectiveness)} = \alpha + \beta_1 X_{(Years\ of\ expertise)} + \epsilon_i$$

.....equation (i)

- **H₀:** There is significant prediction of effectiveness of PRO in collection of e-waste with the year of expertise of PRO in managing e-waste.
- **H₁:** There is insignificant prediction of effectiveness of PRO in collection of e-waste with the year of expertise of PRO in managing e-waste.

Mode 1	R	R Square	Adjusted R	Durbin Watson
1	.735	.721	.720	1.54

In the summary of the model output 1 R = .735 which states that their exist strong correlation between years of expertise (Predictor) and effective of PRO (Outcome) variable. R square = .721 which indicate that effectiveness of PRO depends on the year of expertise of PRO in managing E-waste.

Model		Sum of Square	df	Mean square	F	Sig.
1	Regression	110.148	1	55.074	267.164	.000
	Residual	7.627	49	.206		
	Total	117.775	50			

In the output 2, a significant regression equation was found ($F(1, 49) = 267.164, P < .000, R = .735$ at $\alpha = .05$ & $.10$). This indicates that we fail to reject the null hypothesis. Hence, the result reveals that there is a significant relation between the effectiveness of PRO in managing e-waste and the number of years of expertise of PRO. The higher the years of expertise of the PRO, the higher is the effectiveness of PRO in collection and meeting targets of EPR.

Conclusion

Electronic devices after the end-of-life (EoL) like mobile phones, laptops, personal computers, smart TVs, washing machines and air conditioners are discarded. The Waste Electrical and Electronic Equipment (WEEE) is composed of 1000 hazardous components which make it different from other wastes both physically and chemically and therefore, it has been an important issue on regulators' agendas worldwide. In India, e-waste management and handling rules, 2018 have made it mandatory for the producer to manage electronic devices produced by them. In this event, the producer can do so by itself or through an authorised professional institution like PRO can channelise e-waste generated from end-of-life. The paper aims to examine the role of PRO in effectively managing WEEE and meeting collection targets set by CPCB. The simple regression analysis revealed that the result shows there is a significant relation between the effectiveness of PRO in managing e-waste and the number of years of expertise of PRO. The higher the years of expertise of the PRO, the higher is the effectiveness of PRO in collection and meeting targets of EPR. Thus, the initiative taken by the CPCB by authorising PRO in successfully managing WEEE is a positive step.

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Annexure 14.17

Submission Date	Submission Id	Word Count	Character Count
07-Nov-2022	D156388552 (Ouriginal)	4088	28253

Analyzed Document	Submitter email	Submitted by	Similarity
1.1 ERP1_Zofail_GJEIS Oct to Dec 2022.docx (D156388552)	zofailhassan@gmail.com	Zofail Hassan	10%

Original

Sources included in the report

W	URL: https://www.teriin.org/sites/default/files/files/White_paper_E-wasteEPR.pdf Fetched: 11/19/2022 3:58:16 AM	2
SA	FORMAT FOR PROJECT SUBMISSION-RBU.docx Document: FORMAT FOR PROJECT SUBMISSION-RBU.docx (D139367684)	2
SA	Vrinda Arora.doc Document: Vrinda Arora.doc (D155461821)	1
W	URL: https://www.sciencedirect.com/topics/earth-and-planetary-sciences/extended-producer-responsibility Fetched: 2/3/2020 10:22:43 AM	2
W	URL: https://en.wikipedia.org/wiki/Extended_producer_responsibility Fetched: 11/28/2019 10:56:04 AM	1
W	URL: https://www.sciencedirect.com/topics/social-sciences/extended-producer-responsibility Fetched: 1/8/2021 10:38:38 AM	1
W	URL: https://www.indiatimes.com/news/india/india-is-the-world-third-highest-e-waste-generator-but-s... Fetched: 12/9/2021 6:40:13 AM	1
SA	Harishit Pdf.pdf Document: Harishit Pdf.pdf (D154505633)	1

Reviewers Memorandum



Reviewer's Comment 1: The paper throws light on the alarming state of ever-increasing environmental degradation due to electronic waste. It is a comprehensive study as it starts with a descriptive study of PRO in managing WEEE and further attempts to gauge leverage of partnership between formal-informal sectors in e-waste management.

Reviewer's Comment 2: The study is well structured and comprehensive in nature. The role of PRO is examined through simple regression analysis, which revealed that there is a significant relation between effectiveness of PRO in managing e-waste and number of years of expertise of PRO. Thus, it lays a strong foundation for further study in the area.

Reviewer's Comment 3: With the rising problem of e-waste and its adverse impact on environment, the collection and correct treatment of e-waste is the need of the hour. The present study elaborates on the mandates laid down by CBCS (central pollution control board). Though the study is presented in a systematic manner, a few suggestions on improvement for its effective management would have added to the richness of the study.



Zofail Hassan and D.K.Dhusia
"Producer Responsible Organisation:
A Guiding Principles For EEE Producers"
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Conflict of Interest: Authors of the Paper had no conflict either financially or academically.

Editorial Excerpt



The article has 10% of plagiarism which is the accepted percentage as per the norms and standards of the journal for publication. As per the editorial board's observations and blind reviewers' remarks the paper had some minor revisions which were communicated on a timely basis to the authors (Zofail Hassan and D.K. Dhusia), and accordingly, all the corrections had been incorporated as and when directed and required to do so. The comments related to this manuscript are noticeably related to the theme "**Producer Responsible Organisation: A Guiding Principles for EEE Producers**" both subject-wise and research-wise. All electrical waste contains chemicals that are harmful to the environment. When WEEE is simply dumped in landfills, over time the products decay and leak toxins into the earth and our water systems. This can lead to the toxins entering our food chain and ultimately, into us. Thus, a need for an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle including its final disposal in the name of EPR (Extended Producer Responsibility) is being recognised. After comprehensive reviews and the editorial board's remarks, the manuscript has been categorized and decided to publish under the "**Empirical Research Paper**" category

Acknowledgement



The acknowledgment section is an essential part of all academic research papers. It provides appropriate recognition to all contributors for their hard work and effort taken while writing a paper. The data presented and analyzed in this paper by authors (Zofail Hassan and D.K. Dhusia) were collected first handily and wherever it has been taken the proper acknowledgment and endorsement depicts. The authors are highly indebted to others who facilitated accomplishing the research. Last but not least, endorse all reviewers and editors of GJEIS in publishing in the present issue.

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