Circular economy from the ground: Socioeconomic Impact of the Deposit-Return System on Waste Pickers in Amsterdam and Rotterdam

Ricardo Abussafy
Commissioned Study[1]
Independent Researcher

Abstract

This study explores informal waste pickers' role, challenges, and organizational strategies within the Netherlands' expanding Deposit-Return System (DRS), focusing on Amsterdam and Rotterdam. By employing documentary research and urban observation, the research offers a multifaceted view of how waste pickers navigate and contribute to urban recycling. Through the lens of flânerie, the study captures waste pickers' organic and spatial dynamics in public spaces. The literature review underscores the disconnect between circular economy goals and the marginalization of informal recyclers within formal systems. The study also examines EU and Dutch legal frameworks governing waste management, identifying gaps in policies that neglect the inclusion of informal recyclers. It critically analyzes how DRS limits waste pickers' access to recyclables, positioning them as unrecognized contributors in the recycling chain. The data collected and analyzed details of a demographic sample, socio-economic characteristics, as well as the main regions and work routes. Proposed solutions include dedicated collection hubs and advocacy for more inclusive models that address social inequalities, such as organizing workers in a cooperative organization model, or more flexible association-based models like the African Reclaimers Organization, from South Africa, and Pimp My Carroça, from Brazil, which support autonomy while providing organizational benefits. This research concludes that creating an inclusive circular economy requires integrating informal recyclers and balancing efficiency with social equity to advance sustainable urban waste management.

1. Introduction

In 2023, the Netherlands expanded its Deposit-Return System (DRS) to incentivize the recycling of single-use beverage containers, particularly plastic bottles and aluminum cans. While this system aimed to boost recycling rates and reduce environmental pollution, an unintended consequence was the significant rise in the number of informal waste pickers in the landscape of the major cities, especially in Amsterdam and Rotterdam. Waste pickers, who traditionally rely on collecting recyclables for income, are increasingly engaging with the DRS, prompting the need for a socio-economic diagnosis of this emerging phenomenon.

[1] The researcher and the supervisory team of Dynamics of Inclusive Prosperity / Inclusive Wise-Waste Cities, Erasmus University, were always aware of any ethical issues that might arise and took the best measures to avoid them. We ensure that the final result is not only not harmful to anyone, but also helpful to the vulnerable community in question.

This report provides a comprehensive analysis of the relationship between the DRS and the waste pickers in Amsterdam and Rotterdam. It maps the demographic and economic characteristics of these workers, documents their interaction with the DRS, and evaluates the socio-economic implications of their role within the broader context of the circular economy.

This research employs a multidisciplinary approach, integrating documentary analysis, and field observation to capture the experiences and challenges of waste pickers under the expanded DRS framework. Using methodologies inspired by flânerie and structured urban observation, the study explores how waste pickers navigate urban spaces, adapting their routes and methods in response to DRS collection points. In addition to field observations, this research reviews academic literature, technical reports, and legal frameworks on informal work and circular economy initiatives, providing a comprehensive understanding of how informal recyclers contribute to - and are affected by - the formalization of waste collection.

The study also critically examines the potential of waste pickers' inclusion within formal systems, contrasting cooperative and association-based models as frameworks for organizing informal workers. While cooperative models have been successful in some regions, association-based initiatives like the African Reclaimers Organization (South Africa) and Brazil's Pimp My Carroça highlight alternatives that preserve waste pickers' autonomy while offering organizational support. These models provide flexibility and empower waste pickers by offering resources, advocacy, and public visibility without requiring formal integration.

In conclusion, this research advocates for a more inclusive circular economy model that recognizes waste pickers as essential contributors. By proposing solutions such as dedicated collection hubs and inclusive policy frameworks, the study aims to inform policymakers of the importance of balancing efficiency with social equity in environmental initiatives. Integrating waste pickers into the DRS system and circular economy not only supports sustainable urban development but also ensures that the benefits of recycling extend to those who depend on it most.

2. Research Methodology

The research employed a mixed-method approach combining the **flâneur method**, **structured urban observation**, and **documentary research**. Fieldwork was conducted over two periods: 6 weeks between May and June of 2023 and 4 weeks in August 2024.

This combination of methods allows the diagnosis to cover different dimensions of the research problem.

The method of flânerie, as expressed in the poetry of Charles Baudelaire and analyzed by Walter Benjamin, was adopted as an exploratory technique to map waste pickers in Amsterdam and Rotterdam. The flâneur, a figure who wanders the city aimlessly to absorb and observe urban life, provided the researcher with a framework for unstructured exploration, allowing the collection of organic observations about waste pickers' movements and their interaction with the city's spaces.

