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Dynamics of the Informal Sector in Waste Value Chains Under Extended Producer Responsibility (EPR)

Author: Pranshu Singhal, Expert for the SWITCH-Asia Policy Support Component; Contributor: Vindhya Kaushal

In the context of emerging markets, the informal sector plays a central yet often understated role in waste management. It is estimated by many authors that majority of the waste is handled and managed by the informal channels- for example in India, the informal sector manages a large percentage of recyclables, often cited as **95% for e-waste, around 70 to 80% for plastics**, and other waste materials including metals, and paper. However, for those informal sector players or stakeholders working in this space, waste collection and processing are not environmental services, they are economic lifelines. In most scenarios, this occupation is not by choice but due to economic compulsions.

The informal waste economy operates less as a system of environmental management and more as a complex livelihood mechanism for hundreds of thousands of people, especially in the Global South. While informal sector exists outside the boundaries of formal regulations and legal protections, its reach is in most cases unmatched by a public waste management system. At its core, this sector is driven by economic opportunity, that is, a survival-based economy structured around material value.

The informal waste sector is a complex and multilayered pyramid of actors that differ by function, scale, and social positions. Each layer adds value and redistributes material through informal supply chains that span cities and sometimes even borders. Here is how the structure typically looks:

Composition: A Pyramid of Value Creation

The informal sector operates in a stratified hierarchy, each layer specialising in different aspects of waste collection, sorting, and resale:

- **Top Layer:**
  - ***Informal Dismantlers and Recyclers:*** Using crude methods to extract various types of materials like Aluminium, Zinc, Lead, Iron, Copper, Plastic Granules, and components for selling.
  - ***Informal Refiners:*** Extract various types of precious metals like Gold and Silver from e-waste using crude methods.
  - ***Component, Refurbished Product Sellers:*** Sell manually scavenged components, and products post-repairing.
- **Middle Layers:**
  - ***Large Multi-Stream Aggregators:*** Focused on procurement and sales of multiple streams of products like Keyboards, TVs, Monitors, Printers, HDPE, PET, Paper, Batteries, etc. They many operate at a National or State level.
  - ***Large Aggregators:*** Focused on single-material streams e.g. one of the above-mentioned streams. They many operate at a national or sub-national level.

- ***Medium Aggregators:*** Handle moderate quantities of waste for sales to large aggregators. They operate at a state or a city level.
- ***Small Aggregators:*** Handle small quantities of waste for sales to large or medium size aggregators.

- **Bottom Layer:**
  - ***Independent Collectors:***
    - Those who operate on foot or with carts, collecting directly from households, residential colonies.
    - Those collecting from repair, retail shops, households, offices, etc. and sell it to small aggregators who operate in their vicinity.
    - Ragpickers- who are manually scavenging from landfill sites.

Waste Procurement in the Informal Sector

Procurement within the informal waste sector is highly decentralised and opportunistic, driven by personal networks, local access, and survival needs. Materials are typically sourced from a variety of locations, including individual households, repair shops, electronics retailers, office complexes, formal recyclers, government institutions and even landfill sites. Aggregators and collectors often operate door-to-door, forging relationships with sources that allow them regular access to discarded products. In many cases, these interactions are undocumented and rely heavily on trust, familiarity, or neighbourhood ties. The procurement chain is not limited to physical materials alone; it also includes knowledge: where and when to find the most valuable waste, and whom to sell it to.

What makes this system even more complex is the diversity in payment mechanisms. Transactions do not always involve cash. In many lower layers of the pyramid, particularly among independent collectors, barter and in-kind exchanges are common. People may trade waste for daily necessities such as food, temporary shelter, or even illicit substances especially among vulnerable and homeless populations. Such exchanges often expose individuals to cycles of exploitation, substance abuse, and extreme poverty. Between different layers of the sector, for instance, from small aggregators to large ones, trade may occur in bulk and involve daily or weekly cash payments, but without any formal invoices or tax records.

This unregulated nature of procurement contributes to the difficulty in tracking material flows and integrating these actors into formal EPR systems.

Challenges in Regulating & Integrating the Informal Sector

The informal waste sector presents several pressing challenges, particularly for policymakers aiming to build transparent and sustainable EPR systems.

