

Shifting perceptions of informal operators in the service and value chains: A retrospective of 40 years of observation and advocacy for informal recyclers and waste service providers, through the eyes of five global participant-researchers Waste Management & Research 2025, Vol. 43(6) 850–896 © The Author(s) 2024



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#### Abstract

This article offers a reflective retrospective of the literature and practice on the *informal waste and recycling* sector. The authors have joined to share our experience and knowledge on the interface between the formal solid waste sector and informal recyclers and operators. Together, we discuss where this discourse has come from, where it is now, and where we, as practitioners, think it is going. We share our understanding of the waste and recycling sectors and how informality within them functions. The retrospective covers nearly 40 years of research, practice, advocacy, action, writing and intervention. The main storyline is how the public and private solid waste authorities and service providers relate to informal operators in both recycling ('the (private) value chains') and waste management ('the (public) service chain'). The recurring theme is how engaged scholarship and practice have interacted with, modified and improved the position of informal operators and workers and contributed to positive outcomes in both service and value chains. Throughout the period covered by this retrospective, opinions and framing on all sides have shifted substantially through the years, whereas the economic activities of informal recyclers and informal waste collection service providers have remained largely unchanged. Although we refer to both scientific and operational documents, we do not have the ambition to produce a scientific paper. Rather, we follow other authors of the special issue in referring to ourselves as *involved witnesses* who share a commitment to improving waste and recycling practices at the boundary of formal and informal systems.

#### Keywords

Informal recycling and waste management, circular economy, development cooperation, value chains, service chain

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2. Nadine Dulac, a private consultant working with informal service providers and recyclers in French-speaking Africa, and currently in South Africa.

3. Jacqueline Rutkowski and Dr. Emilia Rutkowski, working with Brazilian recycling co-operatives. respectively as respectively activist and researcher/scholar.

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#### Introduction and points of departure

This retrospective, part of the celebration of 40 years of *Waste Management and Research (WM&R)*, explores the relationship between informal operators in recycling and waste management and the public formal waste management sector. The context is the accelerating modernisation of public waste management systems and increasing investments in solid waste management infrastructure in emerging economies and low-income countries, which are changing the landscape of waste management and introducing threats and opportunities for informal operators.

The article chronicles how various solid waste stakeholders from the global north and south – many of them represented by the International Solid Waste Association (ISWA) – have understood and interacted with informal recyclers and informal micro and small enterprise waste management operators. The retrospective reaches back to the 1980s, but its main focus is on activities during the 25 years between 1998 and 2023.

The article draws on the experience and reflections of the five co-authors, as well as published and unpublished 'grey literature' articles, reports, websites, the 2015 and 2023 Global Waste Management Outlooks, plans, evaluations and other documents associated with or produced by researchers, non-governmental organisations (NGOs) (including Women in Informal Employment Globalising and Organising (WIEGO) and the Avina Foundation) and national and international organisations (Cohen et al., 2013; Dias, 2016; Scheinberg et al., 2010b, 2016; Wilson et al., 2015b).

These documents have been produced and/or financed by:

- Implementing agencies of bilateral and multi-lateral development cooperation such as the German International Cooperation (GIZ), United States Agency for International Aid (USAID), Agence Française Développment (AFD) and Dutch, Belgian, Swiss and Norwegian cooperation organisations.
- International Financial Institutions (IFIs), including the World Bank (WB), International Finance Corporation (IFC), Inter-American Development Bank (BID/IADB) and the EBRD.
- International and UN organisations such as the Organisation of Economic Cooperation and Development (OECD), the United Nations Environment Programme (UNEP), the International Labour Organisation (ILO) and the United Nations for Human Settlement (UN-Habitat) and the International Solid Waste Association (ISWA).

In addition, because this is a retrospective and a reflective contribution to *WM&R*, the *ISWA Scientific Journal*, the authors (hereinafter referred to as 'we' without capitalisation) draw upon their own experience as agents of change and chroniclers in the evolving landscape referred to as *informal integration* or *formalisation*. Although we have collectively contributed to the scientific literature, we as authors use the opportunity of this retrospective to directly share our experiences, synthesise our insights and set them down for the record – even when they have not been the subject of earlier formal publications. This allows us to share information on occupations, earning and working models, social acceptance and governance strategies associated with informality in service and value chains. We thus look both at the experience of the last 40 years, presenting the risks and benefits of modernisation and formalisation of solid waste institutions and how these processes work for and against the interests of informal workers and operators, and at the written record and how it presents that history and experience.

The authors also make use of a second 'We' that distinguishes 'Us', as involved advocates, researchers and witnesses, from 'Them', that is, men and women – and yes, sometimes also children – who earn their living by collecting and valorising recyclable and reusable materials and products, or by removing waste from streets and households. Our experience of the landscape is that the smallest level of buyers of recyclables – itinerant waste buyers (IWBs) and the smallest level of junk shops, who are the first buyers – are also generally informal or semiformal, so we include them in our field of attention.

#### Chronology and geography

It was originally our intention to produce a chronology of the way that 'we' – the involved others – have worked for and with 'them' – the informal operators and workers in the service and value chains, over the last 40 years, as presented in the written and published record.

After several attempts to fit the article into a chronological narrative, we have concluded that the richness and geographic diversity of published and unpublished sources do not fit into a global timeline or a geographic classification. Both the solid waste sector and the recycling value chains are highly globalised, and the experience reflected in the published and grey literature has shown itself to be resistant to disciplined classification. The resulting article is therefore a mix of chronological, analytic and personal reflection and experience.

- The introduction offers points of departure, frames the whole article and provides a thin layer of context and definitions.
- Section 1 'Looking back, looks backwards and comes the closest to a review, starting with the early literature on informality and showing how the published record represents shifting ideas about informality through the years.
- Section 2, 'Facilitating change, focuses on processes of facilitating change and shares experiences of activism and engaged scholarship with and for the informal sector focuses on activism and practice and presents a wide and varied view of what and how we as authors and practitioners and our colleagues worldwide have seen, done and worked for in our personal and professional experience with the informal sector.
- Section 'Current status of the global informal recycling sector, shares our ideas about the current status of the global informal sector: situates us in the present time, defined as the period from 2010 to the present, and gives the reader a sampling of the current issues facing informal workers and operators, as well as their champions and advocates, and

• Section 4 ' Where are we going, takes the reader along as we look forward into the future, using our insights and imagination to imagine how informal recycling and waste management may look in various parts of the world.

We close the retrospective by sharing our views on potential ways forward for formal and informal actors that provide realistic and fair opportunities, decrease vulnerability to threats and facilitate and increase the institutional space for informal recyclers and waste management operators to make their own choices, continue to earn a living and contribute to the emerging circular economy (CE) and its contribution to mitigating climate change (Sena, 2009).

# Published, unpublished and personal sources

The informal landscape connects two worlds, or sectors, with different faces, cultures, economics, power structures and earning models. These shadow their formal counterparts, the overwhelmingly private recycling value chains and the predominantly public solid waste service sector.

In the same frame, this retrospective of development practice focused on informality draws on informal and formal sources and does not limit itself to the scientific literature. We, as authors, draw from our own and our colleagues' experiences and projects, from published and grey literature, as well as from their own direct experiences as practitioners in waste management, recycling, labour organising and development cooperation.

Formal sources used in this retrospective include published articles in the pages of WM&R and other journals, unpublished 'grey literature' the 2015 and 2023 Global Waste Management Outlooks (UNEP, 2024; Wilson et al., 2015b) and other UN publications, project reports and research documents, local and regional plans, meeting and project notes, spreadsheets, modelling calculations, conversations and interactions with informal recyclers and informal waste collectors. In addition, we draw on the direct experience and points of view of the five co-authors, most of whom have been active in this landscape for many years. The active voice here is 'we'.

Our ambition is to support the community of practice to move towards a holistic view of where we have been, where we are now and where the challenges of the coming years will lie. Research is a means to this end, but this is neither a classic research article nor should readers expect that it offers clear scientific methods or conclusions. We hope that we succeed in providing you, the reader, with information, insights, ideas and inspiration.

## How 'we' look at 'them'

As we reflect on this history, we notice the relevance of the English proverb: *where you stand depends on where you sit*. In short, the ways in which we and other writers, practitioners and scholars write about the informal sector depend on when, where and how we have worked with informal workers and operators, our formal and informal roles, the research we have done and

multiple perspectives represented in the literature and practice. At various times, we and our colleagues across the globe have shifted from advocacy to actions, from research to engagement, from proscription to planning and back again. The informal sector is reflected in the eyes and experience of the beholder.

Starting in the 1980s, the written record – including research, project and policy documents and development cooperation reports, represented the view of experts in solid waste management or development cooperation, in effect, outsiders looking at or looking into the world of informal recycling and informal service provision. Gradually, the discourse moved closer to the informal actors themselves. Some of 'us' doing the research writing and reflection are now advocates for or allies of the informal sector and critics of how the sector is treated in law and policy. Another important stream is the work of planners and consultants writing waste management or recycling plans that call for *integrating* informal operations into modern, affordable, fair, 'just' integrated waste management systems.

#### 'May you live in interesting times'

This phrase, often claimed to be a 'Chinese curse', seems highly appropriate to the project of this article. The very 'interesting times' of the 1980s and 1990s represented a period when public works engineers, environmental scientists and social and environmental activists in high-income countries discovered the relationship between waste, water pollution and health (Schall et al., 1988; Simpson et al., 1988). The rapid development of the science, politics, and, inevitably, the economics of waste management and the environment stimulated a period of modernisation in the waste sector, which started in the 1980s and reached maturity in Europe and North America in the early 1990s<sup>1</sup> (Scheinberg, 2011).

During this period of rapid change, the public waste sector significantly expanded its own understanding of its mission, which came to include recycling, and as a result, moved into new positive and negative relations with the private recycling value chains.<sup>2</sup>

As the scope of public sector *municipal recycling* gained in importance, the formal waste sector in high-income countries absorbed recycling as part of its public policy and operational mission and claimed recycling as part of its institutional responsibility. This puts pressure on formal and informal value chain businesses worldwide, but not always in the same way. In North America, private recyclers became the buyers of recyclables from municipal recycling programmes and operations. In the same period, the European Union (EU) required producers to form associations to manage 'the safe end of life' of products and packages, placing producers in the role of having to market or pay for disposal of recyclables and making the formal recycling sector more or less invisible. In emerging economies, the lower levels of the recycling supply chain came to be called 'the informal sector in solid waste'.<sup>3</sup>

Looking across the range of literature of the earlier period (Downs and Medina, 2000; King, 1996; Lubell, 1991), it seems fair to say that those asking the questions represented 'newcomers' to recycling who bumped into the private (formal and) informal sector when their assumptions that 'there is no recycling happening in my city' turned out to be mistaken. The WAREN project of Waste Advisers in the Netherlands was one of these early projects that explored the variety of informal activity in the service sector and materials management in Nairobi (Anschütz et al., 2004).

Already in this period, some activists, scholars and waste management professionals working for cities and NGOs were becoming more involved with the informal sector and sharing their insights. Specifically, in Latin America, activists like this article's co-author, Sonia Dias, began engaging with the informal sector as potential partners in environmental action. Organisations, such as the Kagad Kach Patra Kashkatari Panchayat (KKPKP) in Pune, India; SWAPP in the Philippines; IPES in Peru and the cooperative Asmare in Belo Horizonte, Brazil, came into being and 'gave voice' to informal recyclers in a different way, looking for the logic and benefits that the work was producing, first for the recyclers themselves and gradually also for the society and the environment.

Some of the important questions being asked in that period can be articulated as follows (Cointreau, 1987; Robinson et al., 1992; Simpson, 1993).

- 1. What is recycling, and how does it relate to waste management?
- 2. Who does it, and how does it work in the global south?
- 3. What and who is the *informal recycling sector*?
  - a. How do they relate to the private recycling sector?
  - b. How do they relate to the waste management authorities (if there are such authorities)?
- 4. What and who are they (the informal sector) doing?
- 5. Which institutions own the waste, and is that different when it is recyclable or marketable, in contrast to when it requires safe management and disposal?
- 6. Where do their recyclables come from, and how do they get to the recycling sector?
- 7. How can 'we' (usually development professionals situated in the global North) 'help them' (usually the informal recyclers) get out of such dirty and degrading work?
- 8. Does this 'informal recycling' activity represent a temporary or transitional form (of enterprise or environmental activism), and what circumstances create or inspire it?

# *Economic aspects of the informal sector in solid waste*

Although it was not the first research on informal recycling having an economic and social focus, the 2006–2007 research for the GIZ informal sector study: *Economic Aspects of the Informal Sector in Solid Waste* (Scheinberg et al., 2010a) is currently understood as a turning point in the development cooperation discourse. This study worked with local informal sector advocacy and recycling organisations in six emerging economy cities to analyse and model the performance and economic impact of informal recycling. The authors used a process flow and materials balance approach (today, usually referred to as MFA, *materials flow analysis*). One of the most controversial findings of the study was that informal recyclers were generating significant *positive environmental externalities* for their cities.

This research led to the 'GIZ informal sector study', researched in 2006, written in 2007, and finally published in 2010,<sup>4</sup> probably the first publication outside of Latin America that asked informal recyclers for their views and opinions, especially regarding the economic and social benefits they were getting from the work. It was also in this period between 2005 and 2010 globally, and somewhat earlier in Latin America, that the voices of the IRS (informal recycling sector) began going global. Researching or managing this publication - in which four of the five authors were directly or indirectly involved - informed our ideas about the informal sector and continue to do so. GIZ (German International Cooperation, then GTZ, German Technical Cooperation), as the funder of that study, together with the CWG (about which more later), receives from all of the authors the credit for having changed the way we look at informal activities and how we respond to the informal sector as professionals.

#### High-income country modernisation of waste management

The late 1980s and 1990s represented the period when municipal waste organisations in cities and regions in the global North began to invest in modernising of disposal. Shifting from open town and city dumpsites to regional sanitary landfills was a significant innovation that protected groundwater and reduced methane emissions at dumpsites. This innovation in Europe and North America in the 1980s created a price shock for municipalities because sanitary landfilling was expensive - in the Eastern United States, in a period of a few years, the cost of disposal rose from US \$1 or less per tonne to more than US \$30. The introduction of tipping fees - also referred to as landfill gate fees - made recycling very attractive, because the value chains would pay for clean recyclables. The formal recycling industry both welcomed and resisted this development because it put a powerful player municipal regional governments - in between the large value chain industries and their suppliers. In Europe it worked differently, the producers of products and packages were tasked with ensuring that their materials ended up in recycling. In addition in low-income countries, environmentally motivated 'recycling programmes' created ambivalent reactions in the value chains.

In some countries and periods of history, such potential or real conflicts resolved themselves into sustainable forms of co-existence, such as in Costa Rica, where small buy-back centres operated by NGOs (sometimes co-sited at landfills) buy materials from informal recyclers and are co-financed by municipalities. In Tanzania, in the period 2000–2006, the ILO facilitated the development of a system of micro-concessions for informal operators to regularise waste collection services in several Dar es Salaam neighbourhoods, a system that the ILO subsequently exported to many sub-Saharan capital cities (Ishengoma and Toole, 2003; Scheinberg et al., 2011).

The development cooperation literature also chronicles many types of competition and conflict between solid waste authorities and formal and informal recyclers, as well as scattered examples of productive resolution and active cooperation. The underlying assumption reflected in the early literature is that informality in the solid waste and recycling sector is a temporary or transitional phenomenon, technically illegal but occasionally tolerated for its environmental and resource management benefits. The dominant view from that period includes an assumption that the tensions would ultimately resolve themselves through the disappearance of informal operators or their formalisation and absorption into formal institutions and systems. A relatively small number of forward-thinking bilateral and multi-lateral donors, NGOs, activists, planners, action researchers and labour organisers took a different view, and engaged with the informal sector, seeking to resolve conflicts and create partnerships. Their work is well represented in this retrospective, and some are also in the list of co-authors and contributors (Scheinberg, 2012b; Scheinberg et al., 2016).

## Integrated sustainable waste management and the concept of 'propoor' or 'inclusive recycling'

The waste and recycling ecosystem comprises a variety of aspects and operations, within which these two informal sectors (recycling and waste services) produce value and benefits to the larger society but can also create problems with associated social, economic and environmental costs. The framing and experience of this complex relationship is the dominant theme that runs through this article, and the literature serves as the lens to explore how the informal sector interacts with formal solid waste management activities, as well as with the industrial recycling value chains, now, in the past, and the future.

This article focuses on understanding the nature of informal waste services and informal recycling as a sub-system in the waste management institutional and physical landscape, embedded within the larger systems of the economy, governance, health and the environment. The *Integrated Sustainable Waste Management* (ISWM) framework provides the analytic lens (Anschütz et al., 2004; Wilson et al., 2015b). ISWM was developed in the 1990s by the CWG – *the Collaborative Working Group on Solid Waste Management in Low and Middle-Income Countries* – a group of practitioners working on waste and recycling in parastatal, NGO and consulting organisations in lowand middle-income countries, many of whom also co-operated to produce the GIZ Informal Sector Study.

The institutional context for understanding informality is that of development cooperation – the financial and technical support that the global north offers cities and regions in low- and middleincome countries, with the intention to stimulate modernisation of waste management and improvement of environmental and social circumstances. By implication, this support is designed to



**Figure 1.** The two-triangle version of the ISWM framework. Source: Global Waste Management Outlook (Wilson et al., 2015b). ISWM: integrated sustainable waste management.

accelerate the transition to modern waste management systems that the donor countries themselves experienced in the 1980s and 1990s. Modernisation, by design, is a game-changer for solid waste and recycling systems and brings with it both opportunities and threats for informal operators (Scheinberg et al., 2010b).

The authors of this article belong to a *community of practice* (formerly identified as the 'CWG'). The CWG was convened by Carl Bartone of the World Bank in 1996 in response to what he and other practitioners were increasingly recognising as the failure of technology transfer – up to then the primary mode of development cooperation in the urban service sector. Starting in 1999, CWG affiliates worked on articulating an alternative vision of what waste management is and should be, that challenged the prevailing view that it consisted purely of upgrading dumpsites and modernising collection. This multi-sectoral approach created a concept that came to be called ISWM, associated with a diagram called the 'ISWM egg'. Many of these same professionals worked with ISWM as their main analytic framework, and in 2011, produced the 'two triangles' version of ISWM, in Figure 1.

The left-hand triangle represents the physical systems and technologies for waste and recycling, shown in Table 1 as the physical system components of disposal (P1), collection (P2) and resource management (P3). The right-hand triangle represents the governance aspects, noted in Table 1 as G (for governance) system features of (G4) inclusivity, (G5) financial sustainability and (G6) strong institutions and proactive policies. The informal sector discourse is usually on either the right side of the 'governance triangle' or ascribed to P3, resource management, on the left. In this article, in contrast, we argue that a correct ISWM framing would identify and analyse resource management as a governance function, dispersed over all three points of the governance triangle as G4, G5 and G6).<sup>5</sup>

ISWM allows practitioners to understand the overarching forces 'drivers' that are associated with solid waste modernisation. The *drivers* that influenced the development of waste management

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ISWM triangles	Stakeholders related to the informal value chain = informal recyclers, first buyers, reuse operators	Stakeholders related to the informal service chain=waste collectors, sweepers	Policies and instruments incentivising recycling/ compensating informal recyclers
P1: Collection	IWBs, truck pickers, hybrid recyclable and waste collection (SWACH, Tukang Rosok), first buyer junk shops (kabadis), flea market operators, CBO and NGO recycling centres; WP cooperatives, charity second- hand shops; electronics and mobile phone repairers, traders, refurbishers.	MSE, CBO and NGO waste collectors, household servants, private street sweepers, gutter and drain cleaners, GIEs, (Africa) also NGO and 'good cause' litter and beach clean-up.	Collection fees, diversion credits, price supports for low-value materials (plastic credits), cross-subsidies; GHG and environmental services payment to recyclers (SWACH, Colombia).
P2: Disposal/end use/end of life management	Dump, street and container pickers; junk shops on the road to the dumpsite; mobile phone repairers, traders and refurbishers.	Private landfill/dump owners, dump pickers, guards at dump or landfill and 'gypsies' paid to burn over the dumpsite.	Franchises and permits or ID cards allowing access and removal of materials by the informal; diversion credits; material-specific tipping fees at dumpsites.
P3: Resource management	Junk shops, first buyers, all occupations mentioned above, plus workers at auto salvage yards and a variety of industrial facilities which are allowed to sell post-production scrap; electronics recyclers/refurbishers.	Attic clean-out enterprises, moving and transport companies, NGO campaigns, municipal recycling coordinators or managers.	Landfill gate fees, diversion credits, fines for illegal dumping, PAYT.
G4a: User inclusivity	Policymakers, regulators, zoning inspectors, EPR (extended Producer Responsibility), PS (Product Stewardship) and DRS (Deposit Return System) stakeholders, including the public, communication specialists and 'hotline' operators.	Waste managers and supervisors, budget analysts, inspectors, and procurement officers.	Zonal collection and street sweeping with cross-subsidies for reducing user costs.
G4b: Provider inclusivity	Private formal and informal traders and processors, cooperatives, associations, all levels of buyers and sellers of materials and used products, auto dismantlers, procurement officers, regulators, impact assessment officers, collections of recyclables and clothing, plastics credits and traceability instruments.	Private formal and informal waste collectors and processors, logistics, street cleaning and sweeping firms, procurement officers, Impact assessment professionals; consultants.	Service/value chain agreements with cooperatives; Dar es Salaam model for micro- privatisation; small-route tendering procedures for MSEs, service fee requirements, designated roles for MSEs, NGOs, CBOs cooperatives and formal reporting requirements and metrics that count their contributions and impact.
G5: Financial sustainability and G6b: Pro-active policies G6a: Sound	Donors and donor consultants, recycling co-ordinators, disposal fee enforcement officers, budget analysts and policy officers; climate impact assessors; private formal and informal operators; disposal fee collectors; ministries of transport, housing, environment, infrastructure, Producer Responsibility Organisations PROs, EPR, PS, DRS and Plastics stakeholders; professional associations, development banks and their accountability officers Solid waste districts, authorities, parastatals; public, private, formal and informal recyclors and waste capilies providers.		Cost recovery requirements for landfills and controlled dumpsites, licensing and registration of informal operators, PAYT, waste management, recycling, EPR, DRS and informal 'integration' plans
mattationa	stakeholder platforms; NGO initiative and water	s, ministries of environment	

**Table 1.** Stakeholders and informal sector occupations and business models in the ISWM framework. For more information, refer to Annex 1, glossary of terms, for a few global definitions.