Urban observation aimed to identify daily working life, such as distribution between men and women, average age group, main urban areas, waste collection strategies and tools used, among others.

Documentary research aims to collect data, qualitative information, and narratives about this content from technical and government institutes and the private companies that organize DRS logistics.

These three methods combined provide a multi-criteria analysis for a most comprehensive diagnosis of the research problem and, consequently, direct the analysis toward integrated recommendations on the subject.

2.1 Flânerie as an Exploratory Method for Mapping Waste Pickers

The concept of the *flâneur*, as originally articulated by Charles Baudelaire and later expanded upon by Walter Benjamin, serves as a foundational metaphor for the exploratory phase of this study's field research. Baudelaire's *flâneur* is a detached, reflective urban wanderer who walks the streets aimlessly, absorbing the life and atmosphere of the modern city without a fixed destination (Benjamin, 1989). In his reflection on the *flâneur* in The Arcades Project, Walter Benjamin underscores this figure as someone who moves through the city not to reach a particular destination but to experience the city as it unfolds, capturing its contradictions and complexity (Benjamin, 2006).

In this research, the methodology of *flânerie* was adapted as a key exploratory technique for the initial mapping of waste pickers in Amsterdam, Rotterdam, The Hague, Utrecht, Delft, Apeldoorn, Zwolle, and Leiden over 25 days. The researcher, much like the *flâneur*, wandered through the streets without a predetermined route, using this open-ended approach to observe the interactions of waste pickers with the urban environment. This method allowed the researcher to witness the city's dynamics organically, identifying where waste pickers assemble and how they navigate spaces like public parks, markets, and areas around Deposit-Return System (DRS) machines.

About 25 days of the field research days were allocated to this *flâneur*-inspired strategy. During these days, the researcher's aim was not to conduct structured observations but to walk aimlessly, collecting impressions of the city and the way waste pickers interact with it. This approach aligns with the idea proposed by João do Rio, a Brazilian chronicler and *flâneur*, who argued that walking the streets without purpose is a way of "taking possession of the city" and gaining a deeper understanding of its rhythms (Calliari, 2024). Through this method, the researcher captured sensory experiences and patterns of urban life that would otherwise remain hidden if confined to a structured, predefined observation framework.

This unstructured wandering not only mirrored the researcher's methodological exploration but also reflected the movements of the waste pickers themselves. Like the *flâneur*, waste pickers roam the city, following the trails of discarded materials, with no clear endpoint. They navigate the urban landscape driven by the availability of recyclable waste, a parallel to the researcher's movement, which was similarly dictated by the spontaneous encounters with the waste-picking community.

In Baudelaire's and Benjamin's reflections, the marginalized figures of society - such as street vendors, ragpickers, and waste collectors - are central to the understanding of the city. These figures, like the waste pickers in this research, traverse the city's streets following the flows of modern consumption and discard. The *flâneur's* methodology, adopted by the researcher, thus became a powerful tool for understanding the informal economy of waste picking, where the path taken is shaped by the availability of waste rather than a clear final destination (Benjamin, 2006). In this phase of the research methodology, the important thing is the path left by the trail of waste, not the destination it takes us to.

2.2 Urban Observation

A structured observation technique was adopted to minimize bias and ensure replicability (Byrne, 2021). The urban observation was conducted over 20 days in Amsterdam and Rotterdam. The study aimed to map waste pickers and their daily routines, including gender, age, nationality, tools used, and locations frequented (Google Forms was used for data collection).

Urban observation as a research method is fundamental to understanding the social dynamics of city environments. In this study, we employed structured observation techniques to gather data on waste pickers in Amsterdam and Rotterdam. The methodology aimed to map the behaviors and socio-demographic profiles of waste pickers concerning the Deposit-Return System (DRS), focusing on how they interact with urban spaces and each other while collecting recyclable containers.

In addition, the researcher occasionally added a 'quick approach' method of engaging with waste pickers during the urban observation. Sometimes the researcher would simulate collecting post-consumer packaging from a bin, or sit next to a waste picker and wait for contact, or offer a post-consumer bottle to a waste picker passing by on the street. These techniques quickly established a rapport between the researcher and the waste picker, allowing the researcher to gather additional information such as country of birth, age and, where possible, income.

Structured Observation: Principles and Application

Structured observation involves a **systematic approach** to data collection, designed to reduce bias and ensure that observations are repeatable and verifiable. The observation process is carefully controlled, with researchers adhering to predetermined variables, such as the time of day, location, and specific behaviors to be recorded. This approach provides a high degree of reliability and validity in the data (Bryman, 2016).

