BROOKINGS

*Center on Regulation and Markets Working Paper #11*

June 2024

# Challenges and opportunities of partnering with the informal sector:

## *A CASE STUDY OF INDIA'S E-WASTE MANAGEMENT*

Kalyan Bhaskar, Jennifer J. Griffin, and Verena Radulovic

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## Disclosure

Radulovic is a member of Sustainable Electronics Recycling International's Board of Directors. The authors did not receive financial support from any firm or person for this article or from any firm or person with a financial or political interest in this article. Other than the aforementioned, they are currently not an officer, director, or board member of any organization with an interest in this article.

# Challenges and opportunities of partnering with the informal sector: A case study of India's e-waste management

Kalyan Bhaskar, Jennifer J. Griffin, Verena Radulovic

## 1.0 Introduction

Collaborating across the private, public, and nonprofit sectors is critical for addressing environmental and social grand challenges (Doh et al., 2019; Selsky & Parker, 2005; Griffin, 2021). Yet, in developing countries collaborating with indigenous experts in informal sector organizations—the collection of firms, workers, and activities operating outside legal or regulatory frameworks (Loayza, 2016)—is likely required to address entrenched environmental challenges.

Workers and organizations in the informal sector are often overlooked as collaborators or partners (Austin, 1990; Austin & Seitanidi, 2012a, 2012b) because they may be considered too inefficient for, or shut out from, formal sector jobs (Alvarez & Barney, 2014; La Porta & Shleifer, 2014). This further complicates complex partnerships. In addition, viewing informal sector workers as under- or un-educated entrepreneurs without state-provided basic needs (Alvarez & Barney, 2014; La Porta & Shleifer, 2014) stands in contrast to viewing informal sector organizations as having unique knowledge, unmatched skills, and time-tested, relational advantages (Shepherd et al., 2022). All in all, the limited understanding of the informal sector as a viable partner in addressing grand challenges suggests a need for a more nuanced scholarly examination (Ault & Spicer, 2022; Doh et al., 2016; Doh et al., 2019; Jackson 2013; Jamali et al., 2017; Wickert et al., 2021).

In this study, we examine the role of collaborations with informal sector organizations in India's electronic waste (e-waste) management system. We find that informal sector organizations are both fierce competitors and critically needed collaborators, despite being legally shut out of India's e-waste process. That is, regulatory officials (e.g., India's central pollution regulator, the Central Pollution Control Board (CPCB)) do not mention the informal sector nor their pervasive role in mitigation and remediation (Telangana State Pollution Control Board [TSPCB], 2018). Without formal recognition by the authorities, informal sector individuals and families operate outside legal and regulatory frameworks (Austin, 1990; Loayza, 2016) yet are considered critical collaborators (Turaga & Bhaskar, 2019). This lack of formal recognition is one of several challenges we identify when firms partner with the informal sector to address India's e-waste challenges.

Further, we suggest that collaborations with the informal sector exacerbate many partnership challenges while easing others (e.g., being "invisible" or "under the radar" attracting less scrutiny). In addition, India's e-waste informal sector organizations' time-tested familiarity with, and frequency of, collaborating may emerge as a unique strength of resilience. This creates a situation in which the presence and pervasiveness of informal sector organizations can complicate national policy, for example. We found that informal organizations have unique skill sets and relationships that can handle entrenched e-waste challenges. As such, informal sector organizations have a comparative advantage as low-cost buyers and suppliers (Austin, 1990; Prahalad & Hart, 2004) but remain unrecognized actors.

Our study begins to address the gap in scholarly understanding of the informal sector as incommensurate with its importance (Bruton et al. 2012; Darbi et al., 2018), pervasiveness (Austin, 1990), and myriad impacts (Wickert et al., 2021). We attempt to provide "*in-depth*

*knowledge of the relationships between the formal and the informal businesses*" (Darbi et al., 2018, p. 306) as part of a grounded understanding (Jamali et al., 2017) of collaborations within a developing country context involving informal sector organizations.

In this paper, we explore the complex pressures constraining and enabling collaborations (Jamali et al., 2017) with the informal sector via a grounded understanding[1] (Jamali & Karam, 2018). We start by identifying the importance and pervasiveness of India's informal sector organizations—the waste pickers and ragpickers—as central to turning an entrenched e-waste challenge into socially and environmentally desirable outcomes. Without active informal sector engagement, we believe India's e-waste regulatory aspirations will remain stymied.

More specifically, we examine the informal sector involvement across India's e-waste management system over several years with a particular focus on the emergent organizations—the producer responsibility organizations (PROs)—bridging the tax-paying formal sector and the unrecognized, largely cash-based entities in the informal sector. We find that, counterintuitively, informal sector organizations may be effective, nimble, and fierce competitors to formal sector organizations. As a result, we find an important role for India's PROs, an entity that bridges the demands of formal sector entities (producers, recyclers, and governmental officials) with the capabilities of informal sector organizations in providing low-cost volumes of recycled and/or recyclable materials.

Our paper is structured as follows. We review the literature on informal sector organizations partnerships in developing countries. Then, we describe India's e-waste management system. In the fourth section, we explain our mixed methods methodology to

[1] Rather than examining collaborations, in theory, a grounded understanding suggests the context matters. Thus, we were in the field with the informal sector communities, producer responsibility organizations (PROs), producers, and others to make firsthand observations of e-waste handlers with semi-structured interviews.

develop a grounded understanding (Jamali & Karam, 2018) of informal sector organization involvement across India's e-waste system, over time. In the fifth section, we discuss the results, limitations, and implications of effective partnering while highlighting the importance of India's newly emergent PROs that bridge formal sector demands with informal sector capabilities. Finally, we conclude with suggestions for expanding e-waste policy, at scale, and recommendations for collaborating with the informal sector, more broadly.

## 2.0 Literature Review

In this section, we begin by defining informal sector organizations and distinguishing them from domestic businesses producing illicit goods such as drugs, narcotics, and prostitution and those individuals in poverty, refugees, and migrants. Then, we explore the nascent literature outlining the challenges of partnerships with informal organizations in developing countries.

### 2.1 Informal Sector Organizations

Various terms such as 'informal economy', 'informal sector', 'underground', 'black', 'hidden', 'irregular', and 'criminal' have been used interchangeably to refer to economic activities occurring outside the formal public, private, or NGO sectors (Austin, 1990; Gerxhani, 2004; Webb et al., 2013). For many people, the informal sector remains an important form of employment and income, especially in large cities of developing economies (Austin, 1990; International Labour Office [ILO], 2002). The informal sector comprises individuals and businesses that provide goods and services, often not state-registered, nor legally constituted, and often operating 'off-the-books' and failing to pay all required taxes (Gerxhani, 2004). Individuals in the informal sector who manage or recycle waste, for example, have been referred to as 'ragpickers' (Shepherd et al., 2022), 'scavengers', or 'waste pickers' (Asim et al., 2012; Besiou et al., 2012; Patwary et al., 2011).

Organizations in the informal sector are distinct from businesses producing illegal goods or services, such as narcotics or stolen car parts (Austin, 1990), and are distinct from formal sector industries that are often larger, better organized, more resourced, have access to more capital, pay taxes, and are officially recognized by state authorities (Katusiimeh et al., 2013). Individuals, families, and organizations in the informal sector typically face a higher risk of poverty than those in the formal sector, although not everyone in the informal sector is poor (International Labor Organization [ILO], 2002). Some informal sector organizations are quite rich in resources, including financial and intangible resources including tacit knowledge. The distinction between the informal sector and poverty is important to note, so as not to conflate the informal sector with people living at the 'bottom of the pyramid', who have received considerable attention (Prahalad & Hart, 2004; Viswanathan et al., 2010).

Informal sector organizations, especially in developing countries, have historically emerged out of economic necessity (Austin, 1990). The unemployed, using their own labor and creating their own livelihoods, produced goods or services as small businesses, becoming street vendors, tailors, repairmen, recyclers, transporters, light manufacturers, etc. (Austin, 1990). Operating without a formal, government-sanctioned charter, informal sector organizations operate outside regulatory and legal frameworks (Loayza, 2016). Without governmental recognition, informal sector entities have limited access to legal protections with largely nonexistent (or ineffective) basic needs provided by the state (i.e., healthcare, bank accounts, education), yet also avoid paying taxes, licensing fees, and complying with other potentially costly regulations (Austin, 1990).

With a willingness to operate under less-than-pristine conditions, informal sector entities are unregulated workplaces often operating on an up-front cash basis. As pervasive, low-cost

providers able to operate at scale, often having decades of experience, informal sector organizations may be willing to tackle e-waste challenges that others will not or cannot.