Source: Elaborated by the authors.

Waste picker, a general term for informal collectors of recyclables from streets, dumps, trucks, waste heaps, etc.

P: physical system; G: governance system; MSE: micro and small enterprises (under 10 partners or employees); CBO: community-based organisations (often owned and operated by women); NGOs: non-governmental organisations; WP: waste picker; ISWM: integrated sustainable waste management; IWB: itinerant waste buyer; GHG: greenhouse gas; EPR: extended producer responsibility; PS: product stewardship;

approaches, included public health, environmental protection and resource management (Wilson, 2007). A practical indicator set, the Waste Aware (Wilson et al., 2012), evolved from the metrics used in *Solid Waste Management in the World's Cities* (Scheinberg et al., 2010b). For the public health driver, the key indicator is the percentage of a city's area with waste collection; for the environmental driver, the indicator is the percentage of material directed to controlled disposal, and for resource conservation, the percent or weight of materials recovered and recycled (Wilson et al., 2012).

'Pro-poor' or 'inclusive' recycling represents a (primarily) Latin American framing of both physical and governance aspects of informal recycling and situates it within the frame of ISWM. Activists and researchers are documenting and analysing governance and participatory aspects of solid waste management and recycling under the terms Popular Recycling<sup>6</sup> (Rutkowski and Rutkowski, 2015), Participatory Solid Waste Management7 (Gutberlet et al., 2014) or ISWM (Anschütz et al., 2004). These researchers, practitioners, NGOs and activists (alongside other proponents of respectful cooperation with the informal sector) have sought to include informal recycling in conceptualisations of the social economy or, more recently, the Circular Economy (CE). Framing the activities and contribution of the informal sector includes Bottom of the Pyramid (BoP) micro-enterprises (Anschütz et al., 2004), inclusive solid waste and pro-poor solid waste projects and models (Dias, 2016; Samson, 2020a; Scheinberg, 2011).

Table 1 shows how formal and informal recycling (resource management) fit into the two triangles of the ISWM concept.

#### Whose voices in this retrospective?

'We' as engaged scholars and activists. In the 15 years between 2000 and 2015, 'we', a mix of scholars, activists, environmental and social NGOs, development cooperation organisations and individual stakeholders coming from the formal solid waste sector, began to engage with 'them', that is, the informal recycling sector. At that time, it was particularly the local urban activists – such as co-author Sonia Dias in Belo Horizonte, Brazil, Poornima Chikarmane and Lakshmi Narayan, co-founders of KKPKP in Pune, India, Linda Godfrey and Melanie Samson in South Africa and (somewhat earlier) Gretchen Brewer in Chicago, United States – who sought to bridge the gap between 'we' and 'they'.

Solid waste professionals like Wilson (2023) and his frequent co-author Velis et al. (2022; Wilson et al., 2006) have written extensively about informal recycling and its value, and urge recognition (Velis, 2017; Velis et al., 2022). Wilson and Velis position themselves as *outsiders* concerning the industrial recycling sector but *deep insiders* in solid waste management scholarship and practice. Their publications have brought the informal sector into the development cooperation discourse in fundamental and important ways (Lerpiniere et al., 2014; Wilson and Velis, 2014; Wilson et al., 2006, 2009).

Recycling and zero waste advocates such as Bharati Chaturvedi of Chintan Environmental in New Delhi, Dan Lapid in Metro Manila, Anselm Rosario in Bangalore, India, and Jacqui and Emilia Rutkowski in Brazil, position themselves as *activists*, *working for* the informal sector, but not as *insiders* in the same way as Nohra Padilla, president of the Colombian National Association of Recyclers.

In this period, the informal sector also became the focus of attention of a number of the academy, including social scientists such as Christine Furedy, Harvard University's Marguerite Robinson and later Marty Chen, Ecuadorian scholar and activist Lucia Fernandez, Nigerian researcher Chidi Nzeadibe and many others. Their work has informed this retrospective, and we embrace them as part of the 'we' to which the authors belong.

'They' as subsistence entrepreneurs and service and value chain professionals. The informal solid waste and recycling sectors comprise workers, operators, family businesses and micro-, small- and medium-sized traditional or social-solidarity enterprises. Most of 'them' are engaged in a *subsistence activity*; that is, they work daily to feed their families, send their children to school, pay for shelter or support their families and themselves in primary needs. Generally, somewhere between 7 and 10 informal 'professions' are recognised in the literature (Chen, 2012; Chen and Carré, 2020; Scheinberg et al., 2010a).

# Integration, formalisation, legalisation and the just transition

The work with the informal sector has crystallised around four fundamental (and interrelated) concepts which connect informal operators and workers to the value chains, the service chain and related governmental and private institutions (Scheinberg et al., 2018). In the literature, the most common framing of 'the informal sector problem' is a debate around legality, often framed as 'formalisation'. A key point is distinguishing between formalisation as *recognition* – understanding and politically valuing the multiple benefits of (informal) recycling to the host city and country – and formalisation as *legalisation* – that is, taking steps to ensure that informal operators are either legally registered enterprises and pay taxes or are legally employed.

The entire discussion is usually referred to as 'formalisation' – in the UN and the social corporate arena. Various practitioners and scholars have identified specific aspects of formalisation, such as:

- *Integration:* Systematising and supporting the working relationship between informal and formal value chain actors and formal solid waste and recycling systems, and the source of the terms *integrated waste management* (IWM) and ISWM.
- Just transition: Anchoring and institutionalising the work of informal recycling and waste service workers and operators in formal standards for occupational recognition; compensation, social and medical (and life cycle) protections, and a safe working environment.

- Legalisation and fiscal legalisation: Legalising and normalising the (individual or collective) work of informal enterprises in the service or value chains through personal registration as an individual or family; fiscal registration as an enterprise; collective registration as a cooperative, association or union; or identification as free professionals on the analogy of fishermen, miners or market traders.
- Formalisation: Referring to political willingness to allow informal operators to legalise and continue with their economic activities without having to enter formal employment or conform to the same work practices as public or private formal enterprises.

*Legality and formalisation.* There are also bottom-up approaches acknowledging that formalisation has other attributes, including requiring or facilitating informal operators to have rights to the same level of social protections as are enjoyed by formal workers, receiving tax holidays and incentive packages enjoyed by formal firms (and the individual employee benefits associated with them) and being allowed to organise and to have a representative voice in rule-setting and policymaking processes (Chen and Carré, 2020; Dias and Fernández, 2020; Kasinja and Tilley, 2018).

The debates on formalisation at the ILO have resulted in the approval of ILO Recommendation 204, laying out principles to facilitate the transition of workers and economic units from the informal to the formal economy while respecting workers' fundamental rights and ensuring opportunities for income security, livelihoods and entrepreneurship (Dias and Fernández, 2020).

Another concept in literature and practice is the concept of exit or supported exit. This is used in the case of formal institutions such as development banks, working in a participatory frame with informal recyclers to either regularise their (existing) activities through employment and/or compensate them for losing their homes on or access to a dumpsite and provide financing or capital equipment to support some other form of subsistence or entrepreneurial work. Exit is an institutional response to the idea that informality in the waste and recycling sector is a transitional phenomenon, and so the workers and enterprises should be offered support in the form of an alternative (Cohen et al., 2013). Support can include financial or relocation compensation, small investments or other forms of assistance that lead to financing the completion of education or gaining qualifications, taking a salaried job in the waste or recycling sector, and/or small investments to enhance the ability to earn a living via entrepreneurial or agricultural activities (Scheinberg and Savain, 2015).

## Looking back: The evolving understanding of the informal sector as shown in the literature

In this section, the authors consider how *the informal sector* (as it was and is still often labelled) was identified and treated in the earliest accessible literature. Early publications made little

distinction between informal recycling and the informal waste service sector. The section starts with a general description of the *origins of* the informal sector – as viewed from the outside and recognised as part of the solid waste landscape. It sees the beginnings of mapping the informal sector activities in relation to formal sector waste management and provides early estimates on informal sector participants in cities around the globe. It also offers information on the way that key analysts have framed interventions (by 'us', affecting 'them') with the goal to improve working conditions and/or help in the management of waste.

# The emergence of the informal sector as a concept

From this article's vantage point of 2024, the *informal sector* is a concept that refers to a specific institutional landscape and literature about the informal sector. This early literature focuses less on the technical and economic content of informal recycling and solid waste work, and more on the complexity of relationships with the formal sector and wider economic systems. Keith Hart introduced the concept of 'formal' and 'informal' income opportunities during his 1971 study of economic activities among rural migrants in Accra, Ghana. He documented how new arrivals in a city and/or new entrants to the urban labour force are compelled to seek work or employment in the *unorganised* sector due to inadequate opportunities in the formal sector and their lack of training (Hart, 1973).

As early as 1980, researchers estimated that over 60% of all paying work in Nairobi, Kenya and Kumasi, Ghana took place in the informal sector, as compared to 50% in Jakarta, Indonesia and around 45% in Calcutta, Bombay and Ahmedabad, India; moreover, these percentages were increasing (Papola, 1980).

Following Hart's kick-off, an active dialogue emerged among researchers trying to understand the place of this sector in the labour force. For example, Papola (1980) noted that the labour market characteristics of the formal and informal sectors contrast sharply: the labour market in the informal sector is unregulated and highly competitive on the supply side, whereas that in the formal sector is regulated and has restricted entry based on standard hiring norms and formalised hiring procedures – in fact competitive in terms of demand for labour. *Ease of entry* remains a key characteristic of informal work in the waste and recycling sector.

According to Emmerij (1974), there is a continuum of production activities ranging from rigidly formalised to completely unregulated. This article offers the implicit expectation that unorganised or *informal sector* enterprises may be in the process of transition, leading to the disappearance of such discontinuities. Bose (1974) claimed that it is common for informal sector enterprises to be 'forced' to sell their output to a single buyer or a small group of buyers due either to their inability to reach the market directly or to complex socio-economic relationships with buyers for pre-financing of inventories, credit and emergency help. The *freedom to sell* (materials, products, even one's labour) remains a key discussion point in the literature around *the just transition* for informal recyclers and waste collectors.

Mazumdar (1976) described the informal sector as the 'unprotected' sector, whereas the formal labour force enjoys labour rights protection from trade unions, governments or both. Standing (1974) suggested that the informal sector should be broken down into two sub-sectors: the *irregular* sector and the *regular informal livelihood* sector consisting of small-scale and non-wage family enterprises. Sethuraman (1976) focused on the enterprise and labour market rather than the individual participants in the informal sector. He introduced a distinction between personal and professional disadvantage that is key to understanding the contribution of informal workers and entrepreneurs to larger systems.

Later literature views the informal sector as functioning as a safety net for workers and families during economic downturns, and providing them with a social protection function and means of earning a living when formal sector jobs are scarce (De Soto, 1989; Schneider and Enste, 2000). Informal sector opportunities may be more flexible and easily accessible than formal sector jobs, allowing workers to work part-time or engage in selfemployment activities, which can help them manage other responsibilities such as caring for children or supporting elderly family members (Charmes, 2012; International Monetary Fund, 2020). Conversely, informal sector actors often lack access to basic social and economic protections such as minimum wage, social security and healthcare. They may face greater risks of exploitation and abuse than formally employed workers (Carr and Chen, 2002; International Labour Organisation, 2018).

*Cooperatives* that give informal operators social solidarity and economic power have been the focus of both advocacy and practical interventions to promote the rights and well-being of informal sector recyclers (Chen, 2012). Although cooperatives can provide benefits such as access to training and collective infrastructure, they may face challenges in providing adequate protection for members in relation to the health and safety risks associated with informal work (Gutberlet, 2015). According to a report by the ILO (2017). Despite these limitations, the literature identifies cooperatives as a key pathway for more dignified work, women's empowerment and policy influence (Chikarmane and Narayan, 2005; Dias and Fernández, 2020).

# Early theorising about the informal sector

According to the United Nations Development Programme (UNDP), waste pickers in developing countries play a crucial role in waste management and recycling and integrating them into formal waste management systems can bring potential benefits. The UNDP report that discussed this issue in detail was one of the earliest discussions of the informal sector in waste management at the level of the United Nations (United Nations Environment Program, 1996). Several associated analyses by social scientists like Christine Furedy and Martin Medina brought more depth and focus to understanding the dynamics of the informal and semi-formal waste and recycling systems in several countries (Furedy, 1984, 1989, 1990, 1992; Medina, 2000, 2007b, 2008; Medina-Martinez, 1997). Medina's work, in particular, summarised in Box 1, formally challenged several misconceptions about waste picking (Medina, 2007a). He recognised that because of such misconceptions, public policies were developed to repress this sector of the economy.

Box 1. Medina's eight myths about waste pickers.

- Informal recycling is a recent phenomenon
- All waste pickers are the poorest of the poor
- Waste picking is a marginal activity
- Waste picking is a disorganised activity
- Waste picking has minimal economic impact
- Waste picking is a static activity
- Waste pickers are a nuisance and must be eliminated
- Waste picking has no place in modern waste management systems

Source: Medina (2007a).

As part of developing an analytic framework for informal recycling (and waste management), some practitioners began looking at ways of assessing and measuring the contribution and impact of informal activities. Researchers preparing one of the first studies of landfill picking in Medellin, Colombia, in 1979 estimated that approximately 4000 people were making a living solely from extracting recyclables and selling them to value chain recycling traders. Between 300 and 800 people were collecting recyclable materials at the Medellin landfill, with 3500 buyers working door to door to buy or receive donated recyclable materials from households and businesses (Seldman, 1979).

Sandra Cointreau, a solid waste specialist working at the World Bank, brought into her work many observations and early analyses of the challenges related to waste picking (Cointreau, 1987; Cointreau et al., 1984). Somewhat later, in the early 1990s, other UN agencies such as UNEP, UNDP, UN-Habitat and the ILO started to pay attention to this issue. Through its partnership with the Dutch Ministry of Foreign Affairs, the Dutch organisation WASTE Advisors introduced informal recycling into the Millennium Development Goals focused on human rights and poverty alleviation (United Nation, 2000). Since then, the acknowledgement of and interest in the informal waste and recycling sector has increasingly become a part of discussions and projects around sustainable waste and materials management in high-, middle- and low-income countries.

#### Informal recyclers in history

The practice of recovering materials from the waste stream has a long and rich history, with evidence indicating that such activities date back to ancient times. Metal recycling, for instance, has been traced back 5000 years (Melosi, 2004). In Rome, during Augustus Caesar's reign, and in China, as early as 66 BC, linen rags were used to make paper (Sebastian Jr, 1972). China also had a sanitary police force responsible for removing human and animal carcasses and waste, and there is a long history of removal and valorisation of night soil (human faeces collected from households and businesses before the invention of sewerage) in peri-urban agriculture (Melosi, 2004).

Around 500 BC, the city of Athens, Greece, established the first known municipal dump in the Western world, and city sewers provided fertiliser for nearby agricultural fields (Downs and Medina, 2000). Waste collectors were required by law to dispose of collected waste at least 1 mile from the city walls, and an edict was enacted against throwing refuse into the streets. Waste collectors and informal recyclers were also reported to have operated in late 19th-century Japan, France and England, with France even exporting rags and paper to England during this period (Medina, 2008).

In the Americas, the Maya were skilled in reusing various items, including broken pottery, ground stones and stones from old buildings, which they repurposed as fill for roadways, building temples or other structures. The Aztecs were known for their intensive recycling efforts, with waste pickers collecting urine for tanning hides and human faeces from public latrines for use as fertiliser (Medina, 2008). Littering and garbage dumping were banned and considered punishable offences during Moctezuma II's reign, with designated officials overseeing street sweeping efforts.

In the United States, 'scavengers' or 'rag pickers' (now referred to as informal recyclers or waste pickers) supplied rags to paper mills during the first 125 years of papermaking, with the first paper mill established near Germantown, Pennsylvania in 1690 (https://paper.gatech.edu/papermaking-united-states-america, consulted June 2023). Peddlers, or itinerant sellers of goods, were also involved in collecting scrap materials such as rags, bones and scrap metal – both from their clients, city alleys and municipal dumps. This early form of reverse logistics played a significant role in American society and economy for nearly three centuries, with its origins traced to Boston in the 17th century (Medina, 2001).

## Informality as a response to national, global or local crisis and change

Key increases in informal sector materials collection and *valorisation* (adding value to the supply chain) are often associated with crisis and change, such as war and resulting economic restructuring. Examples include upheavals such as war, natural disasters and/or (rapid) urbanisation. In the case of war, increases in informal materials recovery have multiple explanations. War has a tendency to disrupt or monopolise materials supply chains and may weaken or eliminate public services such as formal waste management systems. War often results in the destruction of infrastructure and formal waste management systems. As a result, periods of armed conflict may be associated with the emergence of new and local demand for both services and materials, which can stimulate increases in informal recycling materials collection and trading. Specifically, war often results in the destruction of infrastructure and formal waste management systems, leaving communities to manage waste and the products of military destruction on their own, as individual economic activities. Secondly, war can displace people from their homes and livelihoods and cause migration and movement of populations, creating informal settlements where people remove materials to increase community hygiene, while others see those same materials as a source of value that can and provide a source of income (Lipsett, 1974; Medina, 2001). The first and second Liberian civil wars were an early example of the destruction of the formal waste management system and the rise of informal sector systems of materials collection, reuse and valorisation (Simpson, 2008).

The turbulent years between 2008 and 2023 provide a record of the impact of global economic upheavals on the informal sector's collection of recyclable materials, as documented in publications about the economic crisis between 2008 and 2012, the COVID-19 Pandemic between 2020 and 2023, and the war between Russia and Ukraine which started in February 2022 (Dias et al., 2022; Hartmann et al., 2022).

Regional or planetary dislocation can create opportunities for informal collectors in terms of their potential to work, save and survive by accumulating materials at times of low market prices, and selling them for very attractive prices when demand rebounds. Global and regional. Such upheavals can have both positive and negative impacts on contingent labour. This became clear when Indonesian IWBs were locked down and forbidden to collect recyclables in Banyuwangi (Resolute et al., 2023). In more than a few cases, economic transition or political chaos has led to informal 'repurposing' of copper electrical wires, telephone lines, and subway transmission lines8 harvested from public infrastructure to and redirected a supply to buyers of recyclable materials (Medina, 2001). The UN embargo against Haiti in 1994 and the economic blockade against Belgrade in the late 1990s resulted in an increase in waste picking in these very different places, as residents created their own ways of sourcing food and building materials. Restrictions on the movement of Palestinians from Gaza to Israel in 1994 also led to a rise in waste picking as residents sought to recover reusable and recyclable items that they could no longer purchase because of economic blockades.

Changes in the economic climate, such as high prices for pulp and paper in the mid-1990s, have encouraged waste pickers to 'harvest' paper from municipal recycling programs in the United States, reducing the revenues from recycling but having no influence on the larger economic and environmental benefits of the avoided cost of disposal. The informal sector's activities also increased in the former Soviet republics and Eastern European countries following the collapse of the state socialism and resulting in wide-scale unemployment. Jewish immigrants relocating from the former Soviet Union to Israel are documented to have turned to waste picking as a means of economic survival in 1993, just as Syrian refugees in Lebanon and Turkey are doing at the time of this writing. These examples highlight how participation in the IRS can serve as a coping mechanism for individuals and families facing difficult economic and political circumstances. These are examples of insights confirm the scholarship delineating associating social upheaval, poverty and unemployment economic dislocation as root causes of informal value chain activity (Downs and Medina, 2000; Medina, 2001).

Recyclables markets are also sensitive to the disruption of global logistics systems (such as the blocking of the Suez Canal by the large container ship *Evergreen* in 2021). A variety of disruptions, such as, natural disasters, political tensions, health crises, climate change and political change, instability are all examples of socio-technical conditions that tend to create spin-off effects in global logistics may affect the functioning of the value chains. Informal recyclers were also affected by the price reductions for plastics in the economic crisis of 2008–2012, and the secondary materials price crash in 2018, associated with China National Sword, where a change in specifications and decrease in acceptable contamination levels suddenly reduced demand (Simpson, 2019).

# *Temporary feature of the urban landscape, or permanent but denied?*

If they paid attention to informal recyclers at all, solid waste professionals active in their own countries in the 1980s and in development cooperation starting in the 1990s believed that informal recycling represented a temporary phenomenon, a transitional stage in waste system modernisation. With this framing, policymakers chose the view that informal activities would gradually disappear due to increasing waste collection coverage, a shift from open dumpsites to gated sanitary landfills, and the emergence of structured and institutionalised (municipal) recycling organisations.

Some NGOs, social economists and social scientists working in development cooperation took a different position in response to the size and contribution of the informal sector in the countries where these researchers were active. Canadian anthropologist Christine Furedy documented the 5000 informal women entrepreneurs picking recyclables at Calcutta's primary dumpsite, and Dan Lapid wrote about the 25,000 people earning their livelihoods through informal recycling of materials coming from Manila's Smokey Mountain (landfill), with an additional 60,000 individuals directly dependent on picked materials for meeting their basic needs (Furedy, 1989). Similar observations led to descriptions of informal recycling and estimates of its extent and importance in Jakarta, Indonesia (Robinson et al., 1992). An estimate at the time suggested that up to 2% of the population in non-industrialised (low and middle-income) countries survive by extracting materials from waste (Bartone, 1988); this benchmark of 2% of the population has been validated and verified many times in the intervening years, even in high-income countries and emerging economies within the EU sphere of influence (Scheinberg et al., 2018).