In this study, structured observation was conducted over 18 days, during which the researcher followed predefined routes across major urban areas in Amsterdam and Rotterdam. These observations were performed during different times of the day and across varied locations, such as tourist spots, parks, shopping streets, and regions near DRS machines located in supermarkets. The observation schedule was designed to capture fluctuations in waste-picking activity and account for variables such as weather conditions, holidays, and peak business hours.

Observation Tools: using a digital form, the researcher recorded key details, including the waste pickers' demographics (age, gender, nationality), tools used (bags, sticks,

carts), vehicles (bikes and motorized wheelchairs), and the types of recyclable containers collected (plastic bottles, aluminum cans). These data points were systematically logged into Excel spreadsheets, a common practice in structured observation research to facilitate the analysis of large datasets (Byrne, 2021). Structured observation was chosen as it allowed for comparisons across different observation days, and different periods of the day, ensuring that the collected data was representative of waste picker behaviors over time.

Observation of Spatial and Social Interactions

Observations extended beyond individual behaviors to encompass spatial patterns. Waste pickers were mapped in various urban locations, focusing on areas with high DRS machine concentrations, such as supermarket entrances and public parks. By utilizing geographic mapping techniques, the research highlighted key zones where waste pickers were most active, thus revealing how spatial factors, such as proximity to supermarkets, commercial streets, and walking areas, influenced their collection routines (Gibson, 2009).

Ethical Considerations in Urban Observation

Ethical issues are inherent in urban observation, especially when observing vulnerable populations like waste pickers. In accordance with research ethics guidelines, the researcher ensured that waste pickers were not overtly identifiable in recorded data. This was particularly important given the informal and often stigmatized nature of their work. Careful steps were taken to anonymize the data and ensure that no personal identifying information was collected (Byrne, 2021).

The researcher also adopted a nonintrusive approach, observing behaviors without direct interaction unless participants voluntarily engaged in conversation in the case of the “fast approach” technique. This form of nonparticipant observation minimizes the observer's influence on the participants' natural behavior, an essential aspect of maintaining objectivity in observational research (Bryman, 2016).

Challenges and Limitations

While structured observation provides significant insights, it also presents challenges. One limitation is the potential for researcher fatigue, particularly during long observation periods on the streets. This can result in missed data or inaccuracies in recording. Additionally, structured observation can miss out on capturing more nuanced, spontaneous social interactions that occur outside the scheduled observation times. For example, important waste picker activities may take place during late evening hours when observations were not scheduled (Gibson, 2009).

Moreover, the structured nature of the observation might overlook complex social dynamics among waste pickers that could be better captured through more immersive methods like unstructured or participant observation. While structured observation provides reliable data on what behaviors occur, it may not fully explain why they occur (Byrne, 2021).

2.3 Documentary Research

A literature review was conducted to understand the role of informal workers in the circular economy and their interaction with formal waste systems. Studies from European nations with DRS programs were reviewed to contextualize the findings within broader regional trends. The research highlighted the lack of formal recognition of waste pickers' contributions to recycling systems, especially in the context of deposit-return schemes (EPSU, 2023).

The documentary research conducted for this study encompassed three main areas: a literature review on informal work, waste management, Deposit-Return Systems (DRS), and the circular economy; an examination of technical reports from DRS companies and government authorities; and a review of legal documents outlining the regulatory framework surrounding waste management and DRS. Each of these documentary strategies contributed to a comprehensive understanding of the socio-environmental and economic contexts shaping waste pickers' work and the DRS's impact on informal recycling in Amsterdam and Rotterdam.

First, the literature review provided theoretical and empirical foundations on informal waste collection, recycling behaviors, and the DRS's role in the circular economy. Studies by authors such as Weghmann (2017) on informal recycling in Europe, and Reloop (2021) on global DRS performance, offered insights into the complex relationship between formal recycling systems and informal waste pickers. Additionally, literature on circular economy models, such as Scheinberg et al. (2016), contextualized the critical contributions of informal recyclers within circular economy frameworks. This body of literature helped identify the knowledge gaps and socio-economic challenges waste pickers face within formal recycling systems, particularly in the context of expanding DRS policies.

Second, the review of technical reports from DRS companies and government agencies provided both quantitative and qualitative data on DRS operations and their outcomes in Europe and the Netherlands. Reports from the European Federation of Public Service Unions (EPSU, 2023; Weghmann, 2017; Weghmann, 2020) and technical documents from industry stakeholders highlighted the performance metrics of DRS, such as return rates, material recovery, and logistical challenges (Reloop, 2021; TOMRA, 2021). These documents offered an industry perspective on DRS, including the economic incentives driving the system and its environmental impact. Additionally, government reports from the Netherlands detailed the operational structure of the country's DRS, revealing issues related to accessibility and the unintended social impact on informal recyclers who depend on public access to recyclables (EPSU, 2023).