The contexts for examining informal sector behaviors have included pollution control (Blackman, 2000), consumer behavior (Yokoo et al., 2018), entrepreneurship (Webb et al., 2013), and employee health and livelihood (Uddin & Gutberlet, 2018) across different geographies (e.g., Greece, India, Mexico, Mongolia, Pakistan, Uganda, Vietnam), using different approaches (e.g., qualitative, quantitative, empirical, theoretical, case study based). Aside from the worrying aspects of informal e-waste recycling (Davis & Garb, 2015), there remains a dearth of scholarly literature examining the informal sectors' contributions to collaborations and management, in general, even though the informal sector provides numerous opportunities to advance management theory (Darbi et al., 2018; Shepherd et al., 2022).

## 2.2 Partnering with Public, Private, and Non-Profit Sectors in Developing Countries

While partnering is generally important, it is not easy (Austin & Seitanidi, 2012a, 2012b; Dahan et al., 2010; Doh et al., 2019; Seitanidi & Crane, 2009; Waddock, 1988). Successful partnerships are not assured and remain ill-defined with outcomes often changing over time (Austin, 1990; Ashraf et al., 2017; Austin & Seitanidi, 2012a, 2012b). Cross-sector partnering is defined as collaborations among entities in the formal private, public, or nonprofit sectors, often aimed at solving complex entrenched issues (Griffin & Youm, 2023; Selsky & Parker, 2005). Cross-sector partnerships are often viewed as a last resort to solve entrenched challenges since each sector acting alone, guided by its interests, cannot achieve the desired outcome (Pearce & Doh, 2005). As such, cross-sector partnerships can become uneasy alliances (Jamali & Keshishian, 2009). Thus, there is a need for insights into *common* shared interests, as well as recognition of *mutual* capabilities and the importance of sustained partnerships.

In developing countries, executing lofty ideals within the on-the-ground reality is particularly challenging (Jamali & Karam, 2018; Jamali et al., 2017; Jamali & Mirshak, 2007; Jamali & Neville, 2011). Rife with institutional voids and characterized by weak institutional environments accentuated by the arbitrary enforcement of the law, bureaucratic inconsistencies, and corruption (Jamali et al., 2017), developing countries present unique challenges for effective partnering between the formal sectors of private, governmental, and non-profits; let alone the added complexity of informal sector collaborations.

For instance, informal sector organizations are not acknowledged or recognized rendering them 'invisible' (Turaga & Bhaskar, 2019) or 'absent' within formal statistics, accounting, regulations, and legislation. The lack of recognition has important implications. For example, if formal sector organizations need to meet specific targets (e.g., kilos of destroyed e-waste), the contributions of informal sector organizations that destroy e-waste are not counted in official national statistics (Davis & Garb, 2015).

Furthermore, informal sector organizations are often perceived to be temporary entities that will evaporate with time (Austin, 1990; Davis & Garb, 2015). Since these organizations operate largely without access to outside capital, the scale or scope can be limited yet encourages *jugaad,* or creative problem-solving through iterative trial and error due to resource scarcity (Shepherd et al., 2020). Informal sector organizations often persist from generation to generation after developing trust-based relationships within informal networks while gaining skillsets, access, and relational advantages that are hard to replicate. Operating 'under the radar' of formal scrutiny, informal sector organizations can be mobile, making them hard to find. All in all, these tacit resources give them an advantage through a cloak of invisibility.

Collaborations with informal sector organizations are further complicated by the perceived or actual levels of corruption and poor working conditions in developing countries. Formal sector organizations (including multinational corporations such as Dell, HP, Samsung, and Lenovo) may be unable or reluctant to collaborate with unrecognized informal sector organizations due to poor working conditions or incomplete oversight leading to (perceived) negative reputational effects (Velamuri et al., 2017). Still, partnering with informal sector organizations may be a promising means for mitigating environmental challenges due to the extensive informal sector network within waste management systems (Turaga & Bhaskar, 2019). Altogether, the reality within developing countries renders much of the extant, Western-centric cross-sector partnering research and theorizing inapplicable in developing country contexts (Dobers & Halme, 2009; Jamali et al., 2017).

In addition to country-level constraints on collaborations with informal sector organizations, firms may have low motivations to collaborate. The desire to create net positive collective action may not exist (Belal, 2001; Fulop et al., 2000; Griffin, 2021; Jamali & Mirshak, 2007). Even when pressured by local community groups, public opinion, and/or investors, large firms operating within developing countries, perceived to have extensive resources, have conflicting incentives (Doh et al., 2016; Jamali et al., 2017; Selsky & Parker, 2005). Ensuring the firm's economic viability (e.g., wages, employment, taxes, profits) might relegate social, community, and environmental issues (e.g., safe workplaces, healthcare, child labor regulations, e-waste) to a much lower, or nonexistent, priority. Firms considering socio-environmental issues as 'discretionary' expenses or governmental responsibilities (Friedman, 1970) rather than opportunities for innovation and enhancing competitiveness (Bhattacharya & Polman, 2016; Dmytriyev et al., 2021; Griffin, 2017) can delay action.

In addition, collaborations among multinationals and domestic firms that may be small or medium-sized enterprise (SME), are particularly fraught with power and invention dynamics (Jamali & Neville, 2011). Further, formal-sector managers (and scholars) focused on government-authorized, chartered, and sanctioned institutions in the formal sector (Austin & Seitanidi, 2012a; Doh et al., 2019; Pearce & Doh, 2005) can overlook innovative, informal sector organizations as 'invisible' entities. As such, many informal sector organizations act without widespread scrutiny (i.e., operating under the radar) with a cloak of invisibility.

In some limited respects, changes are occurring. In India, for example, government regulations are mandating extended producer responsibility (EPR), whereby manufacturers of products must extend their responsibility to ensure end-of-life product management, as explained in the next section. The EPR mandates, such as critical mineral recovery from e-waste, highlight the promise of cross-sector partnerships (Austin & Seitanidi, 2012a; Bhattacharya & Polman, 2016; Carbone et al., 2012; Hickle, 2017). When firms are legally mandated to achieve certain outcomes (e.g., EPR), collaborative efforts tied directly to a firm's economic outcomes, regulatory compliance, operations, or reputation (Griffin et al., 2021) may enhance the probability of successful collaborations (Jamali & Karam, 2018).[2] In addition, addressing environmental challenges (Doh et al., 2019) encourages cross-sector collaborations in developing countries (Austin, 1990; Austin & Seitanidi, 2012a, 2012b; Pearce & Doh, 2005; Selsky & Parker, 2005) that necessarily include the informal sector. Paradoxically, informal sector organizations can thrive 'under the radar' or with implicit and fragmented rules found in

[2] A firm trying to figure out how best to implement EPR, for example, may experiment with new processes, internal procedures, and collaborations with others. Through trial and error, the firm might figure out how to go it alone or with whom to collaborate (Prakash & Griffin, 2012). Experimentation, however, takes time. Alternatively, a firm may 'buy time' yet fail to make credible progress on EPR creating a defensive posture if punitive penalties escalate. Thus, the 'pull' of organizational reputation, leadership, and experimentation combined with the 'push' of punitive regulatory mandates can increase the likelihood of successful collaborations (Griffin, 2016; Jamali & Karam, 2018)

developing countries (Jamali & Mirshak, 2007; Kuznetsov et al., 2009). Further, the implicit nature (Matten & Moon, 2008) of e-waste regulations characterized by a desire for national outcomes without specifying a clear, singular pathway to achieving the outcomes, allows for various forms of organizing e-waste solutions, within and across India. Crafting solutions with informal sector engagement in general, and more specifically in developing countries for e-waste systems, is likely to result in new solutions such as the Indian PROs. We highlight several unique opportunities and challenges in India's e-waste system and for informal sector collaboration, respectively, in the next two sections.

## 3.0 E-waste and India's Informal Sector

A surge in volumes of e-waste has been accompanied by a rapid growth in global sales of electrical and electronic equipment. Worldwide generation of e-waste was 53.6 million tons in 2019 and is projected to rise to 74.7 million tons by 2030 (Forti et al., 2020). Importantly, e-waste contains several valuable (e.g., gold, silver), rare-earth (e.g., lanthanum, neodymium), and toxic (e.g., lead, arsenic) materials. In the absence of proper waste management, e-waste disposal comes with numerous health and environmental hazards (Centre for Science and Environment [CSE], 2015; Forti et al., 2014; Lines et al., 2016; Mahesh et al., 2014). At the same time, economic incentives within the e-waste process cycle were estimated to be 48 billion euros worldwide in 2014 with India's e-waste, estimated to be valued at approximately 2 billion euros (Baldé et al., 2015), creating opportunities for entrepreneurial organizations.

Rapid growth in electrical and electronic equipment has created a surge in Indian e-waste. India is the third largest e-waste generator in the world in 2019 with around 3 million tons per year (Forti et al., 2020). Nearly 95% of India's e-waste is estimated to be handled by the informal sector (Bhaskar & Turaga, 2018) using primitive techniques (e.g., open-air acid baths)

with little attention paid to human health and safety (Sinha et al., 2014). Environmental, public, and occupational health hazards are pervasive (Baldé et al., 2015; CSE, 2015; Mahesh et al., 2014).