By the late 1980s and 1990s, it was becoming clear that most self-sustaining recycling in cities and industrial centres in developing countries - as well as in high-income-country cities such as Paris, New York, Rome and Athens - was primarily an economic activity of informal collectors, small traders and processors. Moreover, those researching recycling noticed that informal recycling was increasing in size and importance rather than decreasing (Papola, 1980). Following the insights of Medina and Furedy, the early 2000s saw an intensification of research efforts to understand and document the scale, importance and environmental impacts of informal recycling and waste management activities. A later analysis by Anschütz et al. (2004) looked at 10 cities in the developing South and provided estimates for the numbers of persons engaging in informal recovery as dump or street pickers. Careful estimates ranged from 650 in Dar Es Salaam, Tanzania, to 50,000 in Kolkata, India, and between 30,000 and 70,000 in Cairo, Egypt, a dramatic figure that has been confirmed in many studies since (Scheinberg et al., 2010a; Wilson et al., 2009).

# Informal waste and recycling in OECD country cities

During the entire period touched by this retrospective, while the literature has focused on the global South and emerging economies, waste picking and informal recycling has also been a feature of the informal economy in the global North, even during the prosperous 1990s. According to Medina (2001), there are at least 700,000 homeless people in the United States at any given time, and waste picking is a common activity among them (Demko and Jackson, 1995), attributed this to several factors:

- Availability of valuable materials in waste, which the researchers associated with the failure of solid waste policy initiatives to introduce or manage formal separate collection or extended producer responsibility (EPR) that create comfortable, clean and convenient formal channels for the collection of marketable recyclables.
- Continued pressure on municipal waste systems to handle rapidly increasing quantities and types of plastic packaging, including an explosive growth of non-recyclable, hard-to-handle single-use and single-service food and cosmetic packages.
- Consistent but fluctuating demand for secondary materials by the industrial value chains.
- The persistence of poverty and lack of access to decent work with adequate compensation for those seeking work at many levels of society, but especially for internal or cross-border migrants, refugees and socially disadvantaged and/or historically marginalised groups.

It has even been suggested that if there were a downturn in the US economy or social support systems for people experiencing poverty were restricted, waste picking in US cities – which has always existed – would increase significantly. Box 2 elaborates

on the relationship between waste picking and homelessness. As noted by the US Congress (1989), waste picking can be a necessary step towards minimising the impact of human society on the environment.

**Box 2.** Waste Picking and Informal Recycling in the United States.

While research on homelessness and waste picking is limited in the United States, a study conducted in 1987 among aluminium can collectors in Cincinnati, Ohio and Lexington, Kentucky, found that 14% of those surveyed were homeless. The sample revealed that 36% of the collectors received Social Security, disability or pension payments, 26% received welfare or charity, 18% were engaged in odd jobs such as selling plasma or cleaning lots, 16% received assistance from family or friends and 4% had full-time jobs. Thus, for these collectors, collecting aluminium cans supplemented their other sources of income. The study also showed that 96% of the respondents were male, 26% were black and 42% were war veterans. As for why they scavenge, 76% indicated they could not find another job or were disabled or 'too old' (Royse, 1987).

There is active modern-day informal recovery in Europe, alongside a tradition of waste picking dating back to the middle ages. In Catalonia, Spain, the 'drapaire' or Catalan merchants emerged in the 18th century, and references to 'rag-and-bone' picking date back to the 19th century. Other European cities have scrap metal collectors ('chatarreros' in Catalán; Rendon et al., 2021). In Paris, the 'clochares' are recognised informal flea market entrepreneurs primarily active in the second-hand textiles sector, whose rights to this activity are claimed to date from the year 1250 (LeCoeur, 2015; French informal sector activist, personal communication; https://www.instagram.com/assoamelior/).

## Facilitating change: Activism and engaged scholarship with and for the informal sector

#### Systems thinking and informal recycling

By the second decade of the 21st century, there were claims that the informal economy employed most workers in developing countries and increasing numbers in many industrialised countries and comprised as much as 60% of the labour force (Rosaldo, 2016). The informal sector was growing, not only in practice but also in the perceptions of those working on solid waste management in low- and middle-income countries, as well as increasingly in high-income and OECD nations.

As the importance of the sector became clear, there was a gradual increase in both the depth of analysis and the understanding of the complexity of this sector. Action researchers and organisers worked increasingly with informal sector operators and their champions to systematise their observations and formulate policy responses to support the informal sector's political and economic ambitions.

During this period, the dividing line between the 'we' of the early researchers and the 'they' of the informal operators and advocates began to blur. This is in part due to the influence of politically sensitive organising and advocacy for and with by informal recyclers themselves in Latin America, especially in Brazil, Colombia, Argentina and Nicaragua. Researchers and advocates listened to demands and came to understand informal waste and recycling as key long-term livelihood activities for those facing barriers to entry for more formal employment.

Informal recycling pays relatively well. Combined with the ease of entry, and 'not having to work for the boss', it can offer relatively stable incomes for internal or cross-border migrants, religious or ethnic minorities, or those facing educational, economic, cultural or political barriers to entering the formal labour market. This created an understanding - among development professionals and in some political parties in countries with a large informal sector, that informal recyclers function as a semiorganised workforce and enterprise sector. Informal service providers (ISPs) in countries ranging from Ghana to Indonesia were shown to have linkages to being paid by the for the removal activities that falled within the domain of the formal waste management sector. Informal recyclers globally, with clear examples in many countries, work as suppliers to the value chains and sell them materials that are used as industrial feedstocks for product manufacturing (Cointreau et al., 1984; Scheinberg et al., 2010a).

Research to quantify economic, social and environmental gains built upon the earlier effort to grasping the scale of the informal waste networks, using various estimation approaches and modelling tools. There was considerable interest in quantifying numbers of dump waste pickers extracting recyclables and initial attempts at a census produced estimates ranging from 400 dump pickers for on a population of 1 million residents in Cali, Colombia, to 10,000 pickers for Mexico City's population of 10 million people (Birkbeck, 1978). Later estimates arrived at 5000 workers at Calcutta's main garbage dump, 25,000 pickers at Manila's Smokey Mountain in the Philippines with an additional 60,000 (including family members) were dependent on the initial collection of materials for securing their basic needs (Furedy, 1989).

From this seminal research, a consensus in the community of practice gradually emerged and crystallised around the idea that as much as 2% of the population in Asian and Latin American cities earns a livelihood for themselves and their families by waste picking (Medina, 2000). Wilson et al. (2009) looked at seven cities in the developing South and classified the informal waste management sector into several clear occupations: itinerent waste buyers (IWBs), street pickers and dump pickers. He attributed the percentage of materials recovered to each category and then compared that with the formal waste management sector (Wilson et al., 2009). In six out of the seven cities, the majority of recycling occurred through the informal sector, with IWBs being the most important factor in capturing and valorising materials.



**Figure 2.** Process flow and materials balance diagram for Pune, India from the GIZ Informal Sector Study. Source: Scheinberg et al. (2010a), based on data provided by staff of KKPKP, the informal sector labour union, and SWACH, the operational co-op.

As far as the authors know, the GIZ informal sector study (Scheinberg et al., 2010a, based on research in 2006–2007) was the first work in which high-income country methods for from benchmarking municipal recycling were applied to the task of systematic benchmarking of informal materials handling. The lessons learned learnings from the *GIZ informal sector study* included that it was feasible to:

- quantify levels of recovery and calculate direct economic benefits to the sector and to the city
- model economic impacts such as positive economic externalities and climate impacts for the cities in which they work

*Process flow and materials balance.* Early studies on waste flow systems and informal recycling networks have provided valuable insights into the process of material recovery and the role of informal sector in waste management. For instance, the World Bank's study in 1984 examined different aspects of waste flow, including collection, intermediate handling and transportation (Cointreau et al., 1984). A study in Jakarta in 1989 mapped out the various steps involved in material flow (Figure 2), for both formal and informal waste handling systems and estimated the number of small business enterprises involved in processing and transportation of recaptured materials (Robinson et al., 1992; Simpson, 1993).

Research on informal recycling networks in Mexico City in 1977 identified sub-populations that were relying on waste removal and material recovery as their primary source of income (Lomnitz, 1977), whereas similar studies in Istanbul and Kathmandu revealed multi-layered networks of collectors, processors and transporters of recyclable materials (Partrick, 1981; Pradhan, 1982).

Studies in the 1970s and 1980s of Zabbaleen community in Cairo, Egypt, known for their waste collection and material recovery activities, showed the world a highly organised network where edible waste was fed to pigs and industrial materials were sold to dealers (Flintoff, 1977; Kodsi et al., 1982; Neamatalla, 1980). There are also cases where formal waste management sector collection crews have an informal role as truck. During their formal routes, they "put aside" re-usable or recyclable items and materials, either for own use or to sell to supplement their incomes (Cointreau et al., 1984). This is yet another example of the complexity of informal recovery and recycling activities and their contributions to diverting materials from disposal at city and system level.

A significant leap in the development of the waste flow analytics was made by the Tellus Institute (1988). The Tellus *WastePlan* tool digitised the tracking of materials flows by mass balances; economic impacts were added by applying cost coefficients to each step by weight of materials. This approach was applied to 36 client cities in China, Mexico, New Zealand, Canada and the United States and was subsequently used to develop an integrated analysis of both informal and formal sector materials management within cities (Simpson, 2007).

This expanded to a number of subsequent analyses of the informal sector's waste handling activities in cities across the developing South and post-soviet bloc countries (Scheinberg, 2011; Scheinberg and Simpson, 2015; Scheinberg et al., 2010a, 2010b). Figures 3 and 4 are examples of the application of materials flow and the assciated mass-balance analysis to the recycling activities of the waste pickers Pune, India and Quezon City, Philippines (Scheinberg et al., 2010a).



**Figure 3.** The recycling system in Indonesia in the early 1990s.

Source: Robinson et al. (1992), used by permission.

#### Drivers behind the continued focus on the informal sector by scholars and activists

After more than four decades of research, scholars, researchers and solid waste practitioners have established that 'recycling', the generic term used in English for the recovery of materials, conserves energy and materials and is a source of ckimate benefits (Scheinberg et al., 2010a). The net material or energy balance depends on specific circumstances, operations and - as the informal sector study shows - on the balance between muscle traction and mechanical traction. Early lifecycle analyses show that in most cases recycling conserves more energy and materials than it uses (Tellus Institute, 1992); in countries and cities where collection is done on foot or with animal traction, it conserves much more (Scheinberg and Anschutz, 2006; Scheinberg et al., 2010a). The other known positive and negative impacts include environmental pollution and health and safety problems for informal operators associated with improper or informal handling, processing and disposal of materials. At the same time, considered from the point of view of the city or country economy, diversion from disposal as a consequence of recycling and marketing materials to the private sector saves money, reduces dependence on foreign imports, creates employment and small-scale enterprises and up skills needed for industrialisation through repair and remanufacturing (Cointreau et al., 1984).

Shared economic benefits. Soon after the concept of informal and formal labour was presented (Hart, 1973), scholars began to look more closely at related issues of economic, social and environmental benefits. An early dominant view had the informal sector being broadly defined to include any economic unit (an enterprise) engaged in the production of goods and



**Figure 4.** Process flow and materials balance diagram for Quezon City, Philippines from the GIZ Informal Sector Study. Source: Scheinberg et al. (2010a), based on data provided by the staff of the Solid Waste Association of the Philippines (SWAPP). For additional information, please visit https://swapp.net.ph/.

services – whether it employs only one person or more, whether or not it uses fixed capital and whether or not it has a fixed location for conducting business (Sethuraman, 1976). There is a broadly shared understanding that informal systems – perhaps by definition, are well adapted to the prevailing conditions in which they arise, such as ease of entry, availability of the resource base, over-abundant labour supply, scarce capital and that their activities are often of benefit to the cities and sectors where they are active (Haan et al., 1998).

Somewhere in the period 2000–2012, activists, champions, scholars and researchers – many of them associated with the NGO WIEGO, sometimes in cooperation with or financed by the ILO, began to explore the system benefits of *formalising* and/or *integrating* informal operators into the formal waste management system and recycling systems. In the first instance, the focus was on win–win opportunities to recognise informal contributions to recycling or city cleaning (informal, peri-urban or low-income) areas – and microeconomic niches – where the formal sector was not able or willing to provide cleaning and removal services, or where there was a lack of interest from local authorities in establishing formal recycling or waste collection operations.

In Latin America, integration of the informal waste sector often took the form of co-operating with and (financially) supporting waste picker cooperatives and partnerships in the value chains or creating systems for micro-privatisation of informal or semi-formal waste collection and street sweeping (Anschütz et al., 2004; Ishengoma and Lyimo, 2002). Such cooperation provided (and in many places still provides) benefits to municipalities and informal operators. Waste pickers and collection micro-enterprises can stabilise their incomes and improve working conditions, and the city benefits from better hygiene in the city (especially in poor neighbourhoods) and reduced need for disposal. In Bogotá, Colombia, waste pickers' cooperatives have a long tradition of offering their members a social safety net and direct income from the sale of materials. Since 2015, by a decision of the Colombian Constitutional Court, informal collectors of recyclables have received a nationally direct diversion credit for the value of the environmental services that recycling delivers. This provides livelihood and income for around 20,000 people and contributes to diverting approximately 11% of the city's waste from landfills (Medina, 2011).

Positive and negative impacts of informal activities. Early studies on waste flow systems and informal recycling networks have provided valuable insights into the process of material recovery and the role of the informal sector in waste management in local and global materials cycles. Studies in the 1970s and 1980s of the Zabbaleen community in Cairo, Egypt, known for their waste collection and material recovery activities, showed the world a highly organised network where edible waste was fed to pigs and industrial materials were sold to dealers (Flintoff, 1977; Kodsi et al., 1982; Neamatalla, 1980). Interestingly, some formal waste management sector employees (in the occupation of truck pickers) also participated in the informal collection and resale of materials to supplement their incomes and allow the public sector to keep the costs of salaries under control (Cointreau et al., 1984). These monographic analyses provide valuable insights into the complexity of informal recycling networks and their contributions at the city and system levels. Research on informal recycling networks in Mexico City in 1977 identified sub-populations that were relying on waste removal and material recovery as their primary source of income (Lomnitz, 1977), whereas similar studies in Istanbul and Kathmandu revealed multi-layered networks of collectors, processors and transporters of recyclable materials (Partrick, 1981; Pradhan, 1982).

The World Bank's 1984 study examined different aspects of waste flow, including collection, intermediate handling and transportation (Cointreau et al., 1984). A study in Jakarta in 1989 mapped out the various steps involved in material flow for both formal and informal waste handling systems and estimated the number of small business enterprises involved in the processing and transportation of recaptured materials, as shown in Figure 2 (Robinson et al., 1992; Simpson, 1993).

Process flow analysis, supplemented by materials balances, represented a significant step in the development of waste flow analytics. At the time of this writing, this combination is often referred to as materials flow analysis (MFA).

MFA has been embraced as a useful tool for understanding the cycling of materials in nature (as in the research on ocean plastics), in relation to formal waste systems, and also for understanding the informal materials management sector. One of the first uses of MFA in relation to recycling was made in the 1980s by the Tellus Institute in their *WastePlan* tool (Schall et al., 1990). WastePlan systematised the digital tracking of materials flows by mass balances; economic impacts were added by applying cost coefficients to each step by weight of materials. This approach was initially applied to 36 client cities in China, Mexico, New Zealand, Canada and the United States. It was subsequently used to develop an integrated analysis of both informal and formal sector materials management within cities (Simpson, 2007).

This formed the basis for developing metrics for analysing informal recycling and waste management activities in low-, middle- and even high-income countries (Scheinberg, 2011; Scheinberg and Simpson, 2015; Scheinberg et al., 2010a, 2010b). Figure 4 provides an example of this form of systembased economic analysis of the recycling activities of the formal and informal waste workers in Quezon City, Philippines (Scheinberg et al., 2010a).

*Early organising in Latin America.* The first documented date of waste picker organising is 1962, the founding date of the Cooperativa Antioqueña de Recolectores de Subproductos, formed in the city of Medellín, Colombia. But it was in the late 1980s and early 1990s that activism really took hold in the Latin American region with the support of organisations linked to the Catholic Church and NGOs supporting waste pickers to organise themselves as in Colombia, Brazil and Nicaragua (Dias and Fernández, 2020; Rosaldo, 2022) Birkbeck (1978), in his famous study on waste pickers from Cali, wondered if they would possess the organisational capacity to organise themselves. Dias and Samson (2016) disputed this and offered contrasting evidence that waste pickers structure their work and find informal ways of 'organising' themselves and their work. They documented the creation of self-help groups, organising work on an individual/family basis or cooperatives, or designating a spokesperson to deal with issues affecting them. They also developed preferences, specialisations and occupations, such as street pickers, doorstep collectors, itinerant waste buyers, dump pickers, sorters or swill collectors.

*Emergence of the concept of integration and inclusive recycling and waste services.* According to Berthier (Berthier, 1983), the first systematic study on the 'social issue of waste management' – waste picking in Mexico – was published nearly 10 years in advance of the interest in the informal sector in development cooperation in European countries in the 1990s. In one of the first in-depth studies on waste pickers, Birkbeck (1978) referred to informal recyclers as 'self-employed proletarians'. Already in the 1980s, several analysts looked beyond the direct phenomenon of independent waste collectors and small enterprises and understood them as part of a more complex materials-handling system that also involved remanufacturing (Bubel, 1990; Cointreau, 1987; De Kock, 1987; Lund, 1984; Rebong and Ekna, 1979; Royse, 1987).

A collaborative effort between the Harvard Institute of International Development and the Centre for Policy and Implementation Studies in 1987 established that approximately 60,000 street pickers and waste collectors were at that time earning a living in the informal waste management system in Jakarta (collectors of recyclables) in Jakarta, Indonesia, were earning 3000-4500 Rps (Indonesian Rupia) per day, and sending upwards of 35,000 Rps back to their home villages (Bennett, 1992; Simpson, 1993) – a system still operating in Banyuwangi, Indonesia (Resolute et al., 2023). This 3-year effort was important because it developed a more systematic framing of donor and government response to informal sector activities, especially regarding their economic and logistical contributions to waste management systems. Interventions included formal training of informal sector recyclers in the process of creating and marketing compost from the organic fraction in the municipal waste stream (Simpson, 1993).

One of the earliest examples of documentation of an inclusive recycling system was the partnership between Belo Horizonte city and the ASMARE cooperative in Brazil (Dias and Schmidt, 1997). This article traces the history of one of the first worker cooperatives in Latin America and elaborates on the main features of the policy advantages of integrating a worker-based organisation into a city cleansing service.

Informal value and service chains: Two main lines of research and scholarship.<sup>9</sup> It is useful to describe the institutional landscapes of solid waste management and recycling, respectively referred to as the *value chain* and the *service chain*. The features of these two different worlds are shown in Table 2 and Figure 5. The *value chains* include informal and formal primary collectors of recyclables, small junk shops, medium-sized traders, large processors and the end-user manufacturing industries that depend upon them. Together, they constitute the private recycling sector. The value chains – as the name suggests – are in the business of mining, extracting, recovering and *trading value* from the waste stream. All informal collectors of recyclables do this work, so this article (following much of the literature) identifies them as 'belonging to' the value chains. All value chain income is in the form of a payment per tonne, per kilo or unit.

The *service chain* is in the business of being paid for the service of *removing disvalue*. The typical activities are collecting and disposing of waste, chemicals, litter and other undesirable sources of pollution (Scheinberg and Simpson, 2015). This activity includes the core 'public sanitation' services of waste collection, street sweeping, litter control and the related environmental services of transport, disposal and pollution control at disposal sites. All of these services are related to *removing or managing disvalue* from the value chain.

The two main lines of research and scholarship around informal recycling that emerged in the 1980s remain important at the time of this writing:

- The role of valorisation through the informal collection of recyclables from households, dumpsites and businesses by micro-private sector waste pickers, itinerant waste buyers and very small traders. Their activities in diverting waste from landfills and contributing to recycling efforts represent most if not all of the process of secondary materials management in countries where the public waste management system is only focused on collection and disposal.
- The contribution to public health that is made by micro and small waste collection service enterprises, who collect and remove waste from neighbourhoods and provide semi-formal street sweeping, drain cleaning and waste removal services to neighbourhoods, and especially in marginal and peri-urban settlements and informal communities not (yet) served by the formal waste collection systems.