Third, the analysis of legal documents focused on the regulatory framework governing waste management and DRS. This involved examining EU directives such as the Packaging and Packaging Waste Directive (PPWD) and the Single-Use Plastics Directive (SUPD), both of which set ambitious recycling and collection targets for EU member states (European Parliament and Council Directive 94/62/EC, 1994; European Parliament and Council Directive 2019/904, 2019). These directives were instrumental in understanding the policy rationale behind DRS expansion in Europe, as they mandate recycling targets that are largely achievable through efficient collection systems like DRS. In the local legislative context, Dutch legal frameworks regulating waste management and municipal waste collection provided insight into the local policies

shaping the access and rights of informal recyclers, who often operate in a legal gray zone due to their informal employment status (Besluit kunststofproducten voor eenmalig gebruik, 2021; Regeling kunststofproducten voor eenmalig gebruik, 2022).

3. Key-points of Deposit-Return Systems: Legal Framework for Single-Use Packaging, Recovery Targets, and expansion of DRS in the EU and the Netherlands

The historical development of Deposit-Return Systems (DRS) has roots in environmental movements and waste reduction initiatives dating back to the 1970s. Initially implemented to encourage recycling of beverage containers, these systems charge consumers a deposit at purchase, refundable upon the container's return. Early DRS models were predominantly localized in the United States, known as "bottle bills," which operated through return-to-depot methods where consumers would bring containers back to designated centers (Cass Talbott, 2022).

As recycling gained momentum globally, DRS models evolved, with Europe adopting return-to-retail approaches. These systems expanded in scope and technological sophistication, integrating reverse vending machines (RVMs) in supermarkets for convenient public access, especially prominent in countries like Germany, Norway, and Finland. Such modernized systems have shown effectiveness in achieving recycling rates above 90%, positioning them as a benchmark for sustainable waste management globally (Cass Talbott, 2022).

This section offers a comprehensive overview of the DRS historical evolution, its current operational status and Dutch context.

3.1 European Union Legal Framework

The European Union (EU) has implemented several key directives aimed at reducing waste, improving recycling rates, and fostering the transition toward a circular economy. Central to this strategy are regulations addressing single-use packaging and the role of DRS in achieving high recycling and recovery rates for beverage containers. Two main legislative frameworks govern these areas: the **Packaging and Packaging Waste Directive (PPWD)** and the **Single-Use Plastics Directive (SUPD)**.

- **Packaging and Packaging Waste Directive (PPWD)**: The PPWD, first enacted in 1994 and subsequently revised, is the foundational legal instrument that addresses the management of packaging waste within the EU. It mandates that by **2025**, EU member states must recycle **65% of all packaging waste**, with specific material targets, including 50% for plastics, 75% for paper, and 70% for glass. These targets align with the broader goal of the European Green Deal, which aims to achieve carbon neutrality by **2050**. The directive also emphasizes the importance of Extended Producer Responsibility (EPR), which makes producers responsible for the waste management costs of their products, encouraging a more sustainable lifecycle approach to packaging (European Parliament and Council Directive 94/62/EC, 1994).
- **Single-Use Plastics Directive (SUPD)**: Enacted in 2019, the SUPD specifically targets the environmental impact of single-use plastic products, including

beverage containers. The directive sets ambitious targets for the collection of plastic bottles, aiming for **90% collection by 2029**, largely achievable through Deposit-Return Systems. The directive also bans certain single-use plastic items and encourages innovation in sustainable packaging alternatives (European Parliament and Council Directive 2019/904, 2019).

These directives place the DRS at the heart of achieving higher collection and recycling rates, particularly for beverage containers that are often discarded as litter. Countries with robust DRS have demonstrated their ability to significantly reduce litter and improve material recovery. For example, **Germany** has achieved a **98% return rate** for beverage containers through its DRS, showcasing the system's effectiveness in meeting EU recycling targets (Reloop, 2022).

Deposit return systems require consumers to pay a small deposit on beverage containers, which they can reclaim by returning the empty container through a reverse vending machine or over-the-counter. These systems emerged in the 1970s, initially as return-to-depot models prevalent in many U.S. states. Over time, a more modern return-to-retail model became dominant in Europe, particularly in Scandinavian and Baltic nations, with each region implementing unique variations. Deposit return systems have gained momentum globally as an effective strategy for reducing waste and associated costs. By the end of 2020, about 291 million people lived in regions using deposit systems, a number projected to approach 500 million by 2023. Most of these systems adopt the modern return-to-retail approach, covering PET bottles and metal cans, with some also including single-use glass and other materials, such as cardboard.