Foremost among these is **absence of environmental, health, and labour standards**. Many informal workers handle toxic materials such as lead, mercury, and plastic residues without any protective gear or knowledge of the risks. Informal refiners, especially those recovering metals from e-waste, often use hazardous chemical processes like acid baths, which can contaminate the environment and endanger community health.

Moreover, the workers in the informal sector operate in extreme conditions with zero social protections. This includes **child labour**, which remains alarmingly common in some regions. These children are often out of school, working long hours in dangerous conditions for minimal pay.

Another major challenge is the issue of **tax evasion**. Because most transactions are undocumented, the government loses substantial revenue, and producers are unable to trace material flows for compliance with EPR mandates.

Additionally, this lack of accountability fosters an environment where **illicit activities** including the handling of stolen goods, drug trade, and illegal imports can be hidden within the sector's operations. These risks make formal actors hesitant to partner with informal ones, fearing reputational and legal exposure.

The absence of formal oversight and the drive for economic gain within the informal sector, coupled with lack of enforcement can lead to the creation and **use of fraudulent documentation**. This includes falsified records of material origin, quantities handled, and recycling processes, hindering accurate tracking of waste streams mandated by EPR. A general lack of awareness or willful disregard for government frameworks and reporting requirements contributes to **widespread non-compliance**. This undermines the transparency and accountability that EPR aims to establish.

Another critical challenge is the **lack of credible data** on the informal sector. Reliable figures on the number of workers, volumes of waste handled, or material recovery practices are either unavailable or highly fragmented. This data gap significantly hampers the ability to propose realistic EPR targets, establish baselines, or design effective verification mechanisms. Without such efforts, policymaking will remain speculative and disconnected from on-the-ground realities.

Pathways for Integrating Informal Sector Actors into EPR Systems

While many informal workers are experienced and could transition into formal roles with the right support, others operate in deeply informal contexts that are difficult to legitimise.

Consequently, EPR systems face the critical challenge of **identifying** informal actors for integration and vulnerable individuals such as children or those with addiction or mental health needs who require alternative social support to shield them from the informal sector's adversities. Developing effective pathways for integration without displacing entire communities is a delicate balance that requires thoughtful policy design, stakeholder engagement, and long-term commitment.

Level of Informal Pyramid	Who Can Be Included	Possible Way of Integration into the Formal Sector
Top – Informal Refiners and Recyclers	Only the workers	Enforce strict regulations leading to the closure of these hazardous operations. Provide pathways for workers within these operations (excluding the heads/owners) to access alternative livelihoods and integration into formalised system through training and support.
Dismantlers, Component and Refurbished Product Sellers	Only the workers	Implement regulations requiring formal registration and adherence to environmental and safety standards for refurbishment and component recovery businesses. Offer support and incentivise for the workers to transition to formal sector under compliant frameworks, potentially focusing on repair and reuse within authorised EPR schemes. Workers can be integrated into these formalised entities.
Large Aggregators	Aggregators with material handling capacity and existing business structures	Register as formal intermediaries within EPR systems, provide access to digital tracking tools for material flow monitoring, and offer bulk procurement contracts directly from Producer Responsibility Organisations, producers, or formal recycling facilities, ensuring fair pricing and transparent transactions, contingent on adherence to environmental and social standards.

Level of Informal Pyramid	Who Can Be Included	Possible Way of Integration into the Formal Sector
Medium Aggregators	Local dealers handling moderate volumes	Create simplified registration programs tailored to their scale, provide access to microfinance and training in logistics, sorting techniques, environmental compliance, and basic business management, including record keeping facilitating their transition into more formal roles within the supply chain, with emphasis on safe handling and storage practices.
Small Aggregators	Informal community-run or household businesses	Support the formation of cooperatives or associations to enhance their collective bargaining power and access to resources, offer safety training and basic compliance kits, and establish contractual linkages with larger formal aggregators under fair and transparent terms, ensuring a stable demand for their collected materials and promoting safe collection practices.
Independent Collectors and Ragpickers	Street-level waste pickers or freelance collectors	Provide official identification cards and recognition within municipal waste management plans, ensure access to essential protective equipment and basic health support, and explore options for integrating them into formal collection systems, potentially through community-based collection schemes or by linking them to registered aggregators, emphasising safe collection and handling protocols.
Children Involved in Waste Collection and Recycling processes	None – children should not be working in waste management	Strictly prohibit children inclusion in any waste management activities; prioritise their immediate removal from labour through access to education, comprehensive child protection services, and family support programs aimed at addressing the root causes of their involvement in waste work.