It is useful to emphasize that the service and valorization sectors belong to different worlds, although they work alongside each other and are increasingly involved with each other's activities. Both began to take their current form in the mid-1800s, in countries – today referred to as high-income countries – that developed during the rapid urbanisation that accompanied the Industrial Revolution. Recycling has its roots in the commercial world of the Industrial Revolution, solid waste management in the social and hygiene movements that arose to manage the health impacts of urban living. demonstrates some of the differences and suggests something about their origins. The last seven rows introduce key service chain roles as elaborated in the GIZ publication series *Operator Models* (Soos et al., 2013).<sup>10</sup>

'Landscape:'	Service chain – public waste management	Value chain – private recycling industry
Formal actors	Public works and sanitation departments	Manufacturing industries concentrated in East Asia
Emerged as a sector	In the 1850s in Europe and North America in relation to urbanisation and the sanitarian movement <sup>a</sup>	In the 1850s in many industrialising countries in response to the changing material needs of the industrial revolution (Scheinberg, 2011)
Main activity	Cleaning and sweeping streets, removal of manure, offal, waste, excreta, litter and other undesired materials from urban areas through physical collection activities and the provision of a specified 'far away' place for dumping those materials	<i>Trading</i> and reverse logistics: returning usable materials to the industries looking for resources; repairing, trading and reselling a variety of products and materials
The main source of 'value'	In the <i>'clean' empty space</i> left behind after the service providers have finished their work	In the <i>commodity value of the materials</i> to be traded
<i>Who pays</i> for the value	Households, institutions, industries and businesses who want to get rid of the materials to be collected, represented by City governments and public works and communities in informal settlements	The <i>buyers of the materials</i> who want to use the material value in their processes and products, connected in a chain of suppliers and purchasers
<i>Main place</i> of economic activity	inside cities on streets, in residential, commercial and industrial areas; business districts and public places; disposal outside of the city	In industrial areas, harbours, transport hubs; small 'first buyers' (kabadis, small junk shops, buy-back centre) often adjacent to residential or commercial areas
Institutional 'owner'	Local and regional government in most cases and PROs in case of EPR schemes	Large manufacturing industries
Regulator	National environmental ministries, regional governments, city councils	World Trade Organisation, national ministries of commerce and trade, city recycling department
Client (payer)	Governments, <i>generators</i> of materials, building managers, owners, producers and manufacturers of products	Industries, entrepreneurs, buyers of materials, in some cases NGOs, producers and manufacturers of products
Source of funds	Individual or collective direct payment for services, real estate or municipal taxes, EPR fees (eco-modulated or not)	Payment for traded materials based on specifications and the <i>retained value added</i> in the materials; Eco modulated EPR fees
Payment unit	Service unit per time or amount (households pay per month; disposers pay per kilo at the landfill)	Kilo (or other measure of weight) or item; price is based on meeting <i>specifications</i> for materials
Revenue collector	City tax or environmental departments or fiscal officers, PROs <sup>b</sup>	Trader purchasing the materials pays the supplier selling the materials, PROs
Revenue special info	Policy-dependent sliding scale payments or PAYT (Pay As You Throw) to encourage recycling and waste prevention	Reverse demand curve associated with risk of contamination and natural /primary resource depletion: higher unit price for higher volumes
Change agent	Environmental regulators who discovered the polluting impact of waste in contact with water and air (odour control); environmental activists; service chain innovators of MRFs and sorting processes in the period 1985–2005	Recycling advocates/co-ordinators/value chain companies experimenting with 'municipal recycling' and 'composting' in Europe, high-income Eurasia and North America in the period 1980–2000

Table 2. Introduction to the formal landscapes of service chain and value chains.

Source: Elaborated by the authors with reference to the Operator Models documents of GIZ (Soos et al., 2013).

<sup>a</sup>In 1842, the Chadwick Report came out and connected the accumulation of waste with the diseases experienced in Europe's cities. This particular report focused on the working class. It ushered in the 'age of sanitation', clearly stating it was the responsibility of public authorities, and this was followed in 1875 by the Public Health Act that formalised the collection and disposal of London's waste, followed by the first waste incinerator built in 1876 (Wilson, 1976).

<sup>b</sup>PRO: Producer Responsibility Organisation, sometimes called 'compliance organisations' when they are involved in operations. EPR: Extended Produce Responsibility.

*Recycling: formal and informal – has positive climate impacts.* 'Recycling', the generic term used in English for the cycling of products, materials and energy in cities, ecosystems and in nature, usually produces a net climate and energy benefit. The extent of the benefit – the positive material or energy balance,

or negative  $CO_2$  footprint – depends on specific circumstances, operations and – as the *Economic Aspects* study (Scheinberg et al., 2010a) shows, how recycling is done and at what scale. An industrial aluminium smelter uses a great deal of energy to *process* aluminium used beverage containers into aluminium ingots. The



source: elaborated by the authors of this paper Axis value (recycling)/ disvalue (waste management

**Figure 5.** Location of informal and semi-formal activities in two sets of axes: formal-informal and value chains-service chain. Source: Adapted from Velis et al. (2012) by the authors of this article.

energy and climate footprint of these *extraction, collection, processing, storage and transport* processes is high when these industrial mechanical capture, production and transport processes use fossil energy. It is much lower when the same number of tonnes of ingot is produced by the work of many individual informal recyclers and their families, who use their muscles and those of horses or donkeys.

Some early lifecycle analyses in the period 1988-1992 were able to establish that, in most cases, recycling conserves more energy and materials than it uses, even with moderate-scale mechanical processes (Tellus Institute, 1992). And in countries and cities where collection is done on foot or with animal traction, the energy balance is even more favourable (Scheinberg and Anschutz, 2006; Scheinberg et al., 2010a). Policy and logistical support to informal operations can increase the positive energy and climate impacts of informal recycling. For example, in Pune, India, where the Municipal Corporation strongly supports the waste pickers' union, KKPKP, the logistics of informal are improved by the provision of storage sheds for the recyclables, and the social safety net is strengthened by support from the municipality and the union for waste pickers to have public medical and social insurances and financial support to send their children to school. In other places without pro-active city or national administrations, the conditions of work can cause environmental pollution and health and safety problems for informal operators associated with handling, processing and disposal of materials. At the same time, considered from the point of view of the city or country economy, diversion from disposal as a consequence of recycling and marketing materials to the private sector saves money, reduces dependence on foreign imports, creates employment and small-scale enterprises and up skills needed for industrialisation through repair and remanufacturing (Cointreau et al., 1984).

Value chain informality. Value chain informality, or *informal recycling*, is an economic activity based on extracting, processing, and trading *value*. Like mining, informal recycling begins with *extraction*, where valuable materials are picked or removed from waste, or collected separately from households or businesses. Extraction is followed by *sorting*, *pre-processing* or *beneficiation*, where different materials are separated from each other based on their physical or market characteristics. In this way the intrinsic or added value of the extracted materials is preserved and upgraded to ensure that the buyer pays a favourable price.

Beneficiation usually consists of three basic types of activities:

- Separation, sorting or classification so that the valuable materials are retained, and the contaminants discarded. Most classification is done visually, either with hand or machine recognition and sorting or is based on physical properties, where a stream of air or water or a solution such as ferrous sulphate is used to separate by specific density. Magnetic and electrostatic processes, such as eddy currents, are also used for separation and classification. Separation at source, asking the generators to do primary separation, is also a form of beneficiation, with the costs externalised to the users.
- 2. Cleaning and/or washing, a second level of processing for even higher purity.
- 3. Densification to make transport affordable. Densification comes in three basic flavours:
  - a. Size reduction through milling, shredding and chipping.
  - b. Compression through baling, compaction or other forms of pressure.

- c. Heat treatment or melting, part of processing for glass, plastics and metals.
- Pre-processing and sale based on material quality and conforming to industry specifications and prices. Prices are set and published in East Asia every month, which are the basis for prices (Scheinberg, 2011; Scheinberg et al., 2010a, 2011).

Enter municipal recycling: Formal recycling in the service chain. Since the 1980s, in Europe, North America, high-income Asia and Oceania, the hybrid activity of municipal recycling has somewhat muddied the distinction between the service and value chains. Municipal recycling and a whole set of institutions around it, including the CE, resource efficiency and zero waste, refer to ways in which high-income country cities and institutions have learned to connect the demand for the value found in captured materials or 'pull' coming from the value chains, with the financial and environmental benefits of diverting materials from disposal, that is, 'the push'. This arose from the drive to make disposal environmently sound by developing the economic argument of combining the benefit of 'avoided disposal cost' with the sale sof recyclables (Schall et al., 1988). Municipal recycling and the institutional and technical changes that it provokes are not the main subject of this article, but they operate in the background and form the context for many of the relationships between informal recyclers and both value chains and service chains.

Informal roles and occupations in the service and value chains. There are diverse roles of the informal recycling system (IRS), spread across both formal and informal processes in the service and value chains. This  $2 \times 2$  matrix is represented in Figure 5. The bottom of the Pyramid Dump pickers – with a higher representation of women and children between the ages of 7 and 12 - (Cook and Velis, 2021), comb through urban dumpsites to recover plastics, non-ferrous metals and paper to sell them to informal and formal recyclers via intermediate buyers. Itinerant waste buyers and mobile waste buyers (MWBs), sometimes referred to as 'the man with the truck', move through residential areas and repair shops to collect or purchase ferrous metals and broken-down electronic equipment to sell to recyclers. Along the value chain, processors of various capabilities pre-process recovered metals, glass, textiles, plastics (or anything else that has value) before transforming them into marketable commodities to sell to the industrial value chains, or converting them into products for local and regional markets.

Their counterparts in the service chain – the informal waste service providers – are responsible for operating waste collection in cities in Africa, Latin America and Southeast Asia, contributing to more than 50% of waste collection coverage (Godfrey et al., 2018; Oduro-Appiah et al., 2021). Through offering simple and inexpensive services, the IRS and IWS workers can make a living, protect the environment and save municipalities hundreds

of millions of dollars in already scarce waste collection and disposal budgets (Morais et al., 2022; Oduro-Appiah et al., 2021; Scheinberg et al., 2010b). They are and (hope to) remain economic actors in the waste and recycling industry, supporting the sustainable development goals (SDGs) (Gutberlet, 2021; Gutberlet and Carenzo, 2020; Rutkowski, 2020; Valencia, 2019). In light of the significant contribution of the informal sector to global solid waste management and recycling systems, we discuss in the following sections stakeholders' perceptions of the IWS, focusing on translating facts and insights into the information that enriches the development and implementation of policy initiatives – both at the international and national levels.

GIZ and the World Bank have shown an exceptional commitment to researching and benchmarking impacts associated with informal waste and recycling activities. GIZ has provided strong leadership in commissioning and supporting research on informal recycling (and, to a lesser extent, waste collection) in the context of poverty reduction and social inclusion, often driven by a policy focus on the protection of vulnerable populations and sub-groups. Through the years, the work that they have supported has been key to strengthening informal sector scholarship and practice. Their 'social inclusion' framing of projects supporting informal recyclers and waste collectors has contributed to the growing focus and commitment to improving basic services and infrastructure in urban areas. Additionally, the link to poverty reduction stimulated projects and actions focusing on improving working conditions and social protections for vulnerable informal workers, along with specific interventions to encourage school attendance of children and discourage child labour. Especially in UN agencies like the ILO, the activities on the informal sector were taken up and framed as a social safeguards perspective critical to sustainable and fair solid waste management modernisation.

A less positive consequence of work supporting poverty reduction and human rights goals has been the assumption (gradually hardening into conviction) that waste picking should be classified as one of the worst possible and dirtiest forms of work. When 'we' visited landfills or saw dirty plastic packaging stored at the homes of informal collectors, 'we' were sure that informal recyclers would gladly take any other options. Fortunately, the techniques of participatory rapid assessment (PRA) have made space for 'them' to tell 'us' their opinions and preferences (Chambers, 1997). The ideas and priorities of informal operators themselves - especially in Latin America - changed the framing and moderated the missionary character of early advocacy on social inclusion. Still, the International Trade Union Confederacy (ITUC) commissioned a study on the IRS in 2014 and was deeply disappointed to hear that many waste pickers would prefer to continue doing recycling work - but with better prices (Scheinberg, personal communication). The issue of child labour is also a source of a certain level of fragmentation in the community of practice. For example, within the group of five authors of this article, there are quite different ideas about the prevalence and impact of child labour in the value chains – with some of us strongly advocating the elimination of all participation of children in recycling and others seeing it in the context of family labour not so different from the participation of farmers' children in milking cows or working in the vegetable garden. Child labour represents a particularly challenging issue when 'we' are from high-income countries with (close to) universal primary and secondary education and strong child labour laws, and the informal sector sees the participation of young people as perpetuating the family enterprise and also as a reliable generational strategy for moving out of poverty.

*Good practice in recognition and inclusion.* The Inter-American Development Bank has produced a guide for investment banks and other development institutions on including waste pickers in planning dumpsite closures, as well as participating in global and national decisions concerning dumpsite closures, offering them alternatives to putting them out of work and depriving them of access to the waste they eke their livelihood on (Cohen et al., 2013).

Several authors and activists have pointed out the environmental and resource conservation and system benefits accrued through the recapture of materials by the informal (and formal) sector and the reduced volume of disposed materials (Cointreau, 1987; Cointreau et al., 1984; Furedy, 1984; Medina, 2007b).

Action research and activism have opened some avenues for growing recognition of the role of the informal waste sector (IWS) and its contribution to urban sustainability and reduced greenhouse gas (GHG) emissions. In 1988, President Suharto of Indonesia declared that waste pickers contribute to the country's economy and should be recognised (Robinson et al., 1992). Up until 1987, waste pickers had been officially classified as *gandingan, that is*, people whose jobs 'are of an improper nature'. As such, they were often harassed and detained by City officials.

## Working with and for the informal waste and recycling sector

At the present time, there is a strong trend for scholars, researchers and activists to work with informal sector champions, letting union leaders and family enterprises take the lead and define the agenda. We define 'the present' as the period from 2010 to 2023 to reflect the period influenced by the introduction of the SDGs in 2015. We start the period in 2010, a year that marked both the publication of the GIZ informal sector study Economic Aspects of the Informal Sector in Solid Waste (Scheinberg et al., 2010a) and UN-Habitat's Solid Waste Management in the World's Cities (Scheinberg et al., 2010b). In some sense, we as an author's group, most of whom were involved in one or both of these initiatives, see 2010 as the year in which informal recycling activities became salonfahig (socially acceptable), that is, it became possible to talk about informal recyclers as a sector, with positive and negative impacts of those recycling activities. The ILO also had a key role in recognising and systematising the work of micro-entrepreneurs in the waste management service chain in African cities (ILO, 2017). We still consider this period to be 'current' because the ideas about the informal sector formed in this period are still the focus of much work in development cooperation, although the emphasis is shifting slightly.

The central question we seek to address for the 'current' period is how the literature and scholarship of this period have moved beyond the analysis and benchmarking of 'their' working conditions, livelihoods, professional autonomy and health and safety to activist scholarship and politics-focused supporting 'them' to address their priorities (rather than 'ours'). This means, in general, how we, as activist scholars, researchers and development cooperation professionals, support informal recyclers and waste management entrepreneurs through our work, also in terms of accepting their ideas of what is 'worthy' of study or publication.

We examine how informal workers' activism has influenced policymaking and how recent global policy initiatives geared towards solid waste modernisation and plastic pollution prevention have influenced informal sector activities and livelihood patterns. Our choice of these policy initiatives is influenced by what is present in the scholarly and grey literature (Cook and Velis, 2021; Gupta and Dash, 2023; Gutberlet and Carenzo, 2020; Rutkowski, 2020; Talbott, 2022; Talbot et al., 2022; UNEP, 2022; Velis et al., 2022). We further examine the current status of recognition, accommodation, support, inclusivity and integration of the IWS into formal waste management systems.

The experiences and lessons of the informal sector in geographies like Latin America, Southeast Asia and the post-socialist countries in the Western Balkans are important, as the informal sector there is significant, while the influence of the formal sector's municipal recycling - while growing - remains marginal (Scheinberg et al., 2016). The literature also confirms the observation that in many emerging economies, informal recyclers are the public 'face' of both the service chain and the value chains. In the absence of priced disposal or well-functioning landfills, street and dump pickers and IWBs are often the only stakeholders involved in the primary extraction and separation of recyclables. Similarly, in Africa, formal waste collection and street sweeping are frequently restricted to high-profit wealthy areas and expat enclaves, leaving informal or semi-formal operators to offer private services as the only option for door-to-door collection or street sweeping (Oduro-Appiah et al., 2019, 2020, 2021).

#### South-South co-operation

Starting around 2006, there have been increasing examples of South–South cooperation, including increasing examples of exchanges between different global regions. NGO activists and waste pickers from India, Egypt and South Africa – to name only a few – began to visit Brazil in cities such as Diadema and Itaúna. But of note was Belo Horizonte as destination of such visits to attend the Waste and Citizenship annual festival to learn about the Brazilian waste picker movement. They came to learn from Brazilian cities such as Belo Horizonte, Diadema and Itaúna, which had integrated waste pickers as service providers in municipal recycling systems. This created room for sharing and learning which inspired advocates in their own countries and also provided important validation to stakeholders working on these pioneering Brazilian processes (Dias, 2009, 2020).

Exchanges and co-operation exchanges strengthened workers organisations from different regions and helped them to create solidarity links which were crucial in the creation of the Latin American Waste Pickers Network, *RedLacre* (in Spanish and Portuguese). Events such as the *Waste and Citizenship Festival* served as an initial meeting place where they strategized about future Latin American conferences that took place in Brazil and elsewhere that were crucial for the creation of *RedLacre*.

Another South–South example was global support of waste picker organising in South Africa. Over a period of the 2 years, scholar-activists Sonia Dias and Federico Parra – respectively from Brazil and Colombia – and Poornima Chikarmane and Laxmi Narayan, activists from Pune, India visited South Africa to support the organising process lead by another scholar activist Melanie Sansom for the Department of Environmental Affairs. These exchanges culminated in the drafting of the South African Waste Pickers Integration Guidelines.

# Current status of the global informal recycling sector: Materials manager and sometimes change agent

In Brazil, Colombia and a number of Latin American countries, informal collectors of recyclables have won the right to formally organise themselves in cooperatives or recycling centres. Cooperatives fulfil many logistical, service and scaling functions of MRFs or sorting plants in high-income countries. In addition, they can serve as a platform to support individual collectors in providing recycling collection services to the municipality. Municipal governments also form alliances with cooperatives that work similarly to public–private partnerships and may enter into direct contracts with waste pickers cooperatives (Dias and Fernández, 2020; Gerdes and Gunsilius, 2010). In Colombia, organised informal collectors are entitled to a national-level diversion credit, an environmental service payment per tonne to individual recyclers for the environmental value of diverting waste from the environment and disposal facilities to the value chains.

At the time of this writing (in 2023), there are many interesting examples of formal stakeholders in Latin American emerging economies acknowledging and formally recognising the positive role of the informal sector, but – outside of Colombia – this is seldom if ever, accompanied by the monetisation of this positive contribution in the form of a diversion credit. The innovation of providing plastic credits is currently approximating the function of a service payment and would do so more robustly if the credit providers would work together to provide some consistency. As it is, more emphasis on documenting, understanding and building on existing informal collection and recycling systems remains a priority, along with inclusive policy frameworks and strategic planning for informal integration in modern municipal waste management systems (Olley et al., 2003).

#### Self-organising and political recognition in Latin America

In Latin America, until relatively recently, informal workers (usually employed) or operators (generally independent microentrepreneurs) - and especially women - were believed to be incapable of agency to organise themselves and seen as difficult to reach via classical labour organising strategies. This is sometimes attributed to informal collectors having mobile professions linked to physically dispersed workplaces often connected to their homes. Moreover, there is no clear consensus on what or who would fill such a role in the realm of an identifiable employer recognized by the rfrmal sector. This, combined with the exigencies of needing to collect materils daily, while having strong individual and family autonomy, the recycling sector's institutional culture of obsessive secrecy, and the feeling, in some countries and cultures, of social and cultural stigmas and barriers to working with waste, means that there are few clear models of successful organising strategies. Historically, waste pickers were invisible not only to city officers and waste specialists but also to labour movements and social scientists (Dias and Ogando, 2015).

Dias and Schmidt (1997) wrote one of the earliest studies on informal recycling workers organising and forming of Asmare, one of the first associations of waste pickers in Brazil. The authors documented how informal recyclers successfully advocated to be a recognised partner in municipal segregation at source in Belo Horizonte city – a success that achieved the status of an icon and an ideal for waste pickers organising in Brazil and elsewhere in Latin America (Dias and Schmidt, 1997). In Brazil, the cooperative model has been a feasible and accessible mode of organisation for waste pickers (Dias and Fernández, 2020).

As Dias and Ogando (2015) explained, the choice of cooperatives as an organising and operational modality has so far proved robust. Three mutually reinforcing socio-economic factors continue to contribute to the success of this strategy in the Latin American context, in several countries and specifically in Brazil.

- 1. The politico-economic attractiveness of cooperatives as alternatives to capitalist modes of production in the context of the 1980s recession.
- 2. The resurgence of social movements following the end of the military regimes in Brazil and other countries, and the re-democratisation that followed.
- The election of local governments aligned with a responsive political agenda supportive of claims for social justice.

These three factors, in the context of the political and economic resurgence of many countries in the 1980s and 1990s, have created an enabling environment in which waste pickers cooperatives have had the space to develop and thrive. In this landscape,

Colombia is perhaps the strongest example of the successful organisation of waste pickers and the mobilisation of both governance structures and the constitutional court to accelerate the institutionalisation of collectivism. The process of dump closure in the 1980s led to the displacement of dump pickers who took to street picking to earn a living. In this process, with the help of a Catholic organisation, they started to organise themselves to form the first cooperatives. By 1990, they had formed the Association of Waste Pickers in Bogota (ARB) and, a few years later, the National Association of Recyclers (ANR). The capital city and national associations share the goal of denouncing human rights violations, advocating for inclusive policies, organising the production of recycling and building the capacity of workers (Parra, 2020). As Rosaldo (2019) puts it, after being ejected from the dumps, they organised themselves into cooperatives, and when the police started to harass them in the streets, they organised themselves politically into a national association. The work of Fundación Social in this early period of organising was very important.

In the atmosphere created by the social activism of RedLacre (the Latin American Waste Pickers Network), Latin American social movements have spawned new or adapted forms of *worker organisation* that serve as important global models for other countries and regions. Since the 1970s, Sociedad Cooperative! de Seleccionadores de Materiales (SOCOSEMA), operating in Juarez, on the US–Mexico border across from El Paso, Texas, constitutes one of the most successful recycler cooperatives in Mexico, formed to counter the monopolistic influence of the medium- and large-scale buyers. By 2005, members were recovering 150 tonnes of paper, cardboard, glass, rubber, plastics, animal bones, organic material and metals daily, or nearly 5% of the waste arriving at the municipal dump (Medina, 2005).