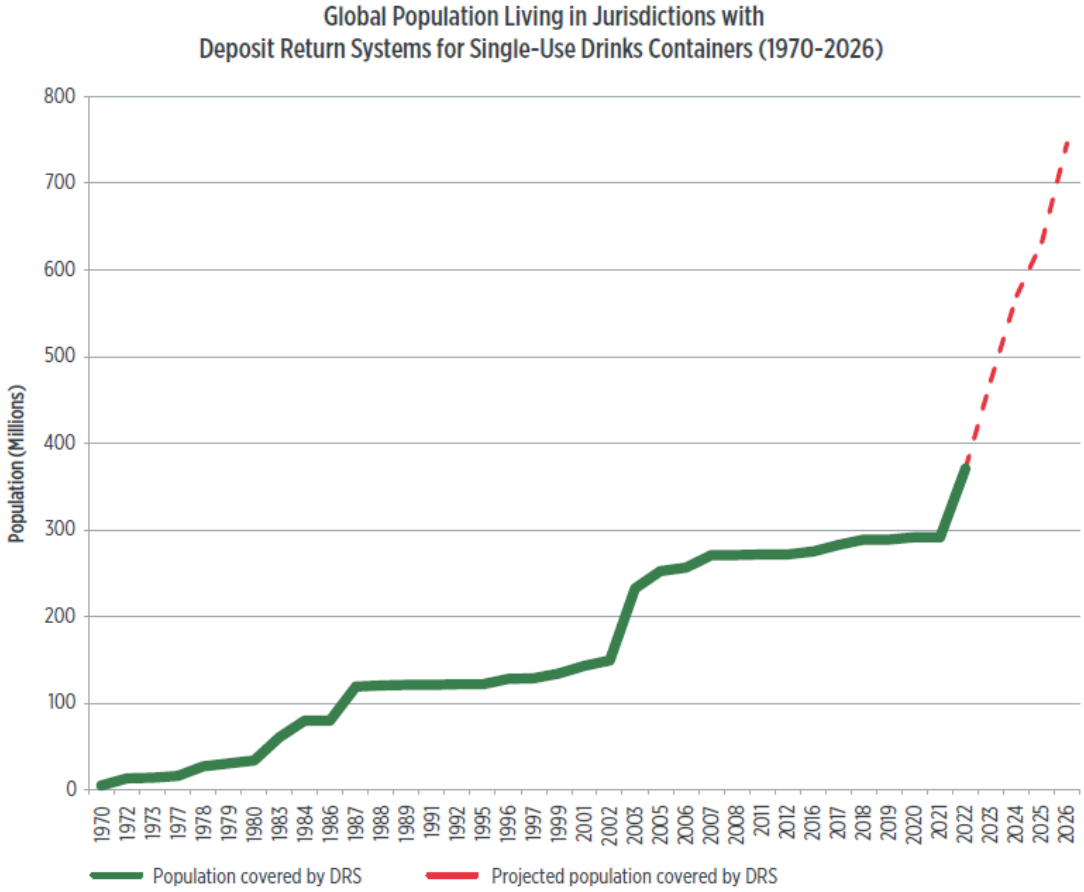


Figure 1 - Replicated from Reloop, 2022.

Deposit-return machines have become increasingly popular across Europe as part of larger efforts to enhance sustainable waste management. Countries such as Germany, Sweden, Norway, and Finland have led the way in implementing deposit-refund systems, achieving impressive outcomes in recycling and waste reduction. Germany, in particular, has set a high standard, with its bottle deposit program achieving a recycling rate of over 90% for plastic bottles, serving as a model for other European countries to follow (Rhein, S., & Sträter, K. F., 2021).

Figure 2 - Replicated from Sensoneo, 2023[2].

In the past decade, there has been a significant rise in the number of regions adopting deposit return systems (DRSs) for collecting single-use drink containers. A primary driver of this growth is the proven effectiveness of DRSs in achieving high recycling rates. Global data consistently demonstrates that areas with DRSs have much higher recycling rates for drink containers than those without such systems. In Europe, most countries with DRSs reach recycling rates exceeding 90%, diverting substantial volumes of drink containers from waste and keeping valuable materials in circulation within the economy.

[2] Detailed overview and results of the current deposit return scheme implementations in Europe. Sensoneo. https://sensoneo.com/waste-library/deposit-return-schemes-overview-europe/ Last accessed November 01, 2024.