In India's e-waste system, the human health and environmental implications of toxic metals are compounded by inadequate public waste management collection and recycling systems, limited public awareness, environmentally unsustainable informal sector practices, and inadequate regulatory design and enforcement (Turaga & Bhaskar, 2019). All in all, these institutional and enforcement voids create opportunities for entrepreneurially-minded individuals and organizations (Barnett et al., 2020; Doh et al., 2019) within India.

Of the studies examining the informal sector in waste management, many focus on the worrying impacts of e-waste recycling on the informal sector (Davis & Garb, 2015). Some describe the role of the informal sector within or across a few countries (Asim et al., 2012; Nandy et al., 2015) while only a handful investigate the complexities of *engaging with* the informal sector (c.f., Davis & Garb, 2015; Estrada-Ayub & Kahhat, 2015). Davis & Garb (2015), for example, focus on cross-sector partnerships in the Israel-Palestine region using case studies to create a taxonomy of approaches involving the informal sector. As one of the few studies examining the pathways or priorities of informal sector partnerships, Davis & Garb (2015) suggest an integrative, synergy-based approach to build livelihoods and reduce ill effects. They propose a pathway for informal sector organizations to join the formal sector at a national scale. Davis and Garb's (2015) holistic, synergy-based approach has severe limitations in a large, developing country such as India, in part, due to India's fragmented system of e-waste targets, metrics, and oversight. Further, as we found in this study, India's informal sector does not

necessarily desire to join the formal sector. Entrepreneurially-minded informal sector individuals can uniquely fill institutional gaps within the complex and growing e-waste challenges in India.

## 3.1 Policy Context - 2011 EPR Rules

E-waste management poses complex, entrenched challenges for the Indian government due to the sheer volume of waste, the use of scarce resources, the pervasive involvement of the informal sector, and the worrying pollution and health challenges affecting many citizens. Within recent decades, India mandated extended producer responsibility (EPR), as described below, starting with the 2011 e-waste regulations with updates in 2016 and 2018.

In 2011, India mandated EPR for e-waste streams, with implementation set for 2012 (Ministry of Electronics and Information Technology [MeitY], 2011). India's 2011 e-waste EPR management regulations, modeled upon the European Union's EPR framework (European Commission, 2014), mandates that manufacturers of electric and electronic products (hereafter, Producers) are responsible for the safe recycling and disposal of Indian e-waste (see Table I). The Government of India's Ministry of Environment Forests and Climate Change (MoEFCC) entrusted a regulatory body, the Central Pollution Control Board (CPCB), with the monitoring and implementation of the e-waste rules. Specific collection targets are stipulated while increasing sharply from 10% to 70% between 2016 and 2023 (MeitY, 2016). Non-compliance is supposed to result in penalties for Producers.

**Table I: Timeline of E-Waste Regulations in India**

| Year | Event |
|---|---|
| **2008** | **March,** Central Pollution Control Board (CPCB) releases "Guidelines for Environmentally Sound Management of E-Waste," the first such report on e-waste released by CPCB. Informal sector is mentioned several times in the report but there is no mention of PROs. |
| **2010** | CPCB releases first ever list of 23 authorized and registered e-waste recyclers/re-processors granted authorization under Hazardous Waste Management Rules 2008. |
| **2011** | **May**, E-Waste (Management & Handling) Rules introduced with no mention of informal sector organizations or PROs.<br><br>**June**, "E-Waste in India" report released by the Secretariat of Rajya Sabha (Upper House of Indian Parliament). No mention of PROs. Informal sector mentioned several times in the report. |
| **2012** | **May**, E-Waste (Management & Handling) rules come into force. |
| **2014** | **November,** number of registered e-waste dismantler/recyclers increases to 138. Total authorized capacity is 349,154 MTA (million tons per annum). |
| **2015** | **September**, number of registered e-waste dismantler/recyclers increases to 148. Total authorized capacity is 455,059 MTA. |
| **2016** | **October,** E-Waste (Management & Handling) Rules are revised, come into force. Revised rules mention and define PROs. No mention of informal sector. Producers' e-waste collection targets are introduced.<br><br>**December,** number of registered e-waste dismantlers/recyclers increases to 178. Total authorized capacity is 438,086 MTA. |
| **2018** | **March,** E-Waste Management Rules (Amendment) rules are revised, come into force. New provisions for authorizing PROs: "PRO shall apply to CPCB for registration to undertake activities prescribed for PRO under the Rules."<br><br>**August**, Karo Sambhav Private Limited, RLG India Pvt Ltd, RLG Reverse Logistics, Terrapro Recycling Solutions Pvt Ltd are first PROs authorized by CPCB. Collection targets for producers, introduced in 2016 Rules, are revised.<br><br>**December**, the number of registered PROs increases to 15. |
| **2019** | **June,** number of registered e-waste dismantler/recyclers increases to 312. Total authorized capacity is 782,080 MTA.<br><br>**December,** the number of registered PROs increases to 33. |
| **2021** | **March,** the number of registered PROs increases to 51; the number of registered e-waste dismantler/recyclers increases to 400. Total authorized capacity is 1,068,543 MTA. 1703 producers have been granted EPR authorization. |

Translating regulatory mandates into effective, persistent results is particularly challenging due to the dominant yet pervasive role of informal sector organizations in India's aggregating, sorting, distributing, and recycling e-waste systems. In 2011, when the e-waste management rules were initially promulgated, informal sector organizations were not mentioned. Lacking formal recognition or oversight, e-waste recycling performed by informal organizations *cannot be included* as properly destroyed e-waste within formal manufacturers' publicly declared waste reduction. Without formal e-waste recycling capacity at scale, manufacturers faced stiff penalties each year.

Under the 2011 rules, producers of electronic goods, (e.g., multinationals like Apple, HP, and Samsung, as well as Indian-domiciled Onida) could meet their collection targets independently or as an alliance of producers. They could partner directly with a recognized recycler or, as of 2016, become indirectly involved by partnering with a new, government-sanctioned, intermediary that bridges formal and informal organizations—Producer Responsibility Organizations.

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### 3.2 Updated 2016 Rules - Emergence of Producer Responsibility Organizations (PROs)

The 2016 revised e-waste rules created a new entity, Producer Responsibility Organizations (PROs), as an intermediary between the formal sector Producers and informal sector organizations that handled e-waste (MeitY, 2016). Yet, the 2016 regulations did ***not*** stipulate the requirements for being authorized as an officially recognized PRO, nor was there any mention of informal sector organizations or acknowledgment of the informal sectors' pre-existing dominance in managing e-waste streams within India (MeitY, 2016). This means e-waste capacity in the formal sector remained woefully under-capacity; tying up with PROs was

yet another pathway created by regulators for producers to comply; and an opportunity to adapt European PRO legislation to the Indian context.

Modeled after but substantively different from PROs in Europe, Indian PROs are meant to offer comprehensive compliance services from negotiating cost-effective regional collection and recycling contracts with different recyclers to helping producers meet outreach and awareness-raising requirements. As such, Indian PROs regularly interact with myriad organizations within the informal and formal sectors. Contextual differences between the EU and India required significant changes in the role, function, and relationships of PROs (see Tables II and III) that became more clarified in 2018.

**Table II: The First Authorized Indian PROs**

| Date of Authorization | Name of PRO, location |
|---|---|
| **29th August 2018** | Karo Sambhav Private Limited, Gurugram<br>RLG Reverse Logistics, Noida<br>Terrapro Recycling Solutions Private Limited, New Delhi |
| **6th September 2018** | Saahas Waste Management Private Limited, Bangalore |
| **14th September 2018** | Pegasus Support System, New Delhi |
| **11th October 2018** | Attero Recycling Private Limited, Noida<br>Earth Sense Recycling Limited, Rangareddy<br>TES-AMM (India) Private Limited, Tamil Nadu |
| **23rd October 2018** | Mahalaxmi Metalloys India Private Limited, Ghaziabad<br>R2 PRO Pvt. Ltd., Bangalore |
| **12th November 2018** | Auctus E-cycling Solutions Private Limited, Greater Noida<br>EPR Compliance Private Limited, Mumbai<br>Hulladek Private Recycling Limited, Kolkata<br>Pro Connect, Jaipur |

Source: India Central Pollution Control Board [CPCB] https://cpcb.nic.in/list-of-registered-pro/