The timeline in chronicles key historical events that have drawn political, economic and social attention to informal recycling in Latin America, dating back to the 1980s. It was not until the 1990s that practitioners saw a significant increase in interactions amongst organisations and national movements within the region; in 2005, the first meeting of the Latin American Waste Picker Network (LAWPN) was held in Porto Alegre, Brazil (Dias, 2009). Today, LAWPN unites waste pickers' organisations from more than 17 countries.

In the case of Brazil, an increase in organising is associated with the enabling environment created by the resurgence of progressive local governments in the early 1990s. Many researchers have noted that interactions between workers from different countries<sup>11</sup> have catalysed the organising process (Dias, 2009; Samson, 2009). The timeline in Figure 6, below, captures the growth of organising for Latin America and also the advances in inclusive policymaking.

A key gain for waste pickers globally in the city of Bogota, Colombia, occurred when the city government implemented a *diversion credit* payment system to recognize the environmental value of recycling and compensate informal recyclers for this value. The resulting system of per-tonne payments was made to ANR, the National Recycling (Waste Pickers') Association and other workers organizations (Parra, 2020; Rosaldo, 2019).

Following on the heels of Latin American examples, Pune, India has seen informal recyclers organised themselves through the SWaCH cooperative and were granted status of service providers (Chikarmane, 2012). In the Philippines, the Women



**Figure 6.** Inclusive recycling organising in Latin America. Source: WIEGO, used by permission.

Balikatan Movement formed many cooperatives in Metro Manila which provide collection of recyclables from households and schools. Cooperatives are able to access loans from the Philippines Department of Trade and Industry and from banks. This process of organising into cooperatives of waste pickers and itinerant buyers started in 1983 and has been providing steady income for workers, delivering raw materials to the value chain industries and contributing to cleaning the San Juan River and the streets (Medina, 2007b: 195).

Brazil has made considerable progress in recent years in recognising and integrating waste pickers. Since the early 2000s the country recognised workers in their National Register of Official Occupations with a specific designation as *Catadores de recicláveis* (pickers of recyclables) and recognised them in its 2010 Solid Waste national legislation as key actors in the recycling value chain (Dias and Silva, 2017; Bouvier and Dias, 2021).

Another noteworthy example is the inclusion of waste pickers as key actors in governance structures as the Brazil's multistakeholder platform *the Waste and Citizenship Forum*, which integrates government agencies, industry representatives, civil society and waste pickers' organizations in planning of inclusive recycling systems (Dias, 2020).

## Asia: strong micro-enterprise tradition, islands of organizing in some cities and countries

Prior to the 2008 World Conference of Waste Pickers, the global community of practice – advocates, action researchers and organisers took the initiative to identify, contact and support pre-existing 'islands' to organise waste pickers in Asia. Several robust and long-running organising initiatives were contacted in India. Researchers also contacted and met informal support organisations in the Southeast Asian countries of Indonesia, Cambodia, Philippines and Thailand.

In Asia, the 'we' who are outsiders often choose the form of an NGO as a vehicle for organising and supporting waste pickers sometimes directly, sometimes supporting their own initiatives. India stands out in the region as the place of many informal workers' organisations. The Self-Employed Women's Association (SEWA) in Kolkata was one of the first, and the anthropologist Dr. Christine Furedy shared their work and achievements through publications in the 1980s and early 1990s. One of the oldest waste picker organisations in India, the Pune (women) waste pickers union Kagad Kach Patra Kashtakari Panchayat (KKPKP), was founded in 1993. In 2007, they formed an operational cooperative, SWaCH, as a vehicle for contracting with the Pune Municipal Corporation to provide household waste collection services. KKPKP also has had a crucial role in establishing legitimacy and recognition for its members as recognised workers and in building consciousness of workers' roles and contributions so that its members can articulate their demands to government bodies and also claim certain types of public benefits in terms of health or schooling, based on the fact that the KKPKP members are performing a public service (Chikarmane, 2012).

NGOs supporting the IRS have a variety of motivations for doing so, sometimes working from a social solidarity mission, sometimes in service to fair and inclusive waste management, sometimes organising unions and working from and for a decent work framework. SEWA in Calcutta is one of several NGOs, such as Hasirudala in Bangalore and Chintan Environmental in New Delhi, that work with and represent waste workers. The Alliance of Indian Waste Pickers (AIW) has existed for over a decade and has been a significant force in building support for workers' organisations across the country through capacity building and mobilisation.

In this same period, organisations and initiatives in other geographies began to follow Latin American examples of supporting and empowering waste pickers. At the beginning of the 21st century, an NGO called the Women's Balikatan Movement founded the Linis Ganda programme in Manila, Philippines. Initially designed as a structured network of waste pickers and recyclable buyers employed by a specific intermediary in San Juan in 1983, the programme has now evolved into a system of cooperatives. As of 2005, there were cooperatives in all 17 cities and municipalities that comprise Metro Manila. In the programme, waste pickers - known as eco aides - follow predetermined routes to collect segregated recyclables from households and schools. These eco-aides are identifiable by their green uniforms and green pushcarts or bicycles. The programme currently comprises 897 intermediaries organised into 17 cooperatives and around 1500 ecoaides; their combined volume is 4000 tonnes of recyclable materials per month (Cointreau et al., 1984; Medina, 2005).

A far earlier Southeast Asian effort to support waste pickers involved intervening at the level of the Pelapaks, mid-level traders in the informal materials recovery system in Bandung, Indonesia. The intervention, which the Technical University of Bandung initiated, supported the creation of waste picker cooperatives. The intent was to take over the role of the Pelapaks and direct the profits away from 'the middleman' and towards the basis, the waste pickers (Versnel, 1986). This was followed by an effort of the Indonesian Ministry of Finance to develop enterprises for recycling and composting throughout the city of Jakarta. This initiative trained waste pickers and iterant waste buyers to supplement their recycling income with the sale of a soil amendment made from composted kitchen and garden waste. The project started with a research facility and moved on to provide operator training, access to financing and coordination with city planners to site operating facilities. The project worked closely with the City's waste management department to reduce the amount of materials going to temporary dumping sites within the city, thereby reducing the volume of material transported to the final land-disposal site outside the city (Robinson et al., 1992).

Later, in Southeast Asia, the MAP Foundation, an NGO in Thailand, was established in 1996 to further the rights of migrants from Burma/Myanmar working in Thailand. It focuses particularly on the labour rights of domestic, factory, construction and agricultural workers (Kabeer et al., 2013; Pollock and Lin Aung, 2010).

#### Informal Waste Activity in Africa

As reported by Godfrey et al. (2018), there has been much more emphasis on Africa's semi-formal micro-enterprise solid waste service sector than on informal recycling. Partnerships between community-based organisations, NGOs and micro-private companies in waste collection are the preferred institutional forms for inclusive waste management. Although men often form microenterprises, women are more likely to participate in the form of youth groups, community-based organisations and cooperatives in solid waste services in countries such as Mali, Senegal, Tanzania and Kenya.12 In South Africa, the cooperative model appears to have failed to yield good results (Samson, 2020a, 2020b; Sekhwela and Samson, 2020). Cooperatives are not always the preferred way workers want to organise themselves, and existing coops do not receive adequate support from municipalities to thrive.13 However, the NGO groundwork brought more than 100 waste pickers from across South Africa's nine provinces to the First National Waste Pickers Meeting to begin the process of promoting collective organising for securing their livelihoods (Samson, 2020a). In addition, the founding of the African Reclaimers Organisation (ARO) in 2018 has forged solidarity links between national and nonnational waste pickers and between dump and street pickers.

In 1981, a Zabbaleen Environment and Development Programme was initiated in Cairo, with funding from the Ford Foundation, the World Bank, Oxfam and others. These initial efforts led to the development of a small industries project designed to provide the Zabbaleen with new business opportunities related to their trade, a project to provide income generation opportunities and credit to women-headed households (Neamatalla, 1998). In 1989, an agreement between the Wahiya (who controlled the collection rights over garbage in Cairo) and the Zabaleen resulted in the establishment of new mechanised companies of waste collection (Environmental Protection Company (EPC)). The Wahiya contracted groups of Zabaleen to collect and dispose of MSW. Although the responsibilities for MSW have long been shared by the municipal sanitation service and the Zabaleen, the formation of the EPC established Wahiya and Zabaleen as key participants in the local government's programme to upgrade MSW management in Cairo (Assaad and Garas, 1993).

In 1997, the Bokk Diom Association was created by waste pickers at the Mbeubeuss landfill in Dakar, Senegal. But it was not until 2021, with the assistance of the ILO and WIEGO, that a formal cooperative was created for informal waste collectors to access formal recognition and help facilitate their social inclusion (ILO, 2021, 2023).

*Informal recycling and landfills.* Conflicts such as those around the Mbeubeuss dumpsite reflect a common pattern that is now very actively being replicated in the Western Balkans. A development bank supports closing open (often very badly operated) dumpsites and spreads the capital costs of building a modern sanitary landfill over a region with a larger population, consistent with the size of the investment and the facility. This leads to the eviction of dump pickers from the closed dumpsites. There are several fundamental (and frequently repeated) problems with this pattern:

- Closing the dumpsite is seen as an environmental gain, but there is little attention to social and environmental threats: without a local dumpsite, which serves as the 'right place' for waste to go, the waste is likely to be dispersed over the landscape and pollute air, water and land.
- The livelihoods of dump pickers are threatened when the dump closes, and the regional landfill usually has restricted access and is too far away. In many cases, particularly in Africa, this drives the dump pickers to pick on the street, creating a dispersed population that is much more difficult to contact or organise.
- Because a new controlled landfill is further away and more expensive to operate, the closed dumpsite may continue attracting waste, especially hazardous wastes that are not allowed at the new disposal site. To hide the fact that these closed sites are still being used, there may be open burning of the deposited materials at night and without any air quality protection.
- If the wastes reaching the closed dumpsite include recyclables, waste pickers may continue to operate at the old sites, often under worse economic and environmental conditions, without supervision and sometimes under the condition that they pay a municipal official for access and/or are forced to sell to employees and officials of the Public Utilities Company (PUC) for very low prices or, if they are allowed to sell to the value chains, they may have to give a share of the revenue to the PUC.
- Since dump picking is much more profitable than street picking in most countries, a forced shift to street picking also, in general, reduces waste pickers' abilities to feed their families.

Cohen et al. (2013) is one of the few publications on informal sector inclusion and modernisation that addresses this approach and provides clear guidance on how to include informal recyclers in decisions around dumpsite closure and modernisation.

## South-Eastern Europe: Investment pressure, many informal recyclers, limited formal services

In Balkan and South-Eastern European countries, in the shadow of the EU, the service chains are almost completely formal, and there is no informal service chain activity in waste collection or management of disposal – other than the fact that most street sweepers employed by the municipality are Roma women. Box 3 provides a case story of the role of informal recycling in reported recycling rates in Bulgaria. There are several forms of 'grey economy' cooperation between Roma informal recyclers and the service chain municipal PUCs. These range from toleration of dump picking 'in exchange for' unpaid services like gate control or burning over some part of the dumpsite (at the request of the PUC) or dump picking on demand so the municipality can report a reasonable amount of recyclables captured and sold to the value chains or the EPR system. **Box 3.** Informal recycling in Bulgaria – inside the European Union.

The Bulgarian Black Sea city of Varna reported a recycling rate of 27% in the period 2010-2015, largely attributed to the livelihood activities of the informal recycling sector. Most recycling in Bulgaria – even the tonnages reported by the EPR organisations - passes first through informal hands, as is the case in much of South-Eastern Europe. Informal recyclers are mostly individuals and family enterprises of Roma ethnicity; they collect or buy metal and cardboard to sell to small junk shops (Otkupljaci). The introduction of EPR in Bulgaria, in combination with the growing income disparity attributed to European accession, resulted in a wave of negative perceptions of informal recyclers and the closing of spaces for them to operate. For example, in the period 2015-2018, City governments in Sofia and Varna and other Bulgarian cities declared small junk shops, or 'first buyers', to be illegal and required them to relocate from residential neighbourhoods where their suppliers live to industrial areas at the edge of the cities.

In other EU and non-EU countries in South-Eastern Europe, the literature has documented the persistence of informal recycling as one of the only (semi-) legal livelihood strategies for women and men of Roma ethnicity. Many Roma settlements (the Mahala) are on or near a dumpsite. In the Western Balkans, GIZ and UNDP have supported publications that show that without informal recycling, there would be (almost) nothing for national governments to report to the EU (Scheinberg et al., 2018; Scheinberg and Savain, 2015).

Despite growing investment in modern landfills and EU-supported municipal recycling, informal materials recovery with direct sales to small junk shops (otkupljaći in Serbian) is the dominant form of recycling that is working in most of the 'new EU'. Estimates are that informal activities are the source of most of the recycling in South-Eastern Europe and pre-accession countries like Serbia, Albania and North Macedonia, as reported to EU authorities both by EPR systems and by environmental ministries. The reasons for this are not only complex but also typical for emerging economies worldwide.

Following is a short explanation, distilled from years of experience of the authors, that explains typical perverse incentives in the formal and informal recycling landscape in emerging economies in Europe and is also widely applicable to emerging economies elsewhere (Scheinberg et al., 2015, 2018, 2022).

- Modernisation of the formal solid waste and municipal cleaning sector is proceeding more slowly and in response to different kinds of drivers than were typical in the first wave of modernisation' in high-income countries. The most important difference is that national and regional authorities will seldom (if ever) charge for disposal, because of the political consequences.
- There is no tradition of charging for disposal (or other public services). Providing good services is one of the main reasons citizens vote for public officials. So, the last thing that politicians want to do is introduce user fees,

especially at a time when prices are rising, other public services like transport are becoming more sober and more expensive, and service users are losing the convenience of having 'free' access to local dumpsite that takes all of their waste.

- As long as disposal is not priced, recycling represents an extra expense for the PUCs rather than a financial incentive based on diversion from disposal. It detracts from their ability to perform their core operations of cleaning, collecting, disposing and maintaining streets and roads.
- Recycling is not part of their expertise nor their formal mission. So, they do not want to expend staff time and energy on this, but they do have to report on recycling rates to the EU. In this situation, tolerating (even encouraging) dump and container picking and hearing from the informal sector what has been captured allows formal authorities to report the quantities recovered by the informal collectors and use these as the basis to report their recycling performance to the EU.
- Local authorities also have no real incentive to develop their own recycling, since it is an extra expense. As a result, there are many documented instances of waste pickers being informally (and with full deniability) engaged by PUC personnel to pick waste from closed municipal dumpsites, and/or to burn over the closed dumpsites and to take the blame for the burning.
- As a result, dump pickers are neither legal nor illegal, neither formal nor informal, with no clear benefits to be gained either from organising or exiting and with little likelihood that local or national governments will be interested in their problems.

In contrast to Latin America, Africa and South Asia, there is little tradition of waste picker self-organising in South-Eastern Europe. A waste pickers syndicate formed in Serbia around 2007 and occasionally recognised by some Serbian governments in the intervening years, exists on paper but has in practice no members or activities. A recycling centre in Niś, Serbia's second city, was set up in around 2010, and sought to copy the models of Latin American cooperatives existed between 2012 and 2020. It does not function anymore; one of the founder-leaders is deceased and the other is no longer active (Scheinberg et al., 2018). Although there are well-supported estimates that there are thousands of waste pickers in the Western Balkans, there is no tradition of organising, leadership or solidarity. As a result, integration and legalisation interventions seldom survive to the end of the project that (re-)finances them.

The parties that might successfully intervene are the value chain buyers, but up to now they have not taken any initiatives. In the Balkans, therefore, there is not much basis for formalisation or legalisation, as there is neither a 'we' (donors, researchers, advocates, project initiators) nor a 'they' (women, men, and youth informal recyclers and small junk shop owners) who find that organising, legalisation and formalisation would be a priority.

#### The informal service chain and EPR in Africa, Asia and Latin America

Extended Producer Responsibility (EPR)a policy that holds producers responsible for the management of their products throughout their life cycle, including after they are no longer in use. For real, sustainable and respectful inclusion of the informal recycling sector, participation of waste pickers and informal operators is necessary at the decision-making level; their knowledge, experience, insights and ideas are the most reliable building blocks for an inclusive recycling system. Those of us working in this space understand within a Circular Economy paradigm that we need to consult with the isector across the entire material value chain, from product design to end-of-life. Perhaps this is why GlobalRec, the International Alliance of Waste Pickers, representing more than 8 million people involved in the informal waste and recycling sector, has elaborated its international declaration stating unequivocally that 'no EPR system can be just, effective or socially inclusive without the participation of waste pickers and their organisations. EPR that excludes waste pickers is an unjust and unfair appropriation of waste pickers' knowledge and innovation, an abuse of our rights that will push us to the fringes and dispossess us of our material and intellectual wealth and property, and our basic sustenance' (statement part of the policy declaration of the International Alliance of Waste Pickers). The declaration calls for the informal sector participation in EPR under conditions of dignity and recognition as legitimate actors, partners and protagonists (Talbot et al., 2022).

The Latin American approach to inclusive EPR recycling focuses on supporting value-chain informal recyclers to occupy specific niches in the collection of recyclables in support of compliance with EPR schemes. In Africa, as in Asia, there are also some opportunities for informal recyclers to supplement their trading income by drawing upon diversion credit or other incentive systems that compensate the informal collectors for reporting and providing traceability.

In Latin America, the product stewardship (PS) organisations go by the name CEMPRE<sup>14</sup>. The CEMPRE organisations in Brazil and Colombia have established pathways for powerful and organised informal recyclers to cooperate with equally powerful producers and business partners. The waste pickers receive some form of transfer payments based on the being recognised and lightly compensated for providing collection services and traceability in voluntary or mandatory EPR<sup>15</sup> schemes. CEMPRE in Brazil works slightly differently: 'Brazil implemented a Reverse Logistics approach enabling sector agreements in which the industry needs to meet environmental and social goals by designing programmes to support workers cooperatives with infrastructure, capacity building, payment for services' (Rutkowski, 2020; Zisopoulos et al., 2023).

In Africa, recognising and including the informal service sector in formal waste management is at an early stage, except in South Africa, where Linda Godfrey of CSA and Mel Samson of WIEGO have been supporting and documenting informal activities and earning models for about 20 years. Through the work of In 2018, Nigeria developed an EPR and Informal Sector Inclusion policy with a focus on electronic waste (E-waste), followed by Uganda with its National Environment (Waste Management) regulations with the aims of enabling the enforcement of EPR and product stewardship to create an opportunity to include the IWS in the collection of recyclables.

South Africa is one example of a country that has been experimenting with inclusive EPR for more than 10 years (Godfrey et al., 2016). As long ago as 1993, a South African steel producer, Arcelor Mittal, started a private-to-private tin (steel) can recovery initiative called *collect-a-can*. This initiative encouraged informal recyclers and others – from school children to treasureseekers – to collect aluminium beverage containers (ArcelorMittal, 2012). South African industries and their trade associations have developed several EPR models designed to evolve over time.

In South Africa, waste pickers must be compensated for the resource value of the materials they salvage (globally referred to as the *market price*), for collecting recyclables, and for the economic and environmental benefits and savings they generate (globally referred to as a *diversion credit*). In 2021, the rules of the mandatory EPR system for packaging required the PROs, the producer responsibility organisations, to be involved in collecting a fee from producers and using this to pay a collection service fee available to all reclaimers registered on the national registration database (Pholoto and Chuitaka, 2022).

Before 2017, some materials were sold to recycling companies in China and India for input into manufacturing. However, this has changed since the China National Sword in 2018 (Simpson, 2019) and parallel developments in India. The new rules require buyers to introduce tighter specifications on allowed contamination levels for imported secondary materials. In South Africa, as well as elsewhere in the world, this has had the effect of significantly restricting the market value for low-value recyclables. In combination with the impacts of the COVID pandemic, causing steep price increases in container transport costs, the conditions are now more restrictive in relation to all processes of export of recyclables. However, as South Africa's existing EPR schemes had already invested in developing local end-use markets, these changes have had a limited effect on waste pickers in that country (Godfrey, 2021).

Asia: Focus on ocean plastics and EPR in ocean plastics hot spot countries. Due to their widely reported contributions to ocean plastics pollution, the long coastline countries of India and Indonesia, and to a lesser extent Vietnam and Thailand, have become the focus of global attention to the fact that many singleuse and non-recyclable plastics are ending up in the sea. The global brand-holders have created several financing mechanisms to stimulate plastics recovery, perhaps as a way of diverting attention from their own roles in producing and distributing nonrecyclable and single-use packages that are found in the 'plastic soup'. This has stimulated both publications and projects on the informal sector's role in these countries as an ingredient of a sustainable and effective solution. As a result, in the last 3-5 years, there has been a kind of rush to contribute to eliminating, preventing and managing ocean plastics in these countries. One result has been massive donor funding for solid waste improvement, EPR systems, plastic credits, CE, digital tracking tools and support for informal recycling. Their impacts on the informal sector up to now appear to have been both localised and minimal, despite the fact that NGOs working with informal recyclers have benefitted, and there has been some good work done on solid waste system planning. According to the authors of this article, despite the elevated level of research, documentation and scholarship in the last 5 years, it is still too early for clear conclusions about the (current or potential) contribution of informal recyclers and ISPs either to the problem or to finding structural solutions.

In Asia - as in much of Latin America - the spread of legislated EPR or voluntary product stewardship initiatives of consumer goods companies under the pressure of upcoming EPR legislation - has created new opportunities for the informal sector to recover and market traditional value chain recyclables. The discussion about plastic credits and voluntary plastic take-back mechanisms, stimulated by the current levels of industry, NGO and government concern about marine litter prevention, has created some new initiatives and modalities for plastic waste capture, recovery and (sometimes) recycling, many seeking to involve the informal sector. Chapter 5 of the OECD Updated EPR guidance from 2016 provided an inventory of how the informal sector participates in existing EPR and PS systems in several emerging economies. Additional recommendations, analyses and examples have been published in the following years in the PREVENT Waste Alliance EPR toolbox by ENDA/GIZ and WIEGO (Talbott, 2022).