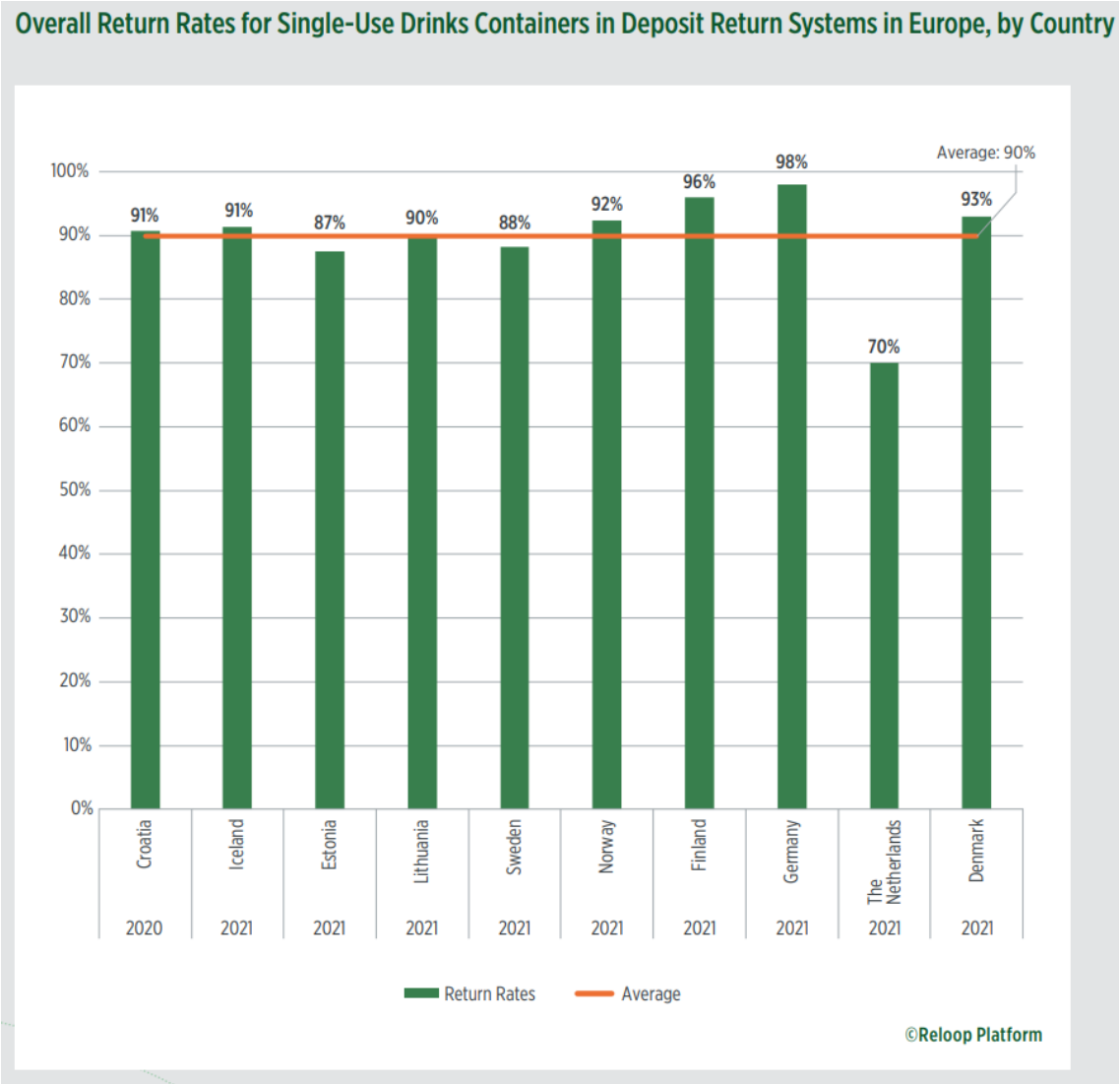


Figure 3 - Replicated from Reloop, 2022.

The graph illustrates the return rates for single-use drink containers across various European countries with Deposit Return Systems (DRSs). The data, provided by the Reloop Platform, shows that most countries achieve high return rates, with the average rate across these countries at 90%.

Countries such as Germany and Finland lead with return rates of 98% and 96%, respectively, setting a high standard in DRS effectiveness. Norway, with a 92% return rate, and Sweden, with 88%, also show strong performance, indicating the success of DRSs in the Scandinavian region. Other countries like Iceland and Croatia have achieved return rates of 91%, slightly above the 90% average.

Denmark has a return rate of 93%, also surpassing the average, indicating effective implementation and public participation in their DRS. In contrast, The Netherlands has a notably lower return rate of 70%, which suggests potential challenges or differences in their DRS approach that may impact overall effectiveness.

Overall, this data confirms that European countries with well-established DRSs are effective in reducing waste and enhancing recycling, as most countries meet or exceed

the 90% return rate benchmark. With the new measures to expand the Deposit Return System, the trend is, hopefully, for the Netherlands to reach the same average indicators as European countries that have had a widespread DRS for a longer time.