## Table III: Comparing EU and Indian Producer Responsibility Organizations, PROs

| | PROs in the EU | PROs in India | References |
|---|---|---|---|
| **Introduction** | ***The first PROs were established in the EU circa 1998***; following the introduction of first EPR policies for packaging waste in 1996. | The first PROs were established in India in 2016 following the introduction of first e-waste EPR regulations in 2011. The 2011 regulations did not mention PROs while the 2016 revised regulations mentioned PROs. ***The first Indian PROs were authorized by the government in 2018.*** | Mayers & Butler, 2013 |
| **Collection Mechanism** | ***PROs collect waste from designated public and retail collection centers***. | ***Public or retail e-waste collection centers were almost non-existent before the introduction of PROs.*** (Nokia had, for some time, run a program for collection of used Nokia phones). PROs collect waste from households, academic institutions, and from the informal sector. | Mayers & Butler, 2013 |
| **Competition from Informal sector** | PROs ***do not face any competition*** for waste from the informal sector as informal sector is absent in the EU waste system. | PROs ***face competition*** for e-waste from the informal sector as informal sector manages more than 90% of e-waste in India. | Mayers & Butler, 2013 |
| **Role of PROs**<br><br>**Initiation of PROs** | PROs help producers meet collection requirements mandated by EPR.<br><br>***Producers pay PROs fees*** for collecting their e-waste and in turn PROs provide producers information about quantities of e-waste collected and processed. | PROs help producers meet collection requirements mandated by EPR.<br><br>***Producers pay PROs fees*** for collecting their e-waste and in turn PROs provide producers information about quantities of e-waste collected and sent to recyclers. | Mayers & Butler, 2013; Widmer et al., 2005; Walls, 2006 |

| | | | |
|---|---|---|---|
| **Initiation of PROs (continued)** | PROs are often instituted as a ***cooperative industry effort*** to collectively shoulder the responsibilities of its member companies to meet EPR obligations.<br><br>Individual ***producers*** may ***have high administrative and transaction costs*** which is why PROs were formed in the first place and why they continue to thrive in countries with take back programs. | PROs have been instituted as ***a cooperative industry effort*** to collectively shoulder the responsibilities of individual companies but also ***to act as a bridge between formal sector producers and informal sector*** e-waste collectors and recyclers since there is limited direct engagement. | |
| **Engagement with Local Governments** | ***Active engagement*** with local governments, right from PROs getting permission from local governments to collect waste from municipal sites, to exchange of information between PROs and local governments on e-waste collected and processed. | ***Limited engagement,*** as of now, with local governments. As per e-waste regulations, PROs are not required to either get consent from or have any agreement with local government before seeking authorization from the national government, CPCB. | Mayers & Butler, 2013 |

India's amended e-waste rules from 2018 contain explicit provisions for formal recognition and authorization of PROs by the government. In particular, PROs "shall apply to [CPCB] for registration to undertake activities for [PRO] under [the 2018 Amended E-Waste] rules" (TSPCB, 2018, p. 5). Yet, informal recyclers, dismantlers, and haulers–the entities handling the bulk of the e-waste at low cost–remain officially unrecognized by the government (TSPCB, 2018). The failure of recognition reflects official governmental policy despite the effectiveness of the informal sector organizations.

As of late March 2023, 2,300 entities are defined as 'producers' per the Indian e-waste EPR rules[3]. Information about the e-waste compliance of these producers, as stipulated in the 2016 rules, however, is not available in the public domain. Some of these 'producers' are partnering with authorized PROs, some with formal recyclers, some have their own arrangements, while information is not available for others.

E-waste regulations continue to remain silent on partnering with informal sector organizations, even though producers must ensure end-of-life compliance with safe e-waste management and specific collection targets that, often, can only be achieved by effective collaborations with PROs and informal sector organizations (Bhaskar & Turaga, 2018). Thus, informal sector organizations remain unauthorized, even though producers and PROs rely on them, and they are pervasive, efficient, and effective entities that process volumes of e-waste and a variety of e-waste materials quickly and cost-effectively. As such, any e-waste safely recycled by informal sector organizations, as the cheapest alternative, does not, and cannot, contribute to producers' annual collection targets.

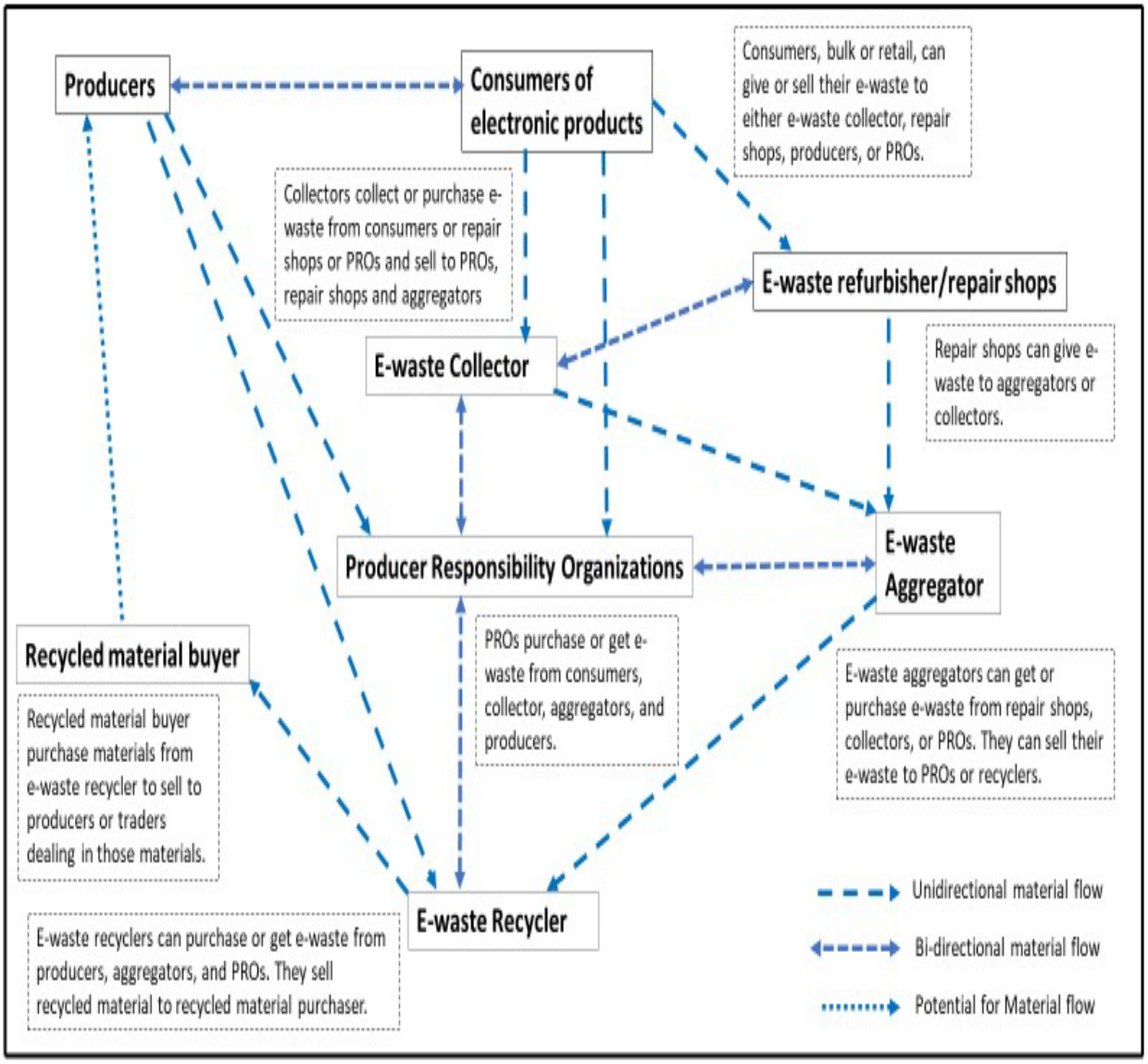
## 3.3 The Informal Sector in E-waste Management

Contributing to the invisibility, and fierce competitiveness, of the informal sector is the complex network of actors and entities in India's e-waste management system. The EPR rules to manage the Indian e-waste systems involve various governmental actors (e.g., federal and state governments and regulatory bodies), private sector actors (e.g., producers, bulk consumers, industry associations, authorized recyclers, and dismantlers), authorized non-state actors (e.g., national and international non-governmental organizations, multilateral institutions), retail

[33] The list of 'producers' is updated on the website of apex environmental regulator- Central Pollution Control Board (https://cpcb.nic.in/epr-authorization-status/), under the Ministry of Environment Forests & Climate Change (MoEFCC). In March 2023, 2,300 entities were listed under the category of producers on this website.

consumers including individual households, and the informal sector. See Figure 1 for a bi-directional schematic depicting the types of organizations involved in the e-waste process that consists, roughly, of: collecting, sorting, recycling, dismantling, aggregating, distributing, and destroying e-waste while reclaiming or re-purposing useful materials. While 'collection to destruction' or re-purposing of useful materials might be idealized as a linear process, without municipal collection systems or market-based incentives, for example, the Indian system is fragmented and fraught with inefficiencies and voids, which the informal sector has historically filled.

**Figure 1: Indian E-Waste System: Bi-directional Flows of Money and E-Waste Material among Key Stakeholders**




Further, recycling includes collection, storing, sorting, dismantling, and material recovery, with the informal sector being the largest, and perhaps the most important, non-government actor for e-waste management in India, given its scale and scope in recycling 90% of

e-waste (Bhaskar & Turaga, 2018).[4] The informal sector's ability to collect, store, sort, and recover large volumes of materials with existing market demand such as copper, glass, and iron often relies upon primitive means and without meeting the norms for minimum wages or safe work conditions for their workers. As such, informal sector organizations process e-waste at very low cost, employing workers living, and in some cases merely subsisting, at the margins of society.

