

ABSTRACT

India is facing serious threats to its environment due to inappropriate management of discarded electrical and electronic products (e-waste). E-waste comprises products such as computers, mobile phones, television sets, photocopiers, washing machines, refrigerators, etc. These are primarily made of plastic, glass, metal, and toxic substances. E-waste processors are firms that create value from e-waste through reuse, refurbish, cannibalization, and metal recovery operations. When e-waste is processed and disposed unscientifically to create value (for example, recovering copper, gold, silver, etc.), toxic substances (lead, cadmium, etc.) are emitted into the surrounding environment, thereby polluting air, soil, and ground water. This affects public health and environment, creating negative environmental externalities. Reducing these negative externalities has become a top priority in India's policy circles.

E-waste processors in the informal economy (Informal Processors) are not authorized or recognized by the Government and do not pay taxes. Such firms are engaged in unscientific processing and disposal (with low set-up and operating costs) of e-waste, with negative consequences to public health and environment. E-waste processors in the formal economy (Formal Processors) are authorized and recognized by the Government and pay taxes. Such firms are engaged in scientific processing and disposal (better technology with higher costs) of e-waste, without harming public health and environment.

India enacted **Product Take-Back Legislation** for e-waste (specific products in information technology/telecom and consumer electronics) in 2012, mandating manufacturers of electrical and electronic products to collect and process their e-waste. This is called E-waste Management and Handling Rules (EMHR), and is intended to minimize negative environmental externalities by reducing unscientific processing and disposal. EMHR also mandated that e-waste processing should be done only by Formal Processors. EMHR is based on the concept of Extended Producer Responsibility, followed in developed market contexts (like USA, EU, Japan), and do not incorporate the *unique issues* of emerging market contexts (like India, Africa, Brazil, China). Emerging markets are characterized by a history of poor compliance with environmental legislations, significant presence of e-waste processors in the informal economy, and difficulties in identifying manufacturers due to the presence of non-branded/counterfeit products.

To resolve some of these unique issues prevalent in emerging market contexts, this dissertation studies the following question within the context of India: *How can e-waste processors in the informal economy be incentivized to adopt safe, scientific methods and become a part of the formal economy?* To develop such incentive schemes, one needs to **understand** the following contextual phenomena:

- (1) *Formalization of Informal Processors*: How did some of the Informal Processors become Formal Processors (i.e. Government authorized)? What operational challenges did they face while transitioning from informal to formal?
- (2) *Structure of Reverse Supply Chain*: What are the sequence of processes involved in transforming e-waste into revenue generating recyclables? Who are the stakeholders involved in this transformation process and how do they transact?

Given the lack of adequate knowledge in published academic literature, an appropriate methodology for this understanding is **qualitative case study research**. This methodology uses a variety of data sources and investigates a contemporary phenomenon (formalization, reverse supply chain) in-depth within its real-life context (India). We followed the case study research approach advocated by Robert Yin. The case study research design consisted of specifying initial research questions to understand contextual phenomena (formalization, reverse supply chain), developing conceptual framework and propositions, deciding unit of analysis, collecting data from primary and secondary sources (spanning 2 years and interviewing 49 stakeholders across the reverse supply chain), evaluating propositions from field evidence using pattern matching technique, revising propositions and discussing emergent themes. These revised propositions and emergent themes led to interesting findings. The key findings are as follows:

- (1) Merely formalizing Informal Processors, as per EMHR, does not reduce negative externalities and consequently does not solve the e-waste problem.
- (2) The simplistic assumption that formalization would help Informal Processors to process more e-waste efficiently due to scale economies, is falsified through this field study.
- (3) It is important to recognize the contingent characteristics of Informal Processors to understand formalization and e-waste Reverse Supply Chain.
- (4) Operational configuration (low cost, high flexibility) of Informal Processors is, surprisingly, aligned with the nature of e-waste processing industry (characterized by erratic supply, heterogeneous products with uncertain yield, influence of market forces).

E-waste Reverse Supply Chain is market-driven i.e. various market forces (ex: technological change, international commodity markets, economic value of products) influence the flow of products and prices in this reverse supply chain. In the current way of formalization, this alignment is lost when Informal Processors become Formal Processors.

- (5) E-waste Reverse Supply Chain is path dependent i.e. the existing supply chain is a function of several historical events (centuries-old scrap metal recycling, ancient metallurgical knowledge, significant presence of informal economy in every industry).

Product Take-Back Legislation, which is adopted from developed markets with strong institutions and small informal economy, relies on costly enforcement (due to command-and-control approach) and criminalizes the informal economy. Our findings suggest that this legislation *may not be appropriate* for emerging markets (like India) with weak institutions and large presence of informal economy in every economic activity. Rather than discussing about effective enforcement, monitoring, and compliance of product take-back legislations, we need to discuss alternate policies. Through this research we provide policy recommendations to incentivize Informal Processors as follows:

- ✓ Set-up Recycling Parks to provide infrastructure, eco-system, and ease-of-doing business for processors in the informal economy.
- ✓ Facilitate markets to function by encouraging the industry of commodities (glass, metals, plastic, etc.) recycling and precious metal refining (recovery of precious metals from e-waste).
- ✓ Provide Industry Status (i.e. Government accords an official status of industry) for the e-waste processing industry. This would enable the following: borrow loans from financial institutions at low interest, tax benefits, and reduced cost of borrowing.

By outlining these implications for e-waste policy, we do not claim that our recommendations are frictionless. Adopting such market-based approaches comes with its own set of challenges. Our contribution is to *reframe* the e-waste problem in a different dimension so that efforts to improve policy can be channeled in ways that are aligned with the nature of e-waste processing industry.

Selected bibliography

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