3.2 The Role of DRS in the Netherlands

Through multiple legislative efforts, the Netherlands has established a robust legal framework to regulate packaging waste management, specifically the Deposit-Return System (DRS). The core regulations are rooted in the **Verpakkingsverordening Productschap Dranken** [**Packaging Management Decree]** (2003), which integrates the principles of extended producer responsibility (EPR) by mandating that producers and importers manage the full lifecycle of their packaging waste. This Decree has been updated periodically, most recently to include a 90% collection target for all plastic bottles (effective from January 2022) and metal cans (effective from January 2024), reflecting the national commitment to EU environmental targets (Verpakkingsverordening Productschap Dranken, 2003; Reloop, 2022).

The Netherlands enacted specific directives under the **Besluit kunststofproducten voor eenmalig gebruik [Single-Use Plastics Decree - SUP] (2021)** and **Regeling kunststofproducten voor eenmalig gebruik [Single-Use Plastics Regulation – SUP Regulation] (2022)** to further align with EU mandates. These laws, implemented in 2021 and operationalized through detailed regulations in 2022, expand the country's approach to single-use plastics by placing explicit restrictions on the sale and distribution of single-use plastic products. For example, the SUP Decree prohibits certain single-use plastic items entirely (such as cutlery and plates) and mandates labeling and public awareness measures for others, like plastic-containing sanitary items, which inform consumers of appropriate disposal methods (Besluit kunststofproducten voor eenmalig gebruik, 2021; Regeling kunststofproducten voor eenmalig gebruik, 2022).

The **Afvalfonds Verpakkingen** (Packaging Waste Fund) administers EPR policy enforcement. Under this system, producers and importers of packaging materials are required to contribute financially to waste management efforts through a waste management contribution. This contribution supports the implementation of DRS as well as the handling and recycling of collected materials. These fees, defined within the **Packaging Waste Management Contribution Agreement (ABBO)**, are intended to cover collection, recycling, and related awareness-raising activities, ensuring that producers bear responsibility for their products' environmental impacts (Afvalfonds Verpakkingen Policy, 2022).

Furthermore, the **DRS structure** in the Netherlands, managed by Statiegeld Nederland, has expanded to include small plastic bottles (in 2021) and beverage cans (in 2022). This system imposes deposits of €0.15 for plastic containers under 1 liter and €0.25 for larger containers, which are redeemable at designated return points, primarily located in supermarkets (Regeling kunststofproducten voor eenmalig gebruik, 2022).

In summary, the Netherlands' approach integrates EPR, targeted prohibitions, and public education measures under its legislative and regulatory framework, aiming for both environmental sustainability and operational efficiency. Nevertheless, the framework could benefit from greater inclusivity measures for informal recyclers, whose role in the circular economy remains unacknowledged by formal policies.

The deposit-refund system in the Netherlands, especially for beverage containers, is managed by several key players, ensuring efficiency and environmental benefits:

1. Statiegeld Nederland: This central organization coordinates the entire deposit-return system. It ensures consumers can return bottles and cans through reverse vending machines (RVMs) at various collection points, primarily in supermarkets and other designated locations like petrol stations and sports clubs[3].

2. Reverse Vending Machine (RVM) Providers:

- Tomra Systems: A global leader in RVM technology, Tomra supplies machines widely used in Dutch supermarkets. They handle everything from small plastic bottles to aluminum and steel cans, contributing to the circular economy in the Netherlands (Tomra, 2021).
- Envipco: Another major provider, Envipco offers tailored RVM solutions to various retailers in the Netherlands. Their machines are equipped to handle a wide range of materials, including plastic, aluminum, and glass[4].

3. Supermarkets and Retailers: Large supermarket chains such as Albert Heijn and Jumbo are required by law to have deposit-return machines, providing a convenient way for customers to return containers and get their deposits back. These retailers work closely with manufacturers like Tomra and Envipco to install and maintain RVMs.

4. Recycling and Environmental Impact: The deposit-refund system plays a crucial role in promoting recycling and reducing litter, helping to return millions of containers annually. This initiative supports the Dutch government's goals for a circular economy, and organizations like Tomra report high return rates for eligible containers.

Consulting technical reports from companies that manufacture Reverse Vending Machines (TOMRA, 2021) and non-profit organizations that support DRS (Reloop, 2022), it can be seen that in the description of the Deposit-Return System, the informal sector of workers, who are responsible for a significant portion of the best results in the recovery of single-use packaging by these systems, are made invisible in the design of these processes.

Take, for example, the infographic published by Reloop, “Global Deposit Book: An Overview of Deposit Return Systems for Single-Use Beverage Containers (2022), where it is possible to have an overview of the DRS context in The Netherlands.