This often means that individuals and organizations within the informal sector disproportionately bear the brunt of numerous negative externalities of handling e-waste, namely human health, safety, and environmental concerns without access to advanced chemical, scientific and technological processes to handle hazardous metals or to extract rare earth metals, for example.

Importantly, while many in the informal sector are poor or low-wage workers, not all are unskilled, poor, or low-wage earners (ILO, 2002). The owners of informal sector organizations may live at a higher standard, while workers live at the margins. Further, individuals and organizations in India's e-waste informal sector have pre-existing expertise (e.g., handling products made of brass and bronze), sometimes spanning multiple generations. These unique skill sets are the basis of being consistently low-cost, high-volume providers of dismantled, recycled, and sorted materials. They have built informal networks over time, developing

[4] Recycling includes collecting, storing, sorting, dismantling, and recovering material through various means. The 'success' of recycling e-waste lies in the ability of the informal sector to collect, store, sort, dismantle, and recover materials like copper, glass, and iron using primitive means. The 'failure' can be in e-waste collection, i.e. e-waste that does not come back to the recyclers (formal or informal) because of being stored by consumers or because of moonlight dumping. The 'failure' can also be in the value lost while using primitive means to recover materials from e-waste as rare earth metals typically cannot be extracted without advanced chemical, scientific, and technological processes. Further, the yield of gold and silver recovered is less than the potential amount of gold and silver recovered due to handling materials using primitive means.

relational advantages that contribute to economies of scale (volume) and scope (variety) of materials recycled, processed, and sold.

Informal sector workers also demonstrate many, if not all, attributes of what has been referred to as *jugaad*, or creative problem-solving through iterative trial and error (Shepherd et al., 2020). Learning through trial-and-error experiments, assertive defiance, and resourcefulness in using available materials, helps some informal sector organizations find quick solutions (Shepherd et al., 2020) as entrepreneurially minded actors in solving challenges (Doh et al., 2019). As such, some individuals in the e-waste informal sector are highly skilled, multi-generational, business owners.

Some estimate nearly a million people are involved in the Indian informal sector across various stages of e-waste management (Baldé et al., 2017). Thousands of informal workers work on the outskirts of Delhi, for example, in Seelampur and Mustafabad to collect, dismantle, or recycle used electronics (Mahesh et al., 2014). Most e-waste dismantlers and aggregators in the informal sector have been in the recycling sector for decades. Informal workers may have multiple revenue streams while for some, electronics recycling provides the sole means to their livelihoods. Strong, trust-based relationships forged among individuals and organizations operating within the informal sector, coupled with longstanding access to e-waste networks (households, dismantlers, repair shops, metal traders, etc.), have created barriers to entry into the e-waste recycling sector. Therefore, it is difficult for formal organizations within the government-sanctioned EPR regime to cost-effectively compete with informal organizations. Of note, not all informal sector workers want to become formalized. Distrust of government entities may be one reason. This paper does not explore incentives for transitioning informal workers

into the formal sector. Rather, we posit that the dominant actors managing e-waste materials will remain in the informal sector for the foreseeable future.

## 4.0 Methodology

Given the pervasiveness and importance of the informal sector in addressing India's e-waste aspirations, our study is guided by the research question: What are the challenges and opportunities of collaborating with organizations within the informal sector? Our focus is developing a grounded understanding (Jamali & Karam, 2018) of the complex, nuanced, interdependent pressures constraining and enabling cross-sectoral partnering behaviors in developing countries (Jamali et al., 2017) bridging to and with informal sector organizations.

We use qualitative research with a grounded theory approach to understand the challenges and opportunities of partnering within the Indian e-waste system that is dominated by informal sector organizations. Closely following the approach used by Bansal & Roth (2000), we collected data over more than three years using mixed methods of in-person, open-ended interviews, field visits, and follow-up conversations without *a priori* hypotheses. While interviewing 52 respondents directly and indirectly involved in India's e-waste process, we continually compared notes to gain a better understanding of the emerging perspectives and phenomena as described by the participants.

Rather than examining a firm's partnerships in (linear, contractual-based) supply or distribution chains, using a traditional firm-centric view, we examine collaborations as part of an end-of-life product-centric perspective. That is, the focus is 'waste products' as they are collected and disaggregated into parts for re-purposing, re-assembly, or landfills. As such, many of the economic incentives and contractual obligations of firm-centric, traditional partnerships are upended, as explicit contracts may be limited while the increased expenses of non-

compliance change the nature of the collaboration. Thus, opportunities emerge for the entrepreneurially minded (Doh et al., 2019), especially for low-cost providers with tacit, intangible skills in handling volumes of e-waste such as the informal sector.

Further, this study examines partnering as context-specific (Doh et al., 2016; Griffin, 2016; Jamali & Karam, 2018; Orlitzky et al., 2017), tailored to the unique realities (Jamali et al., 2017) endogenous to the national context of India (Jain et al., 2017; Sharma, 2011; Taneja et al., 2016). India's formal institutional context (Campbell, 2007) is marked with state-led explicit mandates on environmental e-waste and corporate social responsibility (CSR) laws. This formal context is coupled with country-specific informal institutions, pre-existing complex informal networks, limited accountability, and scrutiny, with overlapping, opaque, local ecosystems, especially regarding environmental degradation (Van Beers & Van Den Burgh, 2001, cited by Jamali & Karam, 2018). We are cognizant of the power asymmetries between the large producers (e.g., HP, Samsung, Apple) and the small- or medium-sized, cash-based informal sector organizations engaged in recycling, dismantling, and aggregating activities. Opportunities for new business models stemming from collaborating with multinational corporations (MNC) (Dahan et al., 2010; Doh et al., 2016) are possible, with both responsible and irresponsible actors (Soundararajan et al., 2018) on each side of the partnership. Data collection details are shown in Table IV while Table V shows emergent themes highlighting challenges and opportunities when partnering with informal sector organizations.

**Table IV: Schedule of Interviews**

| Stakeholders | Number | Labels used | Locations | Interview date(s) |
|---|---|---|---|---|
| **Producers** | 5 | Producer 1, Producer 2, Producer 3, Producer 4, Producer 5 | New Delhi, Bengaluru | May 2017, May 2018 |
| **PROs** | 3 | PRO1, PRO2, PRO3 | New Delhi, Bengaluru, Jaipur, Kochi | May 2017, May 2018, January 2020 |
| **NGOs** | 4 | NGO1, NGO2, NGO3, NGO4 | New Delhi, Bengaluru, Patna | April 2017, May 2018, August 2018, January 2020 |
| **Formal Recyclers** | 3 | REC1, REC2, REC3 | New Delhi, Bengaluru | May 2017, December 2017, May 2018 |
| **Industry Associations** | 2 | IA1, IA2 | New Delhi, Bengaluru | May 2018, April 2019, January 2020 |
| **Governments** | 2 | GOV1, GOV2 | New Delhi, Bengaluru | May 2017, August 2017, May 2018 |
| **International Organizations** | 3 | IO1, IO2, IO3 | New Delhi | April 2017, May 2018, August 2018 |
| **Informal Sector** | 30 | INF1…INF30 | New Delhi, Jaipur, Patna | May 2017, May 2018, January 2020 |

**Table V: Themes Emerging from Interviews**

| Themes | Quotations | Stakeholders |
|---|---|---|
| **1. Emergent, Opaque, Multifaceted Role of PROs** | *"PROs, because they add another layer to transactions, add even more costs to the system."* | **NGO1** |
| | *"The PRO model forgot that the informal sector is a big actor."* | **NGO1** |
| | *"The PROs value add should be that the PRO offers comprehensive services, including collection points and awareness. Recyclers say that can offer these services too, but [upon producer's observations] over the last 8 years of actively working on e-waste, [I] haven't seen them deliver on their claims."* | **Producer 2** |
| | *"A PRO needs to be a for profit organization, how else will you be able to make money?*" | **PRO2** |
| **2. Lack of Accountability/ Enforcement** | "*Japanese and Korean companies are not listed in India [on the stock exchange]. They operate in India as other Indian companies do, not how they do in their home countries.*" | **NGO1** |
| | *"Metals end up in the informal market, where you get a higher price. Producers look the other way."* | **RECycler3** |
| **3. Lack of Transparency and Data Falsification** | "*Mass flow balance is needed; all recyclers are sending their material back into the informal sector."* | **PRO1** |
| | *"Half of applications and paper chain is full of lies, and recyclers only want to take valuable items."* | **PRO1** |
| | *"I recognized my own e-waste. It was sold back to me."* | **INFormal Org 15** |
| | *"Most formal recyclers are selling to the informal sector."* | **NGO1** |
| **4. Lack of Trust Among Actors** | *"Trust is big in the market; many times, you give an advance."* | **INFormal Org 1** |

| | | |
|---|---|---|
| **4. Lack of Trust Among Actors (continued)** | *"PRO1 deals in transactions in white money and giving tax. Other parties deal in cash only and it's an issue/hassle to arrange the cash transfer. So [the 3 aggregators] like getting digital payments…. [The] other party is just doing business. No other organization would have helped them set up digital payments. So, now they have less hassles than dealing only in cash. They have white money. If you have a bank account, it allows you to do a lot more, maybe get a car and show you have [assets]."* | **INFormal Org 2** |
| | *"Typically, there are a lot of logistics challenges in the market. PRO1 gives a good price and PRO1 deals with logistics costs. Earlier … from 15 days before Jan 26 [2018] there was a road blockage so trucks could not get to the Delhi markets. So, in that case, it was worth it to sell it directly to PRO1 and not lose time and money…PRO1 has their way and [informal aggregator] has his way, terms, and conditions, so they find a balance to where the transaction works well for both of them. Most of all, [aggregator] wants a good price. To build trust, PRO1 needs to provide cash advances to make sure they can work together."* | **INFormal Org 2** |