Development cooperation and the emergence of organising and solidarity networks. Latin America led the rest of the world in seeing the connections between politics and informal recycling and in shifting from a 'working on' to a 'working with' and even 'working for' framing of activist participatory research and organising. The founding of a global network of informal recyclers (GlobalRec) signalled this shift and was championed by Dr Laila Iskandar at the 2006 meeting of the CWG in Calcutta, India (Dias and Scheinberg, personal communication, https://globalrec.org/).

Early forms of 'working with' and 'working for' often took the form of consultations with informal recyclers. Using respectful action research techniques and open discussions, World Bank researchers invited informal recyclers and workers in the district of Bethlehem and Hebron in Palestine to give their preferences about what alternatives they would consider for work, as the Hebron landfill was going to close. Individual dump pickers gave their preferences and chose the alternatives offered to them. Their answers depended on age, sex, education and social circumstances (and presumably also their skill and earning capacity as value chain operators). About 20% of the waste pickers - mostly older and younger people - accepted what we could call a 'supported exit'. Some older men agreed to stop dump picking in return for receiving livestock (goats) that would provide them with an alternative livelihood. Some younger men (and perhaps also women) agreed to stop waste picking if they would receive financial support to return to university or school. Another 20% of the picking population - generally younger and less experienced in trading - agreed to take paid employment from the solid waste authority and stop their independent waste picking activity. For purposes of this article, one of the most interesting outcomes was that 60% of the pickers preferred to continue their work as dump pickers, if possible and allowed (Cohen et al., 2013; Scheinberg and Savain, 2015).

A study by ACEPESA (Costa Rica) for the Inter-American Bank for Reconstruction and Development (IBRD, or BID in Spanish) analysing the value chain operators in Central America also provided important insight into preferences. Researchers spoke with members of Red Nica, the Nicaraguan network of informal recyclers, as part of an initiative to provide them with a social safety net package of medical insurance and other benefits, such as pensions. Quite a lot of the pickers, while enjoying and using the benefits, complained because their cash earnings went down, even though their social protections became stronger (Lobo et al., 2015)

A waste planning study in South Africa by a private waste management company interviewed 500 informal sector workers in Johannesburg, South Africa. Even though the average monthly income was only R1000 (\$143), over half of the sample had been collecting for 2–4 years. About 85% of respondents intended to keep collecting material, whereas 63% of them thought it was a good way to make a living. The majority of respondents (52%) said they would appreciate intervention from recycling and waste collection companies to improve waste collection in South Africa. More than 30% of all the respondents stated they needed assistance in areas that have to do with personal safety and health (Thusano Market Research, 2012).

# Informal recycling, reuse and repair, and the Circular Economy

The Circular Economy (CE) concept started to influence particularly recycling policy in 2014 with the European Circular Economy Strategy. Despite multiple definitions and unclear metrics (Kirchherr et al., 2023), and also with few usable benchmarks and metrics (Kapoor, 2021; Kapoor et al., 2023), the CE is perhaps one of the most influential sustainability initiatives of the period of this writing (in 2023).

Informality in the landscape of the CE has received less attention than might be expected, but by almost any definition, formal and informal activities in maintenance, repair, second-hand trade, refurbishing and even renting or platform-sharing processes all fall within the overarching CE landscape (Figge et al., 2023; Kirchherr et al., 2017; Scheinberg et al., 2024). Collecting waste, recovering recyclables from waste streams, dismantling and repairing electronic waste, pre-processing plastics and returning them to the recycling economy, informal recyclers have indirectly become integral contributors to the CE (Gutberlet and Carenzo, 2020; Gutberlet et al., 2017; Kirchherr et al., 2017; Oduro-Appiah et al., 2020; Velis, 2017).

In the global south, especially in South Saharan Africa, the informal recyclers in the value chain have become the principal promoters and implementers of recycling and the CE (Gall et al., 2020; Godfrey et al., 2018). This is true even in cities and regions where the CE concept is not yet widely accepted or operationalised as a policy or practice driver (Velis, 2017). Despite their close connection to recycling on the ground, the inclusion of informal operators and workers in the development or implementation of CE policies has been limited (Ferronato et al., 2019). Neither governments nor the private sector are on record as having made practical efforts to lower the barriers to access to materials for informal operators nor to support the informal sector to have rights to decent working conditions (Aparcana, 2017). Nor have there been clear policies proposed to cities, regions and countries that would serve to regulate and improve the quality and revenues of their recovery and recycling activities (Ferronato et al., 2019; Rutkowski, 2020; Velis et al., 2022).

Even in Latin America and Asia, where NGOs and the private sector have made continuous progress in implementing policies to promote inclusive recycling and waste management decades, the commitment to include informal operators and ensure that they benefit from practical CE measures is rare and generally missing. To be able to achieve a CE, stakeholders in the global south may have to develop their own ideas about investigating, recognising and supporting circularity and micro-private circular processes in their cities rather than listening to politicians touting the benefits of the CE (whatever that means and however it is framed) without any identifiable or tangible forms of support that would benefit the micro-private enterprises and unprotected workers in the informal service and value chains (Ferronato et al., 2019). There are many and varied options, especially for emerging economies, as well as high-income Asia, Oceania and the global North, to unleash further their potential towards waste management modernisation and an inclusive CE (Navarrete-Hernández and Navarrete-Hernández, 2018; Velis et al., 2022).

Recent developments around EPR systems, plastic credits, CE and digital tracking tools and their effects on the informal sector have received attention and some consideration in a variety of geographies. Even when these lead to practical action (which is rare), up to this point, no clear conclusions can be drawn despite the elevated level of research, documentation and scholarship in the last 5 years. The institutionalisation of the CE as a policy initiative has yet to be systematically analysed, and this is a precondition for determining how such policies will (and/or already have) affected the informal sector on many levels.

## 'Integration' of the informal sector in development cooperation and supporting research: Initiatives recognising, strengthening, legalising, formalising and including informal operators

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is perhaps the foremost member of a small but significant group of donors and international organisations that have, as a group, financed and contributed to conceptualising, researching and working with and on the informal sector. Other key stakeholders in this institutional space include the ILO, UN-Habitat, Swiss Development Cooperation, the (former) Dutch Directorate General for International Cooperation (DGIS), the World Bank (WB), the Inter-American Development Bank (BID), the International Finance Corporation (IFC), the OECD and Japanese International Cooperation Association (JICA). Among international organisations, WIEGO, the International Solid Waste Association, GAIA and Zero Waste International - and since 2010 ISWA, the International Solid Waste Association have been involved in (action) research, advocacy, the solidarity economy and direct support to informal organisations and their advocates as have several national organisations in emerging economies. These institutions deserve credit for supporting the authors and organisations who have produced the documents listed in this retrospective.

GIZ has a long list of projects, publications and interventions supporting informal recycling, informal value chains, informal e-waste valorisation and related topics from about 20 years of development cooperation interventions. Many of the publications are products of a sector project focusing on conceptual work, studies, networking and mainstreaming of approaches regarding informal sector integration. 'Economic Aspects of the Informal Sector in Solid Waste' ('the informal sector study,' cited here as Scheinberg et al., 2010a) represents one of the first studies that looked at informal recyclers as part of the solid waste system in the cities where they are active.<sup>16</sup> This research was an important milestone for understanding the role and importance of informality in the value chains and solid waste services. It has created the basis for a focus on integrating the informal sector in several development cooperation projects, many of them in emerging economies ranging from Mexico to Serbia.

Working with the informal sector is complex and time-consuming, and time-bound donor projects are not a perfect match for creating sustainable system change, although they often are critical in opening spaces for dialogue and giving informal operators recognition and self-confidence. Physical system interventions such as building a materials recovery facility or organising a recycling transfer station operated by the informal sector are the easiest for donors and national governments to understand but may be difficult to sustain once the project period is over (Scheinberg et al., 2010b). Changes in informal recycling practices promoted by NGOs and donors as a means to improve working conditions, reduce negative environmental and social impacts or recover additional waste fractions are important game changers and build both capacities and self-confidence of the informal workers and operators to engage with formal authorities and frame positive change. Even when specific initiatives or projects stop, such interventions are often welcomed by waste pickers and move them – as a group – closer to social safety nets and labour protections, even when the new activities and business models are not immediately sustainable in the short term.

One of the lessons from donor engagement with informal operators is that - with some exceptions - the most important standard of improvement is calculated in terms of liquid cash income per day. Subsistence entrepreneurs - whether they are sweeping streets, collecting recyclables or removing waste count on cash income so that they and their families can eat. Even when donor interventions appear to be demand-driven – such as providing tricycles or storage sheds, motorised collection vehicles or processing equipment - the informal operators may underestimate the financial and time burden of new practices, or the cost of maintenance, or (e.g.) the need for drivers' licenses or vehicle registration. Thus, the vehicles or processing equipment or uniforms are welcomed, but the practicalities and exigencies of livelihoods at the bottom of the pyramid may result in their being sold or used for some other purpose. This may look like corruption or project failure to the donors, but it can best be understood as a consequence of extremely lean micro-business models with insufficient resilience, capacities or incentives to take the risks of adapting tried and true practices.

Sometimes, such failures have to do with unexpected or insufficiently explained operational costs associated with the donations, which the micro- or family enterprise business models cannot sustain. Something like this has been happening since around 2005 with groupes d'înterêt économiques (Groups of Economic Interest, GIEs) in West African cities like Bamako and Dakar. A broadly shared ambition to motorise waste collection by providing small Chinese tractors and eliminate animal traction of collection vehicles using donkeys seemed like a win-win idea in the period between 2005 and 2015. What happened is that neither the users of the collection service nor the municipal officials would allow the GIEs to raise their collection tariffs to cover the fuel cost. The business model anchored in local prices of feeding donkeys as the main operational cost was not robust enough to purchase fuels whose prices are globally determined. The innovation of motorised transport failed - at least in the short term because there was not enough willingness or ability to pay to sustain the additional operational costs. This is a good example of how well-founded changes that appear to create real improvements often disappear at the end of the project (Anne Scheinberg, former project leader, Urban Waste Expertise Project (UWEP), Waste Advisers, www.waste.nl).

Successful donor-financed interventions are often based on choosing strong partners active in their own countries, in combination with long-term support for trust building, organisational development and strong partnerships with either public authorities or private business partners who have a genuine interest. One of the most interesting project-based interventions in this landscape was the GIZ support to Gerdau Steel in Mexico and Brazil, which co-financed a programme for Gerdau to strengthen its supply chain of small informal and semi-formal value chain scrap metal enterprises and workers and introduce better practices in Gerdau's ferrous metal value chain. The goal was to strengthen these supply chain partnerships and provide technical and managerial training to informal stakeholders, build national and regional organisational structures, monitor the impacts of the intervention via non-profit intermediary organisations and integrate scrap metal collectors into the supply chain of large formal industries in the metal value chains.

The strategies adopted by development cooperation agencies like GIZ usually depend on the specific situation in the countries where they occur. In the most successful projects, all stakeholders are invited to share their goals, views and opinions. Project staff consider the character and culture of the informal sector activity and also take care to include governmental/public views on the informal sector and the interests of a variety of recycling and waste management stakeholders in the specific country.

In India, GIZ has focused strongly on the informal e-waste value chains due to the interest of public authorities in reducing the negative health and environmental impacts of certain practices and the resulting tendencies to drive them out of business. In Egypt, the support to the Zabbaleen has usually had the focus on improving the living situation and urbanisation in informal areas, and at the same time by formalising informal plastic recycling jobs, as this was of interest to the Egyptian Economic Development Ministry's goals for job creation (Ellen Gunsilius, personal experience at GIZ).

In countries where informal sector stakeholders are of a politically undesirable minority, such as in the Western Balkans where most informal collectors belong to the severely disadvantaged Roma minority, the focus of informal sector 'integration' or 'formalisation' may require more general types of social and economic support, such as:

- Supporting school leavers to return to school
- Connecting informal workers to supporting NGOs
- Facilitating (or requesting) the formation of representative structures
- Providing social support measures like health services
- Supporting additional or alternative income-generating activities
- Improving transparency in relation to material prices and purchasing specifications
- Organising stakeholder dialogues with local governments, banks, citizens and other stakeholders (Scheinberg et al., 2018).

From 2012 on, GIZ and others increasingly took up the topic of integrating the informal sector into EPR and product stewardship systems, in combination with advice to national EPR regulations or roadmaps on e-waste or packaging. This resulted in a specific chapter on the informal sector in emerging economies in the

OECD guidance on EPR (OECD, 2016), as well as modules on informal sector integration in the EPR toolbox published by the PREVENT Waste Alliance (https://prevent-waste.net/en).

Informal operators have shown themselves to be dynamic and capable of ingenuity and flexibility, and in some cases demonstrating successful transitions from informal to formal systems. As long as the donors or initiators (from outside or inside the informal sector) understand that maintaining current (pre-project) levels of daily cash income is a condition for sustainability, these interventions have the potential to introduce sustainable improvement. The key is giving the informal workers and operators a deciding voice in choosing what to do and how to organise it while respecting the exigencies of their cash-based daily income needs.

## Where are we going: A look forward into the future

An important question for this article is whether the condition and position<sup>17</sup> of the informal sector is in improving, or whether informal operators are losing ground. From the point of view of the authors, although there have been some gains in voice and recognition, most informal sector members worldwide are still impoverished and socially marginalised. They still face discrimination from government and society (Bermudez et al., 2019), as well as the probable decline in access to waste materials and in market prices of secondary materials (Steuer et al., 2018). They are exploited by politicians, the private sector, some NGOs and criminal gangs (Velis, 2017). At the same time, those in the informal sector are making a living and feeding themselves and their families and are reluctant to lose their power and autonomy to do so. And that autonomy - especially for dump pickers and other occupations - is increasingly under threat. Let us look a bit more in detail at what we, as members of the community of practice, think the future will hold.

## Valuing the work of the informal sector in integrated waste management systems: The role of ISWM, economic metrics and avoided disposal cost

In the period since 2010, an array of economic, social and governance (ESG) metrics have been used to quantify both negative and positive economic, social and system impacts of private informal activities in solid waste and recycling. Value chain activities to recover and *valorise* (restore economic value to) materials are a source of direct economic benefit to the informal workers and operators who participate in this sector. They are also associated with the creation of indirect benefits to the city, the environment, the business climate and the living environment.

During the research for *Economic Aspects of the Informal Sector in Solid Waste*, study participants were, for the first time, confronted with the fact that informal recycling was creating significant *positive economic externalities* for municipal authorities. The municipalities were enjoying economic, climate and operational benefits (to the solid waste and urban sanitation system) because informal recovery activities were measurably reducing tonnes of materials requiring disposal, diminishing the  $CO_2$  footprint of the solid waste system and improving performance of disposal facilities (Anschütz et al., 2004; Chaturvedi and Gidwani, 2010; Medina-Martinez, 1997; Scheinberg, 2012b; Scheinberg et al., 2010b). Considering the impact profiles of the examples summarised in Table 3, one would expect it to be a political priority of every city to work together with the IRS for the benefit of both the city and the recyclers.

The WABIs and the benchmarking of effective, transparent, fair and cost-effective waste management. The WasteAware Benchmark Indicators (sometimes abbreviated as the WABIs) were elaborated by David C. Wilson and his associates, combining the framing of Development Drivers with the ISWM metrics used in Solid Waste Management in the World's Cities (Scheinberg et al., 2010b; Wilson et al., 2012). The WABI Indicators associate the public health driver with the benefits of waste collection to the living environment and business climate. The WABI public health indicator measures the percentage of a city's area with waste collection. Similarly, the environmental indicator looks at the extent to which disposal facilities exist and are controlled. Controlling disposal refers to a combination of technical and institutional measures taken to manage a disposal site, most of which have the goal of prohibiting the deposition of hazardous materials, decrease the contact of waste (and its hazardous components with water, and prevent migration of waste into the air (via burning or wind) into water (via leaching into groundwater or being carried by water to rivers and the sea). Limiting or preventing groundwater pollution is the key environmental benefit of controlled disposal. The third major physical system indicator is the objectively measured rate of recycling, based on the weight of materials recovered and recycled - measured directly in tonnes or kilos or as a percentage of total waste generated and disposed of18 (Wilson et al., 2012).

Since the informal sector plays a significant role in materials recovery, early work on the informal sector focused on the environmental and resource benefits of their activities (Scheinberg and Simpson, 2015; Scheinberg et al., 2010b; Wilson, 2007; Wilson et al., 2012, 2015a). The benefits to residential neighbourhoods of informal and semi-formal micro-enterprise collection and sweeping by informal micro-enterprise waste service providers create a second stream of value, that of clean cities and good living and business climate. Informal service delivery is highly developed in French West Africa, where micro-enterprise collection is a micro-enterprise activity of the GIEs. Microservice provision in English-speaking Africa received a great deal of support from programmes of the ILO in Dar es Salaam, dating back to the early 1990s, as reported in the work of Dr. Alodia Ishengoma (Ishengoma, 2005; Ishengoma and Lyimo, 2002). In the Accra metropolitan area, more recent analyses and literature dating from 2010 or later have elaborated the concept and measured the positive impacts of recognition of the informal sector (Oduro-Appiah et al., 2019, 2020, 2021).

Economic metric or benchmark	Positive/benefits	Negative/costs	Sources
Income	Many people can earn a living – earning as much as three times minimum wage, and feed their families, even if they are from a disadvantaged minority, are stateless or homeless and/or have minimal education or other difficulties finding formal employment	Informal activities often occur in neighbourhoods or at home and may have negative health impacts or be considered a nuisance	De Kock (1987), Robinson et al. (1992), Fahmi and Sutton (2010), Parsons et al. (2019), Scheinberg et al. (2010a), Sarkar (2003), Beall (1997)
Social services	People involved in waste picking might otherwise be claiming social payments or other kinds of financial support from the government		
Generational social mobility	Some sources suggest that dump picking, usually the most profitable form of waste picking, provides impacts that can have generational impacts, leveraging families into the middle class	Dump picking is dangerous and dirty work, and some sources report control by mafia-like informal cartels	
Waste system functioning	Higher levels of recycling and recovery than the formal waste management sector, combined with lower operating costs	Recovery can be at the cost of safe work and social protections	Chen et al. (2018)
Net system benefits	Net benefit for the informal sector was approximately 130 million Euros attributable to the work of 73,000 informal sector workers		Scheinberg and Simpson (2015), Scheinberg et al. (2010b)
Net system savings in disposal costs	Nanjing (China) estimated the recyclable material collected annually by informal waste pickers to be about 505,000 tons, which saved an annual MSW disposal cost of about \$17.6–22.0 million.		Chen et al. (2018)
Benefits to host cities	Pune, India, waste pickers' work within an integrated waste management system led to a reduction in the cost of waste management for the municipality by up to 37%, based on a calculated 27% diversion from (landfill) disposal, which saved Pune's Municipal Corporation \$13 million in 2018. This is based on 3500 waste pickers handling 1000 tonnes of waste every day and recycling more than 70,000 metric tonnes of materials a year		Parsons et al. (2019), Bhada-Tata (2010), Wilson et al. (2012); www. swachcoop.com

Table 3. Some examples of positive and negative impacts of informal activity in cities.

Source: Elaborated by the authors, recently and during the research and analysis for *Economic Aspects of the Informal Sector in Solid Waste*, in the periods 2006–2007 to 2009–2010 (Scheinberg et al., 2010a).

*Current monitoring and support initiatives*. In an attempt to understand the role of the informal sector in relation to the triple planetary crises of climate change, pollution and loss of biodiversity, the *Informal Economy Monitoring Study* presents findings across five cities in three continents. This study shows that waste pickers are principal stakeholders in formal solid waste and recycling systems, primarily in low- and middle-income countries, but often in high-income country cities as well, ranging from New York to Singapore. Informal recycling activities are key suppliers to the recycling value chains and provide critical inputs to the formal economy (Dias and Samson, 2016). Two examples are noteworthy: in Cairo, Egypt, waste pickers' partnerships with formal waste management companies led to an increase in their income by up to 140% and an improvement in their working conditions. In São Paulo, Brazil, waste pickers' cooperatives provide employment and income for around 20,000 people and contribute to the diversion of around 90,000 tonnes of waste from landfills each year (Ramos et al., 2018).

Informal contributions to improving solid waste performance: Controlling disposal, avoiding pollution and limiting GHG emissions. Starting around 2010, the idea that formal waste management systems can benefit from the knowledge and expertise of informal recyclers and informal waste management workers has been gaining ground. Still, debates continue as to how to choose the most effective paths to integrate informal workers into formal waste management systems while ensuring fair compensation, adequate working conditions and social and life cycle protection (Medina, 2011; Wilson et al., 2012).

The common denominator and driver for modernising formal solid waste management in high-income countries, emerging economies, small island developing states and the poorest economies is the prevention of groundwater pollution, with eliminating uncontrolled disposal and keeping cities waste-free as strong second and third motivations. Modernisation is a multi-step process, but all steps have in common that when they are well done, the real cost of (safe and environmentally friendly) disposal increases: the cost of disposing of waste in a controlled landfill ranges up to US \$50-75 per tonne, whereas open dumping in an uncontrolled dumpsite appears (to the users) to be 'free'. This is where the impact of the IRS comes into the picture because when disposal is priced, every tonne which is diverted from whether by formal municipal recycling systems, EPR packaging recovery or composting or animal feeding or allowing dump picking - represents a savings. And informal recovery saves just as much as formal recovery.

Upgrading uncontrolled (open) dumpsites to become controlled landfills, which concentrate waste and prevent it from entering groundwater, represents clear environmental improvement over uncontrolled disposal and prevents landfills from emitting methane, a key GHG. Research in the early 20th century showed that the recycling performance attributable to informal recyclers positively mitigates GHGs (Gupt et al., 2007; Simpson and Dulac, 2005). A study in Buenos Aires, Argentina, showed that waste pickers who collect and recycle paper prevent around 110,000 metric tonnes of CO<sub>2</sub> equivalent emissions per year (Gutberlet et al., 2017). In Belo Horizonte, Brazil, the application of a lifecycle analysis to aluminium can production confirmed that the waste pickers who collect aluminium cans prevent approximately 2000 metric tonnes of CO<sub>2</sub> equivalent emissions per year by diverting those cans from disposal (Fuss et al., 2021).