Formalising the Informal Sector

Formalising the informal waste sector in emerging markets presents a multifaceted opportunity to enhance economic growth, improve social equity, and strengthen environmental governance within the framework of Extended Producer Responsibility.

Transitioning informal operations towards recognised company structures, such as proprietorships or limited partnerships, lays the foundation for legal recognition and access to formal business support. Integrating all trading activities under established tax regimes not only broadens the national revenue base but also inculcates a sense of shared responsibility and enables the provision of public services.

Developing cooperatives or associations for informal waste sector workers such as the Saleng and Recycle Trader Association (SRTA) or community-driven “garbage bank” initiatives in Thailand can ease the administrative burden on governments and Producer Responsibility Organizations (PROs) by reducing the need to engage with individuals directly. These collective structures enhance workers’ bargaining power, enable fairer compensation, and create stronger negotiating positions for win-win outcomes in waste management systems

The SWaCH cooperative in Pune, India, offers a successful model of such integration. Formed as a worker-owned cooperative of waste pickers, SWaCH (Solid Waste Collection and Handling) works in collaboration with the Pune Municipal Corporation to provide door-to-door waste collection services. By giving waste pickers formal recognition, identity cards, and legal status, the initiative has improved income stability, working conditions, and access to social protection, while simultaneously reducing municipal waste management costs. This example demonstrates how formalisation through community-based structures can institutionalise the role of informal workers, aligning social inclusion with environmental objectives.

In Pakistan, GarbageCAN in Karachi exemplifies a modern approach to integrating informal waste collectors, known locally as "kabaris," into formal recycling systems. As Pakistan's first Materials Recovery Facility (MRF), GarbageCAN collaborates with kabaris by providing incentives and infrastructure to enhance recycling rates.

It is also important to have establishment of open bank accounts and the routing of transactions through traceable financial channels introduces transparency. This can reduce the risk of illicit financial flows, and facilitates access to formal financial services like credit and insurance for these enterprises. Crucially, making operational data visible on government portals enhances monitoring, accountability, and evidence-based policymaking, allowing for better integration of the sector's contributions into national economic and environmental strategies.

This structured formalisation, while requiring tailored approaches to address the specific contexts of emerging markets, can offer a pathway towards a more inclusive, regulated, and ultimately more sustainable waste management ecosystem under EPR.

Conclusion

Integration of the informal waste sector into Extended Producer Responsibility frameworks in emerging markets necessitates a strategic and differentiated approach.

A practical pathway for integrating the informal sector into EPR systems could follow a phased integration model. First phase could focus on the mapping and registration of informal actors, generating critical baseline data to inform targeted engagement strategies. The next phase may involve the rollout of municipality-aligned pilot programs, led by Producer Responsibility Organisations, to test inclusive collaboration frameworks under real-world conditions. The last phase could then support the scaling and institutionalisation of proven models through enabling legislation at the state and national levels. This progressive approach allows for a context-sensitive transition that balances operational continuity with regulatory alignment, enhancing traceability, social protection, and environmental performance.

Within this broader framework, a differentiated treatment of the informal sector's tiers becomes essential. While acknowledging the sector's pivotal role in material recovery and income generation, the inherent environmental and safety risks particularly at the upper tiers involving informal refining and hazardous dismantling necessitate their **regulated phase-out**. In contrast, the significant value addition and scale of participation at the aggregator and collector levels warrant **focused formalisation efforts**. Facilitating their transition into legally recognised entities with transparent financial operations, tax compliance, and data visibility enables EPR schemes to leverage existing efficiencies while systematically improving conditions. Supported by robust social safety nets and alternative livelihood opportunities for those displaced from high-risk activities, this calibrated integration offers the most viable pathway toward a **sustainable, equitable, and accountable EPR-driven waste management ecosystem** in the Global South.

Series Overview

This paper is part of a short-paper series developed under the Technical Advisory on Strengthening EPR in Asia, with the objective of advancing the circular economy. Each paper focuses on a specific issue related to EPR and the circular economy—such as product design, cross-regional learnings, high-quality recycling, cost of EPR compliance, prioritization of sectors, collection channels, and the inclusion of the informal sector in EPR systems. The purpose of these papers is to provide policymakers and advocates with concise, actionable guidance that can serve as a starting point for more detailed analysis and in-depth exploration.

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