## 5.0 Results, Implications, and Limitations

To become e-waste compliant, partnerships between formal and informal sector organizations are voluntary, not mandated. However, due to the pervasive, low-cost advantage, and pre-existing dominance of informal organizations in e-waste management, attempts to avoid cross-sector partnerships involving the informal sector have not been effective or sustained over time.

Some producers initially ignored informal sector organizations altogether and managed e-waste streams on their own (e.g., Nokia, Sony), others partnered with formal waste management firms (e.g., Acer), and still others collaborated with other producers to jointly manage their e-waste (e.g., Apple) (Bhaskar & Turaga, 2018). Another option was for producers to remain non-compliant without scrutiny or a media spotlight (PRO1).

Informal sector organizations have created unique cost advantages through longstanding relationships with bulk consumers and retail consumers to gain access to e-waste material. Informal sector organizations have sustained, unique economic advantages due to operating with limited overhead and minimal investments (e.g., in workplace operations), externalities borne by others (e.g., harmful hazardous techniques leading to individual or familial costs), or by offloading toxic materials with limited or no residual value (e.g., arsenic and barium). In addition, the pervasive social networks among the 'invisible' informal organizations when combined with cost leadership, first-mover advantages, and access to volumes of e-waste, create significant barriers to entry for formal sector competitors.

The difficulty of forging effective relationships with informal workers and organizations is one challenge for producers and formal sector aggregators, recyclers, and dismantlers in the e-waste trade. Most pressing, however, is the legal requirement that producers are ***unable*** to use informal workers' e-waste efforts towards mandated collection targets as e-waste material handled by unauthorized informal sector organizations is not officially counted.

PROs, as authorized intermediaries, fostered partnerships between formal-sector producers wanting to meet e-waste recycling, traceability, and accountability requirements, and informal sector organizations able to cost-effectively handle e-waste streams. As of 2022, PROs are recognized as a part of the formal sector (Central Pollution Control Board , 2022). The emergence, heterogeneity, and continued refinement of Indian PROs as an important conduit bridging formal organizations (e.g., producers, formal recyclers specializing in specific material recovery) with the dispersed network of informal organizations (e.g., waste traders and recyclers) is consistent with Rizzi et al.'s (2013) assertion that extended producer responsibility (EPR) success is likely to depend on inter-company innovation. In this case, the innovation is an

intermediary bridging the formal sector producers and informal sector providers of recycled goods.

Numerous innovations emerged when the collaborating partner was not recognized as a formal sector 'organization'. Below, we outline four insights that may guide policymakers and executives to capitalize on the opportunities of cross-sector collaborations inclusive of informal sector organizations in developing countries. These insights augment the need to address persistent institutional voids such as the lack of government-sanctioned e-waste collection facilities.

### 5.1 The Emergent, Opaque, Multi-faceted Role of PROs.

In 2017-2018, cross-sector collaborations were especially fraught with confusion at the start of our study. PROs had neither explicit, government-sanctioned licensing requirements, nor explicit roles and responsibilities causing some producers to ignore them altogether while limiting access to large volumes of raw materials, creating additional friction.

While producers contracted directly with PROs and recyclers to meet collection targets, only materials recycled by formal-sector recyclers are officially sanctioned and 'counted' towards producers' annual targets. As a result, the materials handled by informal sector recyclers are not counted towards the producer's annual targets. In response, many informal sector recyclers collected e-waste and then produced a certificate from a 'dummy' formal recycler that was set up for essentially these pass-thru purposes. Due to a combination of weak regulatory oversight and corruption, these practices persisted.

Other producers opted to partner with unauthorized PROs, with these producers bearing the risk that the PRO could meet legal expectations within an unspecified timeframe once

licensing requirements were made explicit by the government in 2018. Without government authorization or a clear pathway to authorization, PROs faced several constraints.

First, the unauthorized PROs were not allowed to bid for e-waste streams at recycling auctions for large volumes of e-waste even though informal aggregator-traders, due to long-standing relationships, were able to bid at the recycling auctions. This meant that PROs had to purchase e-waste at an inflated price from the informal sector (dismantlers, recyclers) since most of the e-waste generated in India ends up in the informal sector.

Second, PROs did not have relationships with bulk consumers (office buildings, companies) to directly procure significant volumes of recycled materials. Unable to bid against dismantlers and recyclers at auctions while closed out of bulk quantities directly from office buildings, unsanctioned PROs were blocked from gaining access to a significant supply of e-waste raw materials. The lack of volume at a low price severely limited PROs' economies of scale, cost structure, and competitiveness.

Third, PROs were seen as unwanted competitors with informal sector organizations. Since PROs did not have a recycling infrastructure, they had to send e-waste to formal recyclers to have the recycled material 'count' for producers' annual targets. At the same time, PROs were negotiating future contracts with the producers to scale up their operations. Tying up with producers and formal recyclers created conflicts of interest with competing informal e-waste recyclers (PRO1, PRO2, and PRO3).

Caught between producers, formal recyclers, and informal sector organizations, PROs had significant bargaining disadvantages and increased costs. PROs had to purchase bulk volumes of e-waste from informal organizations (dismantlers, recyclers) at a marked-up cost to

meet legally required annual collection and recycling targets. Then, PROs had to contract with and pay formal recyclers to receive official certificates of destruction for the producers.

Some stakeholders were forcefully opposed to PROs and believed that PROs raised system costs (NGO4). Others, including formal recyclers, recoiled at the entry of PROs into the e-waste system, viewing them as competitors, rather than as partners to improve efficient waste management (PRO2). When PROs invested in building capacity with informal collectors and dismantlers, they were looked at with suspicion –while most formal recyclers had not invested in capacity building. Such sentiments reveal a lack of agreement on a desired role for PROs (as a buyer, seller, competitor, or partner) or a common path for developing a workable e-waste management system within India.

Further, once authorized, PROs operated in response to economic incentives, in contrast to government-funded entities that might be pursuing a common goal of 'social betterment' (Margolis & Walsh, 2003). PROs were not welcome stakeholders. In short, creating government-sanctioned yet market-motivated PROs as an intermediary cemented tensions with both the formal and informal sectors as the e-waste goals and the mechanisms to achieve them were opaque. Without clear objectives or mechanisms, cross-sector collaborations are often stymied (Austin & Seitanidi, 2012a, 2012b).

### 5.2 Lack of Clear Oversight or Regulatory Enforcement.

The current EPR system is reliant upon government-authorized PROs, as producers seek to work with authorized organizations. Yet the Indian e-waste regulations have not assigned clear accountability to ensure the physical destruction of e-waste at each step of the long and complex e-waste handling process. Further, the lack of oversight reflects both the incomplete and confusing nature of the regulations (e.g., excluding informal sector organizations) and a lack of regulatory enforcement, with no third-party verification in place. For example, the 2018 CPCB

guidelines remain riddled with confusion without a clear registration process for PROs (PRO1). Nor do the 2016 and 2018 rules acknowledge the role of the informal sector (NGO1). Combined with the lack of regulatory enforcement (due to complicity, technical, operational, or manpower constraints) to guarantee that e-waste is permanently destroyed, some e-waste products are instead continually 'processed' and reprocessed, transferred among multiple organizations in the formal and informal sectors, with multiple payments exchanged along the way yet without waste being destroyed. There is no end-to-end audit (NGO1) or tracking system of the physical e-waste (PRO). Instead, the Indian rules create an information tracking and reporting system based on the weight of material processed, rather than an accounting system for individual (physical) items destroyed, thereby making it easy to repeatedly "account for" tonnages processed without actually destroying the e-waste.

A focus on information tracking and reporting, rather than a destroyed-item accounting system, allows for a piece of hazardous and toxic e-waste, for example, to be continuously transferred between the formal and informal sectors. The toxic e-waste can be channeled to unsafe recyclers creating additional unintended health and environmental consequences due to improper handling of hazardous materials. While regulatory agencies have recently become more proactive by issuing closure notices and taking punitive actions, the state does not have an adequate collection or enforcement system (NGO2) based on physical verification of destroyed e-waste materials.