Modernisation of the waste sector often begins with covering the dumpsite: that is, introducing the practice of spreading daily cover on landfills. In cities, a comparable development is retrofitting conventional urban waste incinerators for dust and smoke control. Both of these approaches offer immediate and popular improvements in terms of reducing odours and preventing water infiltration and smoke pollution (Wilson, 2007). Diverting surface water to run around the perimeter of the dumpsite, rather than into it, provides additional benefits in terms of reducing the potential for water, soil and air pollution. These are widely advocated as a significant first step towards sound environmental control (Whiteman et al., 2021). Introducing controlled disposal usually includes ensuring that the disposal site has some or all of the following features:

- Perimeter fencing
- Staffing (a real person on the site at all times that it is open)
- Gate and access control
- Diversion of surface water from flowing into the site
- Limited opening times and prevention of access and dumping outside of opening times
- Personal safety equipment for workers
- A weighbridge (scale and scale house in American English)
- A filling pattern, meaning that users are instructed where on the site they can deposit waste
- Operating practices (such as daily cover) to reduce emissions
- A plan including instructions and restrictions for both users and inspectors, as to what wastes may be discharged, where, when, how, under what conditions, by whom and at what cost

A key reform associated with the environmental driver is *the pricing of disposal, which makes waste generators responsible for the costs of disposing of* these valuable resources in the ground or incinerating them (Scheinberg, 2012a). When disposal is priced, recycling and composting represent win–win activities, creating fiscal and economic benefits through the economic driver of 'avoided disposal costs' for cities, and in conjuction with the employment, environmental and public health benefits (Robinson et al., 1992; Schall et al., 1987; Simpson, 1993; Simpson et al., 1988) and in this situation, there is a strong motivation to include and recognise informal as well as formal recycling in the formal waste system (Wilson et al., 2009).

Other important benefits of informal (or formal) diversion relate to diminished methane emissions associated with increased levels of collection and controlled disposal. Uncontrolled decomposition of organic waste in landfills produces methane, a potent GHG; methane formation is avoided when dump or landfill operators facilitate informal operators to (continue to) divert kitchen and garden waste from landfills to recovery. There are gains from even the most basic recovery activities, including allowing animals to graze the landfill and informal organic or garbage collection for animal feeding. More formal separate collection of household and commercial kitchen and garden waste going to composting or anaerobic digestion are also effective - and usually easier to measure. In general, all activities diverting organics to other uses or treatment options lead to a reduction in the amounts of methane produced and help to mitigate climate change (Robinson et al., 1992; Simpson, 1993, 2008; Simpson and Dulac, 2005).

Therefore, informal activities directing organic waste to various uses contribute to avoiding GHGs in the service chain. IPES, the Peruvian partner in the GIZ informal sector study, analysed the impact of 5000 informal swill (food waste) collectors in Lima and Callao (Scheinberg et al., 2010a). WIEGO's GHG calculator (https://www.wiego.org/ghg, downloaded July 2023) has indicated that in 2021 the recycling and waste management services of Pune's SWaCH Cooperative of self-employed women waste collectors prevented the emission of 1424 tonnes of  $CO_2$  equivalent per year, simply by operating manual pushcarts in place of diesel-driven waste collection trucks. This is on top of the prevention of the release of 167,301 tonnes of  $CO_2$  equivalent/year achieved by their work of collecting waste and preventing open burning of waste in underserved communities.

In the research phase, contributors to the 2010 UN-Habitat book Solid Waste Management in the World's Cities assessed the carbon footprint of various solid waste management practices, including landfilling, incineration and recycling, in 20 cities. They used a life cycle assessment methodology to estimate the emissions of GHGs associated with each waste management practice, including CO<sub>2</sub> emissions from the combustion of fossil fuels used in transportation, energy production and waste processing. The total estimated GHG emissions per city in the 20 cities ranged from 177 kg CO<sub>2</sub> to 5982 kg CO<sub>2</sub> equivalent per capita per year, with the highest emissions associated with cities that relied heavily on landfilling and incineration, and the lowest emissions associated with cities that prioritised recycling and composting (Scheinberg et al., 2010b). The methodology used to construct the mass balances (Simpson, 2007) to support these estimates in each of the cities combined the net avoided emissions through formal and informal capture of materials that were diverted to recycling and composting options, as the basis to calculate the total CO<sub>2</sub> equivalent per capita per year.

Plastic credits and digital ecosystems: Valorising traceability as a strategy to support the informal recycling systems. Digital registration, reporting and payment systems entered the informal sector discourse around 2015 but are not very present in the literature. Most of the currently available digital tracking systems have originated in emerging economies. In economic terms, digital tracking lays the basis for paying price support to the IRS as a way to stimulate recovery of specific material and product types with weak demand or low prices, such as sachets and other forms of single-use or multi-layer packaging. Price supports represent a (relatively) low-threshold approach for polluters or producers to indirectly compensate informal operators and workers for the work of collecting, processing and transporting very low-value recyclables. They also provide a path for EPR systems and producers to secure a status as business partners in informal and formal plastic value chains.

Digital registration can contribute to better price transparency and sometimes 'broadcast demand' to informal operators, letting them know which traders are buying materials and at what price. Some of them, such as the Indian-based *Kabadiwallah Connect*, are part of a consultant model aimed at donors and producers interested in increasing the uptake of the materials for which they are liable. Others, such as Brazil-based BV Rio, are designed to channel donor and producer funds into a transparent system of diversion credits for plastics, combined with providing due diligence to producers who want to be able to claim recycled content or materials removed from the ocean (Scheinberg et al., 2022). Because these systems are relatively new and may be associated with proprietary information belonging to producers, donors, or the plastics industry, there is neither much about them in the literature, nor is there yet – at the time of this writing – a body of evidence on their benefits for informal recyclers – even though this is one of their stated goals.

Some waste picker organisations view the rapid expansion of such organisations into their landscapes as a (potential or real) threat to their livelihoods, as they have the potential to create parallel value chains for some or all materials and could disrupt markets. In some sense, digital traceability can be viewed as the second big privatisation effort, after waste collection, that has the potential to disadvantage, dislocate and marginalise informal workers and operators. Despite suspicion from their desired target groups, the spread of such systems and the openness of many of the providers and users of such systems, which include national PROs like Karo Sambhav in India, social enterprises like *Kabadiwallah Connect* (described, e.g. by Retamal et al., 2021), Plastic Banks or rePurpose Global, can constitute opportunities for the inclusion of informal workers in formal value chains.

Digital tracking tools are often presented as a 'solution' to informality through their ability to connect informal recyclers to buyers on the one hand and to create and offer EPR system traceability on the other. On the positive side, it lowers the bar for informal recyclers to report their tonnages, types of materials, addresses or names of buyers and the like. It also can facilitate horizontal linkages between informal recyclers in a city and connect them to buyers or information channels. It can also prove useful for basic bookkeeping and tax accounting for informal stakeholders or associations who have achieved formal status.

The risk of digital tools is that they can be exclusionary and restrictive of trade: such systems can be used to prevent entry of new enterprises, individuals or organisations into collection systems, associations or cooperatives. The ability of digital systems to qualify their users for price supports is an enormous advantage but can skew the market by disadvantaging older waste pickers or those who are not digitally connected. Although in principle ease of entry characterises both informal recycling (in most countries), and informal service provision in some, any digital or other information tool has the potential for being used by one group to exclude or disadvantage others. It is best to conclude that these systems may have significant potential, but they also present a downside risk which should not be ignored. Caution in implementation is therefore advisable.

More experience and research are needed to assess better the opportunities and threats of these technologies and systems on the informal sector (Gong et al., 2022). For this reason, at the time of this writing, certain development cooperation stakeholders like GIZ, Prevent Waste Alliance or the UNDP Accelerator lab (UNDP, 2022), have taken up the challenge to options and set up collaborations with stakeholders that facilitate the inclusion of informal workers and businesses via digital value chain tracking tools.

# Hardworking but oppressed, vulnerable and without security or social safety net

Even considering the advances in organising and advocacy for the sector, in 2023, at the time of this writing, informal workers and operators remain an oppressed and unrecognised sector in most emerging economies.

- They do not enjoy political protection from formal public, private or para-statal formal waste management organisations.
- Political and administrative decisions in relation to which they have little or no influence – put them at risk of losing access rights to materials from dumpsites, from the street or from containers, or to direct collection of recyclables from commercial generators, or to their homes which are close to dumpsites.
- ISPs risk losing livelihoods and clients when cities or waste or public works authorities offer concessions or contracts to formal service providers. Even when these tendering processes are technically open to ISPs, the ISPs usually do not have the ability to meet the administrative or transparency criteria, such as providing a bid bond or showing a specific balance in a formal bank account.
- NGOs and environmental advocacy organisations with recognised rights to contribute to ESG impact assessments do neither often consult waste pickers and ISPs nor consider their wishes and professional needs.
- Informal workers and operators are not represented in change processes, such as investments in upgrading disposal or ESG analysis for new landfills or other solid waste or recycling facilities. By definition – because of their informal status – they lack options and pathways to contribute to or influence political and administrative decisions about waste and recycling.
- Informal operators and workers are continually at risk due to their social status and lack of access to social safety nets (Rosaldo, 2022).

#### Pathways to improvement

Until and unless advocacy and research turn into practical interventions, workers, operators and participants in the informal waste and recycling economy across the globe will continue to face commercial disadvantage, prejudice, social stigmatisation, harassment and other forms of marginalisation. They will be vulnerable to exploitation by the very stakeholders who hold the power to develop policies to include them in the solid waste and recycling systems – and, in fact, the very same stakeholders who would most benefit from their integration.

Despite their contribution to the waste management and resource recovery system, a majority of the bottom of the pyramid waste pickers still pick from dumpsites, earning a living and feeding their families, but working in deplorable conditions that are likely to affect their health (Ferronato and Torretta, 2019; Gutberlet and Uddin, 2017; Schenck et al., 2019; Velis et al., 2022). For them, initiatives to close dumpsites and regionalise disposal – a globally recognised form of environmental improvement in the waste service chain – represent a nightmare. And even when they are offered alternative work, many of them say they would prefer to keep their status and occupations as they are.

Conflict-related displacements, rural-urban migration and the effect of globalisation on employment opportunities continue to motivate those without formal work to work in the informal service and value chains. The desire to work, accumulate savings, raise capital and be financially independent are both traditional and new motivations for their continuous presence in solid waste and recycling sector activities.

In 2023, there is a rich literature on problems and possibilities, but little in the way of practical commitments, even in the context of the SDGs. An exception is signalled in the French literature on informal recycling. The West African ENDA supports a network of organisations for whom the informal workers are respected as 'popular workers' or a people's economy, a classification also used to designate those formally employed in the recycling sector (Lazare et al., 2014).

For all intents and purposes, waste pickers in the value chains must somehow be compensated for the economic and environmental benefits and economic savings they generate. The monetisation of these benefits belongs to those doing the work, alongside and above and beyond the resource value of the materials they capture and currently receive.

It is useful to ask: have real gains been made for the sector? Even though there have been some gains in voice and recognition, most informal sector members worldwide still are marginalised. Conflict-related displacements, rural–urban migration and the effect of globalisation on employment opportunities remain the dominant drivers of informal sector members in making a living in the informal service and value chains. However, the desire to work, raise capital and be financially independent are both traditional and new motivations for their continuous presence in solid waste and recycling sector activities.

And despite the advances in organising and advocacy for the sector, they remain vulnerable to political decisions (Rosaldo, 2022). Where advocacies do not turn into practical interventions, the informal sector continues to be socially stigmatised, marginalised, harassed and exploited by stakeholders expected to develop policies and initiatives to include them in the solid waste and recycling system.

The GIZ informal sector study (Scheinberg et al., 2010a) established that informal recyclers and service providers provide an environmental service, generating positive externalities that benefit the local authorities, the environment and the economy. Although much has been done with the research findings, there is still a long way to go before it is generally accepted that waste pickers be compensated for the environmental benefits they produce and the resource value of the materials they capture and sell. The Just Transition stream of waste picker organising, and activism is basically demanding that these public benefits be transformed into either a direct revenue stream or an indirect right to social protections and labour benefits that formal workers and entrepreneurs in the waste and other sectors claim as part of their just compensation.

#### Serving goals of poverty reduction, human rights and SDGs

There is a general trend that the literature on the activities of the IWS – as well as the numbers of women, men and sometimes youth who are earning a living from these activities – have been increasing (Kaza et al., 2018; Lau et al., 2020). The activities of the IRS represent the focus of more than 90% of all published works on resource recovery and recycling in countries of the global South (Godfrey et al., 2018, 2019; Kaza et al., 2018; Rosaldo, 2022).

It seems that the increase in documentation is associated with an increase, rather than a decrease, in informal activities on the ground. This increase is most obvious in Asia, Africa and Central and South America, where globalisation, urbanisation and insufficient formal waste management providers and infrastructure have had the unintended effect of creating relatively large informal economies (Achankeng, 2003; Coletto and Bisschop, 2017; Velis, 2017). Informal activities in both service and value chains - and also in informal reuse and repair - are an important feature of the urban waste landscape in Southeast Europe, including in some of the member states of the EU, such as Greece and Italy. In Western Europe and North America, where IRS activities are less prevalent, there are cases where they support cities in achieving their environmental goals (Rendon et al., 2021; Scheinberg et al., 2016). The IRS in South Africa reported recovery rates for postconsumer paper and packaging materials, reaching 80-90% capture, recovery and marketing to the recycling industry in 2015 (Godfrey et al., 2016).

Globalisation demands better cooperation. Formal actors cannot make choices for the informal workers and operators, but they can strive for new models of accommodation and cooperation, especially from the solid waste system because this sector actually has the most to gain. Donor and development bank initiatives to speed up, or 'jump-start', solid waste modernisation and the CE in the Global South have sometimes proved harmful to waste pickers and decreased their ability to earn a basic living and feed their families. This is happening on two fronts, first when the implementation of modern controlled-access landfill technology results in restricting their physical access to materials, and second, when donors or consultants - following the model of the evolution of municipal recycling in high-income countries - require that solid waste system operators develop their own public-sector recycling institutions that can establish a monopoly on access to materials - at which point informal recycling is identified as theft and often criminalised.

In emerging economies, this creates a perverse effect since the formal sector waste management institutions do not know what to do with the recyclable materials (other than dispose of them in a landfill), and so instead of off-setting the costs of disposal, incomplete 'half' recycling practices make disposal more expensive. The net result is usually less rather than more materials recovery, higher rather than lower net costs per tonne for safe and environmentally sound management of waste, and often higher levels of GHG emissions. Moreover, informal recyclers have (likely) lost their houses at the edge of the landfill, and their income levels have dropped, with associated health and social impacts to the families and informal workers themselves.

It is incumbent on public and private entities initiating these modernisation transitions to plan for and implement an inclusive modernisation process (from research on the impacts of priced disposal and avoided environmental impacts to planning to dump closures to relocation and restoration of livelihoods. Insights from research and organising identify a need for broad cooperation with informal actors to co-design physical processes, collect and manage more data, and explore the value profile of informal activities that divert recyclables from disposal. Waste pickers must be the ones making the decisions that affect their lives while becoming better equipped to secure social protections and defend their rights.

The faces of intervention. Improving the status and quality of life for informal sector workers has come from many disciplines - as well as the political organising of sector members themselves. Advocacy for recognising the informal sector activities grew both from inside the sector, where the informal sector workers self-organised to be legitimately recognised as players in the local economy, and from academics, researchers and sustainability advocates from the outside looking in. The 'integration discourse' draws on various ideas, from development cooperation and 'helping' to climate change, poverty alleviation and workers' rights. These interventions received a 'push' with the establishment of the Millennium Development Goals and have been strengthened and made more specific with the SDGs and the WACT tools for reporting to SDG 11.6.1. This was enhanced by the efforts of donors and international organisations, development banks and specific national-level international cooperation efforts that have listened to waste pickers and their ambitions and contributed to the conceptualisation of sustainable change and fair intervention pathways.

Drivers for initiatives on informal sector integration have been the poverty reduction discourse (pushed by the establishment of the Millennium Development Goals), a public health discourse on linkages between waste management activities and community and worker health and safety, an environmental discourse on the environmental importance of materials recovery and recycling; and an urbanisation and equity discourse about charity second-hand shops and flea markets and their place in the city. Public health has been the historical foundation of waste management in urbanised contexts, going back hundreds of years, but more recently, public health workers. Epidemiologists and scientists have begun to focus seriously on the health of informal workers and their families, sometimes following the wishes of the informal sector and sometimes deciding for them. Whose face do we see, and whose voice do we hear in these discussions and actions?

Resource conservation has two faces: the environmental face of avoiding resource depletion and limiting climate change and the economic face of value chains and trading resources. From an environmental perspective, the recapture, reuse and remanufacturing of materials avoids further use of raw resources that have environmental impacts at the point of extraction and the limitation of GHG emissions. The latest manifestation of this perspective is the avoidance of the related energy use of extracting and processing the virgin material input, as compared to the avoidance of extraction and the lower energy demand of remanufacturing recycled materials. This energy can be equated to the environmental impact of loading GHGs into the atmosphere. The concurrent economic lens of resource conservation is the net savings realised from avoiding material extraction and the lower costs of remanufacturing recaptured materials.

As members of the community of practice - representing engaged scholars, consultancies, donors, NGOs and the waste management and recycling sectors, we recognise that there is an unarticulated question lurking at the edge of the literature. Behind the question 'how shall we intervene for a better result?' is a more fundamental question, and that is: 'who are we?' The institutional tension in this landscape, particularly in the context of development cooperation, is about agency. Are 'we' formal stakeholders or informal recyclers, or some form of alliance between them? As formal stakeholders, we are caught between research, engagement, facilitating, accepting, managing and/or welcoming selforganisation and direct action by informal recyclers and service providers. If 'we' as middle-class university educated researchers and advocates think social protections are important, and the informal recyclers themselves would prefer higher cash incomes, how does this difference get resolved in practice? If formal solid waste institutions are not succeeding to extract recyclables and meet national or local targets for diversion from disposal, and the informal sector is doing this, what is the balance between competition, cooperation and co-optation?

Still a long way to go. It seems fair to say that while on the ground there are small but significant steps to respect, recognise, integrate and co-operate with informal operators in recycling and waste management, there is still plenty to do. Particularly at the policy level and in terms of large investments in the sector, the role of the informal sector remains one of unwilling but defence-less victims, rather than being seen as an essential partner in resource management and environmental protection with its own traits, needs and characteristics, and, even more importantly, its own opinions, goals, strategies and ambitions.

Thus, although the literature shows that informal sector workers and entrepreneurs have made real progress in gaining their voice to advocate for formal recognition, there are also plenty of indications that most informal sector members are impoverished, excluded, unprotected, unrecognised and socially marginalised. They still face discrimination from government and society, as well as a likely decline in access to waste materials associated with investments in the modernisation of disposal, threats to sourcing materials and asymmetrical power relationships with parastatal, public and private waste management companies and large value-chain industries who set the market prices for secondary materials.

According to the literature, the key to integration is developing true working relationships between both the informal and formal value chains, the formal solid waste and recycling institutions, and also with NGO sector recycling and reuse initiatives that claim a monopoly on material access and rights to sell. Another set of threats comes from EPR organisations and their PROs, who in their turn claim – and may literally have – an exclusive right to second-hand trade, recycling or repair. There is enough to be done to muster structural support for and recognition of the IWS in its journey to integrate into formal systems and claim its own economic niches.

The work to be done ranges from integrating the work of the informal recycling and waste service workers and operators with that of formal institutions, as well as introducing formal standards for occupational recognition, fair compensation, social and medical (and life cycle) protections and safer working conditions. Beyond this there needs to be a formal recognition of these workers livelihoods as legal and passage of legislation that codifies the profession. In addition, it is important to create incentives for informal enterprises to formalise; and incentives for firms to hire workers with standard contracts and social benefits instead of focusing on legalisation only.

Our research suggests that the number of informal waste actors that have been integrated into the formal waste management system is less than 1%, even with strong support from Development Cooperation stakeholders like GIZ and the Inter-American Development Bank (Rosaldo, 2022; Velis, 2018). Therefore, until advocacy translates into practical improvements, the informal sector globally faces the risk of being socially stigmatised, marginalised, and, in the worst cases, harassed and exploited by formal stakeholders with a modernisation agenda. This is ironic since these are precisely the stakeholders who could be choosing inclusive policies to integrate them into the solid waste and recycling system. Real change will happen only when formal stakeholders and waste pickers recognise their mutual contributions to the essential environmental services they can provide and develop strategies for recognition and compensation based on facts and measurements. The core of the issue for informal recyclers is access to the resource value of the materials they capture and sell; that same activity is a source of value for the formal system that creates economic and environmental benefits for society.

There is a need through policy creation and economic development to develop tighter CE loops so that the recapture of materials and the time and distance to remanufacturing is at the regional rather than the global scale. Investment outside of the solid waste sector, in industries' technical and institutional willingness to prefer sourcing secondary materials over-extraction, is key. Assistance from international development organisations and local NGOs can help facilitate an agreement between the organised informal sector and the manufacturers, that is, for inclusive and fair EPR and product stewardship – following the lead of Latin American cooperatives and their public-sector clients.