Yet, without physical verification of the claims made by producers, there can be no substantiated evidence of actual improvements in e-waste destroyed. With weak oversight and no third-party verification of destroyed materials, public health and environmental outcomes are unknown. The public health externalities affecting informal workers continue unabated, as no

incentives exist for implementing improvements (NGO1). Even the new 2019-2020 Labor Codes (Ministry of Labour & Employment, 2021) arguably loosen protections for informal workers, suggesting that protections for informal workers may be many decades away (NGO2). An industry association executive (IA1) stated the lack of regulatory oversight challenges plainly:

> "For producers to meet their collection and recycling targets, they need to tap the informal sector by leveraging NGOs and PROs … The problem with the rules is that producers just need to meet the targets, namely whatever is collected needs to be recycled, but there is no oversight on what happens after. The role of the CPCB should be to regulate the formal recycling sector as well. CPCB could rank and segregate recyclers and only give authorizations to those who demonstrate that they have capacity. Right now, there is no criteria for [formal sector] recyclers to meet. There should also be a system for examining where the material is going after it is recycled [e.g., the specific end markets]."

### 5.3 Lack of Transparency with Data Falsification.

Lack of transparency is related to incompleteness within the e-waste tracking system and information asymmetries. As noted in the section above, some formal sector recyclers may claim to process the same e-waste on behalf of different producers (PRO1, PRO2, Producer1, and Producer2), reflecting waste tracking challenges. Further, information asymmetries lead to allegations of corruption and bribery as to why some formal sector recyclers have operating permits that are much higher than their (actual) capacity— allowing them to 'handle' large amounts of e-waste, issue more certificates of destruction, and, in turn, receive higher payments (IA1).

The lack of transparency in tracking the timing of e-waste destruction and thus payments from producers are questioned. For example, in early 2018, Producers were faced with a reporting deadline to meet e-waste destruction targets. Beginning in late 2017, informal sector aggregators became increasingly aware of the potential for a (large) infusion of producers' funds due to the government-imposed deadline and significant penalties if producers' e-waste targets were missed. As a result, aggregators delayed the delivery of material precluding certificates of

destruction. The withheld material drove up prices creating an artificially constrained supply (Producer1, Producer2, PRO1, and PRO2).

These annual deadlines continue to exist, where government-sanctioned incentives for e-waste recycling (and increasing penalties for missing targets) motivate manipulation of supply and demand to extract premiums. Such actions from the informal sector hinder the ability to foster trust, as discussed in the next section when developing cross-sector partnerships.

### 5.4 Lack of Trust Among Stakeholders.

Successful cross-sector partnering is conditioned upon fulfilling the interests, preferences, and common goals of the actors involved (Austin & Seitanidi, 2012b; Jamali & Karam, 2018). Without trust, stakeholders' true preferences may remain veiled or unrevealed (Jamali & Karam, 2018).

In the case of Indian e-waste, the pragmatic, short-term preferences of informal sector organizations were clear (i.e., up-front cash or digital payments, desire to remain part of the informal sector, desire to avoid taxes, etc.). When combined with the informal sector's persistent, long-term goals (i.e., steady revenues for self and others such as children, cousins, and siblings), unique capabilities (i.e., relational advantages, invisibility, ability to expand and contract quickly), and willingness to bear health externalities, the Indian e-waste EPR rules created opportunities for building trust, yet trust remains elusive.

Without guarantees (i.e., upfront payments, a large, steady supply of e-waste), traditional contractual elements of cross-sector partnerships (e.g., signed contracts at pre-approved prices or getting paid after disaggregating materials) were stymied. To build trust, PROs had to secure significant volumes of e-waste and provide upfront cash to informal sector organizations. Further, with many informal sector entrepreneurs angling to build their own profitable solutions, sustaining PRO-informal sector relationships was limited.

The lack of trust among producers, PROs, informal sector organizations, formal recyclers, and bulk consumers was in part due to deeply ingrained, short-term economic opportunism. The lack of government support, oversight, and enforcement also perpetuated many unintended, long-term consequences. As discussed, reselling 'destroyed' materials between the informal sector and formal recyclers continues unabated while the annual influx of producer funds to meet increasingly stringent, annual targets may be too tempting for entrepreneurial informal workers given the weak regulatory enforcement with few reprisals (Producer1). Going forward, several policy recommendations are highlighted below.

## 6.0 Policy Discussion for e-Waste Disposal

After the government officially authorized PROs, the Indian e-waste system initially became more competitive, as PROs reduced prices to gain business, (PRO1) while seeking to ensure safe recycling and destruction of e-waste for their customers -the producers. Over time, many stakeholders expect the rates and prices to reach an equilibrium. Initially entering a highly fragmented system, some PROs tried to create low-cost, high-volume, scalable solutions that met government mandates.

The future of PROs remains uncertain. Some informal sector organizations see PROs as competitors - limiting the type, duration, and success of cross-sector collaboration. Some PROs have expanded, others have consolidated, and still, others have gone out of business despite the continuation of the Indian and worldwide e-waste problem (Forti et al., 2020).

Looking forward, increased competition and consolidation among PROs as well as horizontal diversification of the PROs into other waste streams (e.g., PET plastic bottles, plastic packaging, or electric engines) will continue to both disrupt collaborations and increase opportunities for collaborating with the informal sector with mutual benefits to the informal and

formal actors. Disruption might happen if PROs emerge as a bigger player in both variety (scope) and volumes (scale) of waste or diversify into recycling operations. Collaborative opportunities might arise if informal actors see PROs increasing the scale and scope of e-waste traded and processed by them. We expect differentiation among PROs (scope, scale of operations) to emerge even with similar institutional pressures (Delmas & Toffel, 2004; Dyllick & Hockerts, 2002) alongside horizontal specializations, such as engagement with specific low-cost informal sector organizations.

## 6.1 Proposed Policy Solutions

From a policy perspective, fostering effective collaborations with the informal sector poses unique challenges despite regulations explicitly ignoring the informal sector. Policies may need to offer a combination of building capacity through nudges (Thaler & Sunstein, 2021): small, everyday, behavioral changes that encourage individuals to make better decisions.

First, using nudge policies, targeted at households, large generators of e-waste, and the informal sector, to reduce harmful e-waste processing practices might engage the informal sector to build capacity. Indian governments have used community-based "nudges" relatively successfully in Clean India Mission to reduce open defecation by promoting the use of toilets and improving sanitation (Mishra, 2019; Ministry of Finance [MoF], 2019). Similarly, governments could a) use community-based nudge interventions to raise awareness about the numerous health, environmental, and economic consequences of improper and unscientific processing of e-waste and b) incentivize creation of suitable infrastructure for managing and processing e-waste. Rather than solely relying on traditional incentives and/or punitive approaches, creating family-, peer-, and community-based pressure to change attitudes and behaviors towards e-waste processing or to focus on higher value-added steps in the e-waste

value chain might lead to limiting health and environmental externalities[5]. These measures, such as inculcating habits from a young age by targeting at schools and colleges, could complement other efforts by the governments in India in recent years to focus on cleanliness and proper solid waste management.

A second policy recommendation focuses on India's Ministry of Electronics and Information Technology (MeitY) 'eco-park' scheme that incentivizes clustering e-waste capacity building (MeitY, 2021; Press Trust of India, 2017; Ramanath, 2016). Eco-parks aim to foster informal and formal sector collaborations through supportive infrastructure by co-locating synergistic scrap industries to leverage similar recycling processes, at scale. By clustering related and complementary skills among workers, processes, logistics, and industries, the objectives are efficiencies and improved public health outcomes around India's major e-waste-generating cities. These eco-park hubs could feature e-waste dismantlers, refurbishes, and recyclers, with technical support from the government for existing and new technologies (Radulovic, 2018). The success of such eco-park hubs, however, depends on the ability of policies to attract involvement of informal actors. The latter are likely to fear being reprimanded or apprehended by government and regulatory authorities and tacit government support, therefore, that allows their integration will be required.

Along with behavioral nudges and eco-park-like incentives, a third policy prescription could be punitive, enforcement actions to deter egregious behavior as the lack of regulatory

[5] Indian governments have used nudge-based policies (e.g., Give Up Scheme for LPG Subsidy) in recent years to get people to decrease reliance upon LPG subsidies. Similarly, the Clean India Mission (Swachch Bharat Mission) has relied on incentivizing a variety of small behavioral changes (aka nudges) such as building awareness, constructing indoor toilets, and improving water-based infrastructures to meet policy objectives of eliminating outdoor defecation (PM India, n.d.).

enforcement has emerged as a significant barrier to effective cross-sector collaborations. After e-waste management rules were introduced, regulators did not actively issue enough closure notices or take consistent punitive actions against violators. Based on experience with other waste streams, regulators believed that producers should be given more time to comply with the rules before taking strict enforcement actions (Bhaskar & Turaga, 2018). More recently, regulators have been more proactive as evidenced by the increase in closure notices and actions taken against errant producers and recyclers (Nivedita, 2021).

## 7.0 Recommendations and Conclusions

A nuanced understanding of informal sector organizations, with unique goals, resources, and capabilities, has long been ignored or under-explored (for exceptions, c.f. Davis & Garb, 2015; Darbi et al., 2018). Informal sector organizations are increasingly becoming dominant, pervasive, and in some instances, are necessary partners to address entrenched challenges in addressing end-of-life waste streams, due to their unmatched skills, low-cost production methods, and relational advantages of vast networks (Bhaskar & Turaga, 2018). Therefore, overlooking their contributions is increasingly untenable.

India's e-waste ecosystem provided a rich, contextual description of the role, functions, and unique capabilities of organizations within the informal sector, to help build a nuanced, grounded understanding of these often-overlooked individuals, families, and organizations. Organizations in the informal sector suffer from many stereotypes yet have many hidden strengths such as resilience and being low-cost suppliers of high-quality goods and services. In part, but not entirely, due to low or no regulatory compliance, no tax burden, and limited bureaucratic overhead lead to favorable cost differentials (Blunch et al., 2001; Darbi et al., 2018).

Thus, partnering with non-traditional partners in the informal sector may be a way for formal sector firms to "co-invent custom solutions" (London & Hart, 2004, p. 361). Partnering can be a way for formal sector firms to effectively address organizational needs (i.e., compliance, material recovery, prospects for circular economy) as well as enabling marginalized individuals to improve their economic prospects (i.e., upgrading outreach, larger scale or scope of informal sector enterprises, digitized up-front payments, and/or recognition to individuals within the informal sector). Yet, upskilling and improving the safety and health outcomes of informal workers may be a long-term investment (Shepherd et al., 2022).

The odds are likely stacked against cross-sector partnerships with informal sector organizations. Evidence in the literature suggests that cross-sector partnerships with uncertain economics amid unstable relations (Ashraf et al. 2017; Seitanidi & Crane, 2009) have limited benefits (Austin & Seitanidi, 2012a, 2012b; Jamali, 2008; Jamali & Keshishian, 2009). Further, commitments without monetary incentives have not created value (Austin & Seitanidi, 2012a; Waddock, 1988) as incentives remain ill-defined and uncertain (Wickert et al., 2021).

Collaborating with non-traditional partners compounds problems. Confusion and a lack of trust, as we affirm in this study, remain important challenges (Babiak & Thibault, 2009, Bruton et al., 2012, London & Hart, 2004). In order to sustain a web of relationships across diverse organizations and institutions (London & Hart, 2004) trust is needed (Griffin & Youm, 2023). Trust, affirmed in this e-waste example[6], plays an outsized role in relationships involving

[6] PROs had to overcome a trust deficit to do business. Initially reviled, ignored, or engaged with in a token manner, the growth in the number of PROs, the subsequent legislation affirming the role/status of PROs, and ongoing relationships among PROs and its partners affirm, over time, the building of a continuum of trusted relationships in the e-waste space. While this description refers to PRO-centric relations; there is evidence of improved trust among many actors such as Producers and Informal Sector or among informal sector providers. As there are different types

social networks within subsistence markets (Viswanathan et al., 2010). Connectedness (Bruton et al., 2012) through widespread cooperative engagement can help a firm, or in the e-waste context a set of loosely coupled firms, achieve goals over time that cannot be achieved alone (Griffin & Prakash, 2014; Youm et al., 2023). Trust and connectedness remain challenging in fostering and sustaining cross-sector partnerships (Austin & Seitanidi, 2012a, 2012b; Babiak & Thibault, 2009).

In the absence of trusted relationships with common objectives (Ashraf et al., 2017), partnership attempts may not last, limiting scalable solutions. Thus, resiliency through continually making, breaking, and re-developing relationships might become an important skill set within formal organizations, requiring them to cultivate relationships across multiple social networks spread across cities and regions throughout India, over multiple generations. In the absence of trust, PROs, which bridge the formal sector (i.e., producers, formal recyclers) and the informal sector (i.e., informal collectors, dismantlers, aggregators) might find the lack of e-waste networks to be a significant barrier to growth. Without the ability to leverage relational networks for effective e-waste management at the national level, scalable solutions may be limited.

Yet the potential for beneficial outcomes remains unrealized. Partnerships with informal sector organizations, that directly address the Indian e-waste challenges, can lead to potentially transformative solutions (Austin & Seitanidi, 2012a) that limit the propagation of negative externalities (Bryant et al., 2023). The emergence of Indian PROs that bridge institutional and implementation voids by addressing the lack of municipal e-waste collection is a transformative solution, as most private sector producers recognize that go-it-alone strategies are ineffective.

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of trust (hard trust through contracts, for example or real trust and good trust, see Fort (2007) for more elaboration on types of trust.

PROs can help fulfill the formal sector's extended producer responsibility (EPR) mandate by collaborating with cost-effective, efficient informal sector organizations, which bring critical, tacit, longstanding knowledge. PROs also connect informal sector organizations with formal sector recyclers and manufacturers of electronic and electrical goods, to dismantle, collect, and aggregate e-waste recycling at volume.

The downsides of informal sector organizations agreeing to cross-sector partnerships include real risks of capture by large multinationals. Capture and exploitation are real risks within a system lacking transparency and accountability, with minimal penalties, lax regulatory enforcement, and limited governmental oversight. A multinational corporation (MNC) may find it easier and cheaper to engage in unethical transactions with limited recourse for the informal sector organization and limited reputational damage. If widespread unethical treatment occurs, the government-sanctioned PROs may be cut out of the process drying up their revenue streams, which in turn puts significant pressure on their cash-based arrangements with informal sector organizations, which spills over to undermining their ability to fulfill contracts with producers. A lack of cooperation- especially among MNCs and the PROs they employ- can accelerate a 'race to the bottom' whereby environmentally sound waste management practices are not viable, potentially propagating contagions (Bryant et al., 2023). These 'market imperfections' can increase the negative environmental and health externalities (Cohen & Winn, 2007) and may produce outcomes varying from exploitation of informal sector organizations, to new entrepreneurially minded solutions, and/or increased intervention from the government.

Finally, we anticipate the EPR and PRO learnings from India to extend to other geographies, especially transitioning economies (Kuznetsov et al., 2009; Newenham-Kahndi, 2011). Although EPR originated in Europe, Indian EPR operates quite differently, by 2019, a

total of 79 countries had introduced e-waste management policies based upon EPR (Forti et al., 2020).

Organizations in the informal sector are also likely to play an outsized role in managing different waste streams such as plastic (PET) and packaging waste in EPR ecosystems with cross-sector collaborations positioned as entrepreneurial solutions to these entrenched waste management challenges (Doh et al., 2019). The combination of governmental regulations and private sector risk-taking is likely to create new pathways for viable solutions (Bryant et al., 2020).

For example, India introduced EPR-styled plastic waste management rules in 2016 for manufacturers of plastics. Three years later, India announced a ban on the use of single-use plastics (SUP) resulting in what appeared as an unlikely alliance between an e-waste PRO, Karo Sambhav, and an industry body, PACE (Packaging Association for Clean Environment) which is composed of more than 30 multinational and domestic firms that include Pepsi, Coca-Cola, Diageo, Dabur, and Bisleri (Tandon, 2019). PACE decided to partner with Karo Sambhav primarily due to the PRO's ability to manage/collect PET bottles with the informal sector through its experience with e-waste cross-sector partnerships. By March 2021, the Indian government had set up 11 committees focused on recycling different waste streams, including e-waste, to explore pathways for transitioning India from a linear economy to a circular economy (Press Information Bureau of India [PIB], 2021). Though the government persists in not mentioning the informal sector in its official policy establishing the committees, a prior report had emphasized the informal sector's role in effectively managing waste streams (Rajya Sabha, 2011). Interestingly, this 2011 report was published by the research unit of the Rajya Sabha, the Upper House of Indian Parliament, explicitly acknowledging that the informal sector plays an important

role in managing waste streams, yet subsequent government reports do not mention the effectiveness, efficiency, or a role for the informal sector in waste management systems.

In conclusion, there is still more work to be done. Ignoring the informal sector and the potential of partnering with knowledgeable, industrious individuals and organizations in the informal sector ignores the reality of their intangible resources, tacit knowledge, networks, entrepreneurially minded creativity, and what is happening on the ground in India and elsewhere. A cross-sector partnership approach inclusive of the informal sector that intentionally builds trust and mutual success could have a greater probability of building capacity to effectively address grand challenges. Yet, the goal of an e-waste system operating with socially and environmentally safe practices remains elusive. Partnerships in general, and informal sector partnerships built upon mutual, persistent trust, may be able to achieve these outcomes more rapidly and more effectively.

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