The market for recyclables is global, complex and – to outsiders, untransparent. Any number of current and future developments might influence the work and livelihoods of informal stakeholders and affect their earning power and subsistence enterprise models. Thus, it is important to support the informal waste and recycling sector in their resilience, adaptability and skills so that coming generations of informal value and service chain workers are motivated to look beyond today's urban waste activities to their future livelihoods as resource and waste managers. Following are some factors that are likely to be relevant:

- Volatile raw material markets, de-globalising value chains and interest in securing critical materials for the Energy and Mobility Transition. Currently, political objectives in many countries advocate or mandate reducing the extraction of raw materials for products and energy production and moving towards making raw materials usage more expensive. This could contribute to the competitiveness of recycled materials. Disruptions of established value chains as a consequence of COVID-19 and the Russian war in Ukraine make such interventions controversial. Some countries might follow the EU to push for local sourcing and marketing of materials instead of partnering with business partners in other regions.
- 2. A growing need for certain materials, especially critical metal resources for batteries, computer chips, etc., provides an opportunity for formal and informal recycling suppliers, as the primary sources for these materials are limited and concentrated in some countries. Extending the reach and coverage of recycling to new types of resources might thus be seen as an important additional source of income, which could boost innovation in recycling technologies and stimulate the set-up of large-scale recycling facilities. But it will also probably increase the competition around certain materials streams (resulting in companies seeking to dominate value chains or public institutions trying to prevent certain end-of-life products or materials from going to the informal sector). This will hold both opportunities and threats for informal operators and workers.
- 3. Corporate Targets on Recycled Content, Reuse, Remanufacturing and Product-as-a-Service Models. The results of the CE transition in large multi-national consumer goods companies are uncertain. Circular business attributes, such as recycled content in products, reuse or remanufacturing and product-as-a-service models, might provide a strong demand for recyclables or recycled materials from groups of informal stakeholders. Purchasing

these materials from associations or cooperatives of informal stakeholders might also fit company interests in promoting CSR activities with a social dimension, in addition to securing their supplies of recyclable resources. At the same time, corporate targets on reuse and product-as-aservice models may also represent a risk for informal stakeholders. They could lead to producers investing in their own, company-controlled or business-to-business take-back and recycling models. This development would shrink informal stakeholders' opportunities to access used/ end-of-life goods or recyclables.

- 4. EU Regulations on Product Passports and Due Diligence along the Value Chains The upcoming due diligence reporting requirements along value chains for companies bringing products to the EU market will probably result in high standards of transparency about suppliers and business partners not only regarding quantities and sources of materials but also regarding environmental management systems and social aspects. The reporting requirements for providers of recyclables and recycled materials will rise, and informal stakeholders will need to adapt to these requirements sooner or later. They will also need strong partners (business or non-profit structures) and long-term support, either by their business partners or by donors and governments, in order to be able to live up to the reporting and management requirements. In addition, even if informal sector organisations are able to fulfil necessary reporting obligations, they might be confronted with scepticism by potential business partners that fear reputational risks from potential cases of insufficient environmental standards, allegations of child labour or similar if they enter into business partnerships with informal sector organisations.
- 5. Government and Donor Perspectives on Sustainable Infrastructure and CE. Some of the newer policy initiatives allow informal actors to join efforts to improve recycling. The recent Plastics Treaty, the 2017 Minamata Convention and the 2019 Basel Convention are critical policy frameworks that serve as inspiration for the development of international legally binding instruments on plastic pollution - with increased recycling as one of the main strategies to reduce ocean plastics. The political commitment of many countries to establishing a CE and setting up the necessary incentives for businesses is an important opportunity for the IRS to extend their business and to get integrated into formal value chains. But despite the strong push in the EU for the CE, other narratives, such as the discussion about sustainable infrastructure under the 'Global Gateway' initiative, are starting to become more dominant, and it is less clear what role business models of the IRS will play in this narrative. In this landscape, there is a need through policy creation and economic development to develop tighter CE loops so that the recapture of materials and the time and distance to remanufacturing is at the regional rather than the global

scale. Investment outside of the solid waste sector and industries' technical and institutional willingness to prefer sourcing secondary materials over extraction is key. Assistance from international development organisations and local NGOs can help facilitate agreements between the organised informal sector and the manufacturers.

## Integrated sustainable waste management

This retrospective has looked at the literature of the informal sector through the lens of ISWM, with attention to both the physical and the governance systems and the relation of informal activities to them. Research has shown two kinds of informality (Scheinberg and Simpson, 2015). The first is informal recycling, the 'bottom of the pyramid' for the industrial value chain, based on trading materials with value. Informality in the value chain dominates informal contributions to the sector in Southern Africa, as well as in North Africa and the Middle East (Scheinberg and Savain, 2015).

The second is the informal service chain, independent or NGO enterprises working as waste collectors, street sweepers, cleaners and the like. Service chain informality is the focus of most informality in sub-Saharan Africa. These two informal sectors not only produce value and benefits to the larger society but can also create problems with associated social, economic and environmental costs.

For more than 40 years, the relationship between the informal sector and the formal institutions involved in waste management has been the focus of researchers and scholars, project managers and scientists, NGOs and informal sector champions, organisations, development banks and governmental decision-makers. The earliest efforts both tried to map the system of materials flow, as well as making estimates of the size of this sector in various countries. Over time, this analysis became more sophisticated, analysing materials flowing through the system and estimating the costs and benefits of the informal sector. More recently, life cycle analysis tools are being applied to the activities of the informal sector to ascertain the avoidance of GHG emissions into the atmosphere.

Contrary to predictions dating back to the 1980s, informal work overall, and therefore also the work of informal recyclers and waste managers, is increasing in terms of the number of workers and operators and the amount of materials they are handling. The two informal sectors that are the focus of this article are not disappearing in low- and middle-income countries and are even reappearing in cities of the global North, including in high-income countries, whose policies and practices criminalise 'scavenging' and may make this work difficult and dangerous. This sector contributes at least 90% of materials recovery in the global South. They are not, as early researchers assumed (and their policymakers wished), a temporary feature of the landscape. Informal workers and operators are widespread, difficult to eliminate and represent the norm for recycling outside of the EU – with the exception of a very few high-income countries.

The relationship between the formal (public sector) waste management and the recycling sector is often of tension. In some countries and at some periods of history, it has been resolved into a sustainable form of co-existence; at other times and especially where solid waste management is being modernised – as is the case in many emerging economies, there is competition and conflict, with only a few examples of productive resolution and active cooperation.

But this does not mean that there can be no changes. Working conditions, social protections, evidence-based monitoring, respect and 'the just transition' are all on the priority list for informal sector researchers. The informal sector actors themselves are usually more interested in higher prices and better conditions of sale, so there is a clear priority for facilitating (but not forcing) more transparency and efficiency in the value chains and the position and condition of informal recyclers who are at the 'bottom of the pyramid'.

#### In their own hands

The informal waste and recycling sector in Latin America is perhaps the clearest example of informal actors claiming agency and creating space for change as they assume the power of the 'we', as shown by the long history of local advocacy and self-organisation of the informal workforce. In Latin America, some waste picker organisations date back to 1962. But it was in the late 1980s and early 1990s that activism to organise informal workers into cooperatives really took hold in the Latin American region with the support of organisations linked to the Catholic Church and NGOs. The formation of informal sector cooperatives in this region followed a move to create a stronger voice in the marketplace supported by local social movements and the rise of governments oriented towards social justice. These early efforts have led to the creation of a 17-country Latin American Waste Picker Network. In the early years of the 21st century, the informal sector's situation became more widely known with the first-ever World Conference of Waste Pickers.

The 1980s and 1990s saw local city-based initiatives in India, Indonesia, Cambodia, Philippines, and Thailand, with NGOs working on the issues of waste and waste pickers, sometimes loosely organised in self-help groups or facilitated by leaders of social equity and women's movements. India stands out as it is home to many workers' organisations, from which emerged The Alliance of Indian Waste Pickers, which has been crucial in building synergies that enable capacity building, mobilising and advocacy of workers' organisations across the country and inspire the formation of organisations at the local level.

On the African continent, partnerships between communitybased organisations, NGOs and private companies have earning models based on collecting a weekly or monthly fee per household for the service of waste removal. The 'Dar es Salaam model' works with community groups and micro-enterprises to organise waste collection services in informal and low-income parts of cities such as Accra, Dar es Salaam, and Nairobi. The system is more institutionalised in French-speaking cities in West Africa. There, semi-formalised GIEs have micro-collection franchises from the communal government. In Egypt, the much deeper-rooted (and entirely private) system of the Zabbaleen in Cairo to collect waste and valorise whatever can be used represents an important contribution to public health, clean communities, and bottom-of-the-pyramid economic activity for women and men who cannot or chose not to find other forms of work. Organising occurs through youth groups, community-based organisations and micro-enterprises in solid waste services. Recognition, acceptance and inclusion of the informal sector in the formal waste management service sector in Africa is alive and well – although it still has, despite progress, a rather long way to go.

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#### Notes

- The polarisation between these two nascent sectors at the end of the 19th century is first signalled in the English literature in Myman Melosi's classic, Garbage in the Cities, at a time when there was no clear distinction between formal and informal Melosi (2004) Garbage in the Cities: Refuse reform and the Environment. University of Pittsburgh Pre, Scheinberg (2011) Value added: Modes of sustainable recycling in the modernisation of waste management systems. Wageningen University and Research.
- 2. In US National Environmental Policy Act, Clean Water Act, Resource Conservation and Recovery Act and The Toxic Substance Control Act. . . all past in the early to mid-1970s. . . made the connection of waste, water pollution and human health. . . these went through a number of amendments in the 1980s and 1990s.
- A tender issued by German Technical Cooperation (GTZ, now GIZ) in early 2006, under the title Economic Aspects of the Informal Sector in Solid Waste, may have been the first use of the term by a mainstream development cooperation institution.
- 4. The delay in publication was directly connected to the controversial nature of the findings, including especially the insights that informal recyclers in the cities researched were earning considerably more than minimum wage in their countries (Scheinberg et al., 2010a).
- 5. With this framing, this article implicitly and explicitly challenges the claim that P3 is really about 'resource value' (Wilson et al., 2015b).
- 6. Popular recycling a term used by Brazilian waste pickers' leaders and their advocates is seen as the advance of the waste pickers in the recycling value chain, gradually aggregating the set of collection and sorting activities involved in the industrial processing of recyclables, constituting another type of production chain.
- To indicate reclaiming wastes, reuse, composting, semi-processing of wastes, and or actual recycling done by waste pickers organisations in the context of municipal and or industry lead

programs with emphasis of combining environmental, social and public health aspects (2014: 171).

- 8. Co-authors Simpson and Scheinberg also noticed widespread reported (and sometimes documented) theft of cabling or rails from public transport systems in Bulgaria in the 1990s during the transition from state socialism to market economies. Blame for disrupting public transport by stealing infrastructural metals still 'sticks' to many informal recyclers of Roma ethnicity (the group that dominates the informal sector in South-Eastern Europe (Scheinberg, personal experience in Bulgaria, Serbia and North Macedonia, 1998–present).
- This section is based on the work of Anne Scheinberg and colleagues, first presented in this form at the ISWA World Congress in Rio de Janeiro in 2014. Available in the ISWA knowledge base, www.iswa.org.
- 10. The application of these roles to the value chains is original to this article, was not included in the original publication, and has not yet been approved by the authors of the Operators Models document.
- 11. See Samson (2009) and Dias (2009) for an account of the role of worker-to-worker exchanges in organising.
- 12. Recycling Networks research project internal report.
- Sonia Dias field notes from workshops (2016–2018) organized by Witts University and South Africa's Department of Environmental Affairs – DEA. Participation as WIEGO's waste specialist.
- 14. A wordplay on the Spanish word *sempre* meaning *always* and/ or *forever*) is the acronym for *Compromiso EMpresarial Para el REciclaje* (English: Entrepreneurial (Business) Commitment to Recycling.
- 15. EPR is attributed to Sweden's Thomas Lindquist of Lund University and is defined by OECD as an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. There are two related features of EPR policy: (1) the shifting of responsibility (physically and/or economically, fully or partially) upstream toward the producer and away from municipalities, and (2) to provide incentives to producers to incorporate environmental considerations in the design of their products (Favot, 2014).
- 16. The study was produced for GTZ in 2006–2007 and co-financed by the CWG network, WASTE Advisors, and EAWAG. The research was completed, and the first version of the report was released in 2007, but questions about the accuracy of the data for Cairo delayed publication. In 2009 the team received supplementary support from GIZ to re-visit and re-analyse the Cairo case, and the report now available on the GIZ website was released in 2010.
- 17. These two terms from gender analysis are useful: by condition we mean, how informal operators are treated, and what kind of facilities and protections they are offered or required to have; by position we refer to their power and strategic reach to change or improve or protect their current operating models (Information provided by the authors of this article).
- 18. At least one of the authors of this article have gone on record with a critique of this framing of resource recovery, and are in the process of looking for another type of indicator that would give a more complete picture of the role of recycling in the system, and to relate this to governance system characteristics of the city, such as whether disposal is priced and whether the role of the private value chains has been recognised and institutionalised into reporting practices.
- 19. Annex 1 is adapted from the glossary of terms for two large informal sector projects, the GIZ Informal Sector Study

financed by German International Cooperation in 2006–2007 and revised in 2010 (listed here as Scheinberg et al., 2010a), and the working glossary used by WASTE Advisors in the Netherlands for the MarColombia project financed by RVO, the Dutch Enterprise Agency between 2014 and 2016 (provided by former WASTE staff person Anne Scheinberg, co-author of this article).

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## Annex 1 Glossary of terms<sup>19</sup>

There are many different terms in use for different parts of the solid waste and recycling systems. The terms in this glossary are the ones that the project team agrees to use. Wherever possible these are drawn from standard English-language use in the UK and in the USA.

Term	Other terms or abbreviations used	Working definition
Avoided cost of disposal	Diversion credit	The amount that would have been paid per kilo for disposing of materials in a controlled or sanitary landfill and paying the official tipping fee; also the costs associated with formal obligations of the public authority to manage wastes, that are made unnecessary by informal valorisation activity. These are modelled as reducing the number of materials that flow through the main or default waste management path.
Junk Shop, Buyer of recyclables	First buyer, kabadi, small junk shop, otkupljaci	A trader in one or more types or grades of recyclables who trades materials, buying from small collectors and selling to larger processes in the private value chains
Capital cost	Investment cost, capital, purchase cost	The amount it costs to purchase new equipment, facilities, space, buildings, etc
CBO	Community-based organisation Grassroot organisation	A group organised to provide a solid waste function or service in a community, often fully or partially staffed by volunteers
Cooperative	Co-op, buyers or sellers' association, sellers' association, organisation of waste pickers	An enterprise organised as a cooperative with multiple owners who participate in the activities. In some Latin American countries, cooperatives have a special tax status and so are a favoured form for establishing a recycling business whose members are informal recyclers, and who formalise their status by being members of the cooperative
Cost per ton, cost per input ton	Cost, price	The cost for a process step, or for a whole subsystem, divided by the number of tonnes that enter that step. Note that for many steps, input tonnes are not equivalent to output tonnes.
Controlled disposal site	Controlled dump, dumpsite, dump, depot, controlled dumpsite, non-sanitary landfill	The site where solid wastes are deposited on land without precautions regarding human health or environment.
Illegal dump	Wild dump, illegal landfill	Disposal of waste at a site different from one officially designated by the municipal authorities
Environmental costs.	Carbon footprint, environmental footprint, GHGs	Costs of emissions, energy use, and extraction of raw materials, if they can be expressed in terms of tonnes of $\rm CO_2$ equivalent

#### Annex I. (Continued)

Term	Other terms or abbreviations used	Working definition
Formal sector	Official, government	in the study, used to mean the official solid waste authorities and the activities they sponsor and operate. See above, Annex 1.
Formal waste sector	Solid waste system, solid waste authorities, government, materials recovery facility	Solid waste management activities planned, sponsored, financed, carried out or, regulated and and/or recognised by the formal local authorities or their agents., usually through contracts, licenses or concessions
Informal sector	Waste pickers, rag pickers, scavengers, junkshops	Individuals or businesses who are involved in waste activities but are not recognised by the formal solid waste authorities, or who operate in violation of or in competition with formal authorities
Informal waste sector	Waste pickers, scavengers, junkshops	Individuals or enterprises who are involved in waste activities but are not sponsored, financed, recognised or allowed by the formal solid waste authorities, or who operate in violation of or in competition with formal authorities
ltinerant waste buyer	IWB	Woman, man, child, family or enterprise that purchases source separated waste materials from households, shops or institutions, usually focusing on one specific material or type of materials
Landfill	Dump, dumpsite relleno sanitario	'the engineered deposit of waste onto and into land'
Mass balance	Process flow diagram, materials flow diagram, chain analysis	A visual schematic representation of the movement of materials through the entire waste system or only the formal or informal waste system, which indicates the weight of each fraction at each stage
MRF (materials recovery facility)	Materials recovery facility, intermediate processing centre (IPC), intermediate processing facility (IPF) recycling processing centre	An industrial facility of moderate scale that is designed for post-collection sorting, processing, and packing of recyclable and compostable materials. It is usually of moderate technical complexity with a combination of automated and hand-sorting. The inputs are usually commingled or mixed recyclables and not mixed waste. The outputs are industrial grade materials,
MSE	Micro and small enterprise, micro-enterprise, junkshops, materials recovery facility	The smallest businesses, smaller than SMEs, usually having less than 10 workers
Organic waste	Bio-waste, green waste, wet waste, organics, putrescibles, compostables, food waste	The decomposable fraction of domestic and commercial wastes includes kitchen and garden wastes, sometimes include animal products
Pre-processing	Sorting, screening, sieving, compaction, densification, size reduction, washing, drying	Preparing waste materials for subsequent processing without adding significant value to them
Primary collection	Pre-collection, house-to- house collection	Organised collection of domestic waste from households, taken to a small transfer station
Process flow diagram	pdf, materials flow, chain analysis	A visual schematic representation of the movement of materials through the entire waste system, which DOES NOT indicate the weight of each fraction at each stage
Processing	Beneficiation, upgrading	Manual or mechanical operations to preserve or re-introduce value-added into materials. Usually involves densification, size reduction, sorting, and packaging or transport
Recovery rate	Capture rate	A percent relationship between the amount of recoverable materials that reach recycling, composting or energy recovery and the total amount generated
Recyclables	Recoverables	For purposes of the study, 14 types of materials which have a value to the users and may also have a price.

(Continued)

#### Annex I. (Continued)

Term	Other terms or abbreviations used	Working definition
Recyclers	Scavengers, waste pickers, MRFs, junkshops	Entrepreneurs involved in recycling
Recycling		Processing and transformation of waste materials to be used
Recycling or composting market	End-user industry, buyer, dealer, broker	A business, individual, organisation or enterprise that is prepared to accept and pay for materials recovered from the waste stream on a regular or structural basis, even when there is no payment made.
Residual waste	Rest-waste, rest-fraction, residue, rejected	The discarded materials remaining in the waste stream or on the sorting line because they are not recyclable or compostable because they are perceived to have little or no monetary value
Resource recovery	Energy recovery, materials recovery	Process of extraction of economically usable materials or energy from wastes. may involve recycling. In English- speaking countries, the term is usually restricted to recovery of energy.
Reuse	Second-hand use	Use of waste materials or discarded products in the same form without significant transformation
Sanitary landfill	Landfill, state-of-the-art landfill	An engineered method of disposing of solid wastes on land in a manner that protects human health and the environment. the waste is compacted and covered every day. the landfill is sealed from below and leachate is collected, and there is gate control and a weigh-bridge
Sanitation	Solid waste, urban cleansing	In the 'French sense' used to refer to urban environmental activities including solid waste management.
Scenario	electroning	A projection of a hypothetical future situation for the solid waste system of each city
Secondary collection	Transfer, small transfer station	The movement of wastes collected from households from their first dumping point to processing, larger-scale transfer or final disposal.
Separate collection	Segregated collection, collection of recyclables, organics collection, selective collection	Collection of different types of materials at a different time, in a different container or vehicle, or in another way so as to maintain the separation and maximise the recovery.
Separation at source	Segregation at source	Actions taken by a household to keep certain materials separate from others
Shadow price	Proxy price, hedonic price, contingent valuation	A reasonable estimate for the price of something based on extrapolating the price for something similar
Service chain	SME, MSE, waste collectors	Public waste collection and disposal institutions, micro and small private companies and micro-enterprises collecting waste, sweeping streets, cleaning canals and gutters, and generally being paid to <i>remove disvalue</i> from public and private spaces
Socio-economic costs		Costs associated with impacts to individuals or family units
Source separation	Separation at source,	Actions taken to keep and store certain materials separately from commingled (mixed) waste at the point of generation
Street picker	Street scavenger, waste	Woman, man, child or family who removes recyclable materials from dumpsters, streets and public places
Tipping fee	Dump fee, tip fee	The amount that is charged for disposing of waste at a facility, usually per top, per cubic metre, or per vehicle
Transfer station	Transit point	A place where waste from collection vehicles is assembled before being transported to disposal sites or treatment stations
Treatment	Decontamination, processing, composting	Manual or mechanical operations to make discarded or disposed materials or mixed waste less dangerous or to improve the physical characteristics so it is easier to incinerate or landfill. In some locations also used to mean conserving value added.

(Continued)

#### Annex I. (Continued)

Term	Other terms or abbreviations used	Working definition
Value chains	Recycling sector, recycling industry	The collection of private enterprises that functions buy trading (buying and selling) secondary /recycled materials
Valorisation	Recycling, recovery, conserving value added	Recovery of materials separated from or extracted from the waste stream because of their retained value. Valorisation involves commercial transactions; recovery can also be without payment as long as there is some transaction that recognises the value of what is traded
Junk shop, Kabaddis, bodega	Junkshop, recycling trader, consolidator and waste buyer	Individual or business purchasing materials for recycling or composting, storing them, upgrading or processing them, and then reselling to the poor who trades in recyclables and uses a dedicated storage place
Waste pickers	Scavenger, rag picker, recycler	Person who salvages recyclable materials from streets, public places or disposal sites