[3] https://www.statiegeldnederland.nl/
[4] https://www.envipco.com/reverse-vending-machines

System structure & administration

Clearing system
Centralised

System operator
Statiegeld Nederland (a not-for-profit organisation established by the soft drink and mineral water suppliers in cooperation with the food trade; took over operation of the system from Stichting Retourverpakking Nederland as of March 2021)

System finance
Producer fees

Unredeemed deposits
Producers/Importers

Material owner
Producers

Container return & refund points

Collection model
Return-to-Retail: Although there is NO legal obligation for retail to take back empty containers, approximately 5,000 registered supermarkets are currently taking them back, plus some train stations and gas stations (for a total of approximately 5,600 collection points.

Pop. per collection point
~3,121

Method of return
97% automated / 3% manual

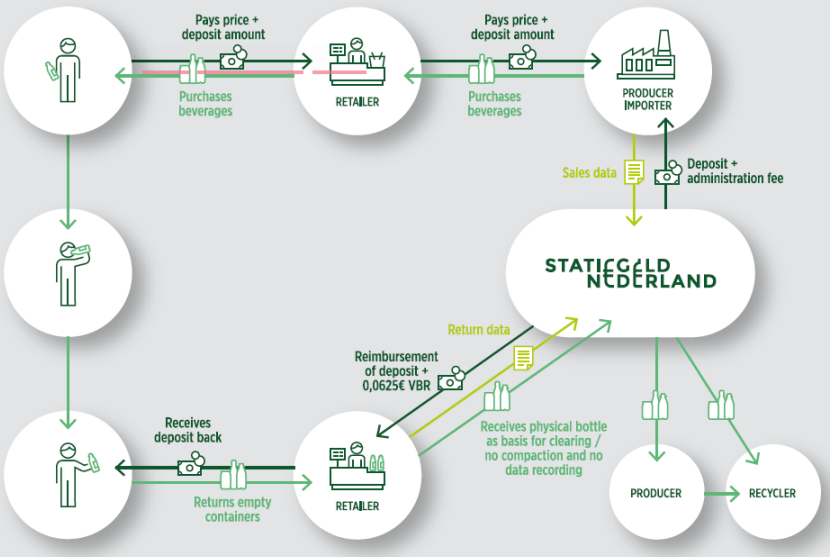
Barcode-based system?
Yes

Note: The overall return rate of 70% is for the second half of 2021. Material-specific return rates are estimated as there is simply no accurate data publicly available due to lack of transparency on the part of the system operator. It is estimated that 90% of the 600 million large bottles are collected and 57% of the 900 million small bottles are collected.

Return rate (2021)

Plastic <1L	Plastic 1-3L	Total
57%	90%	70%

Money, material & data flow



GLOBAL DEPOSIT BOOK 2022

[1] Dutch law allows for these targets to be met with up to 10 percentage points of the contribution coming from alternative capture methods outside of the DRS, if this material is of comparable quality to separate collection.
[2] Until recently, the Netherlands' DRS applied only to large plastic bottles (>1L). For decades, a small group of members of the Dutch beverage and food industry had prevented a DRS on small plastic bottles and cans in the Netherlands. In 2018, the State Secretary for Infrastructure and Water Management Stientje van Veldhoven presented producers of cans and small plastic bottles with an ultimatum: they either reduced the amount of beverage packaging as found in litter by 70%, or the government would expand the deposit return scheme. Initially, the agreement only applied to the small plastic bottles. The number of small plastic bottles in litter did not decrease, but increased in 2019. That is why the Dutch cabinet decided in April 2020 to put a deposit on small plastic bottles, which went into effect on 1 July 2021. After parliamentary motions of MPs Jan Paternotte and Carla Dik-Faber in October 2019, the government in April 2020 decided to set up a similar trajectory for cans, with a deadline for industry in the second half of 2021. The deposit system will expand to beverage cans as of 31 December 2022.
[3] As of 31 December 2022, when metal beverage cans 3L or less are added to the DRS, single-use beer and other low alcohol drinks will also be included in the system.
[4] The deposit on cans will be the same as that on small plastic bottles (€0.15 (USD$0.16)).

Figure 4 – Copyrights to Reloop, 2022.

In all the information in this infographic, there is no mention of this important player in the single-use packaging return chain. Take, for example, another technical report, published by TOMRA, a manufacturer of Reverse Vending Machines, whose infographic below details the entire packaging cycle within the Deposit-Return System, without also mentioning the participation of an actor who is not the usual consumer, but rather an informal worker who lives off the income generated by collecting packaging from ordinary rubbish bins.

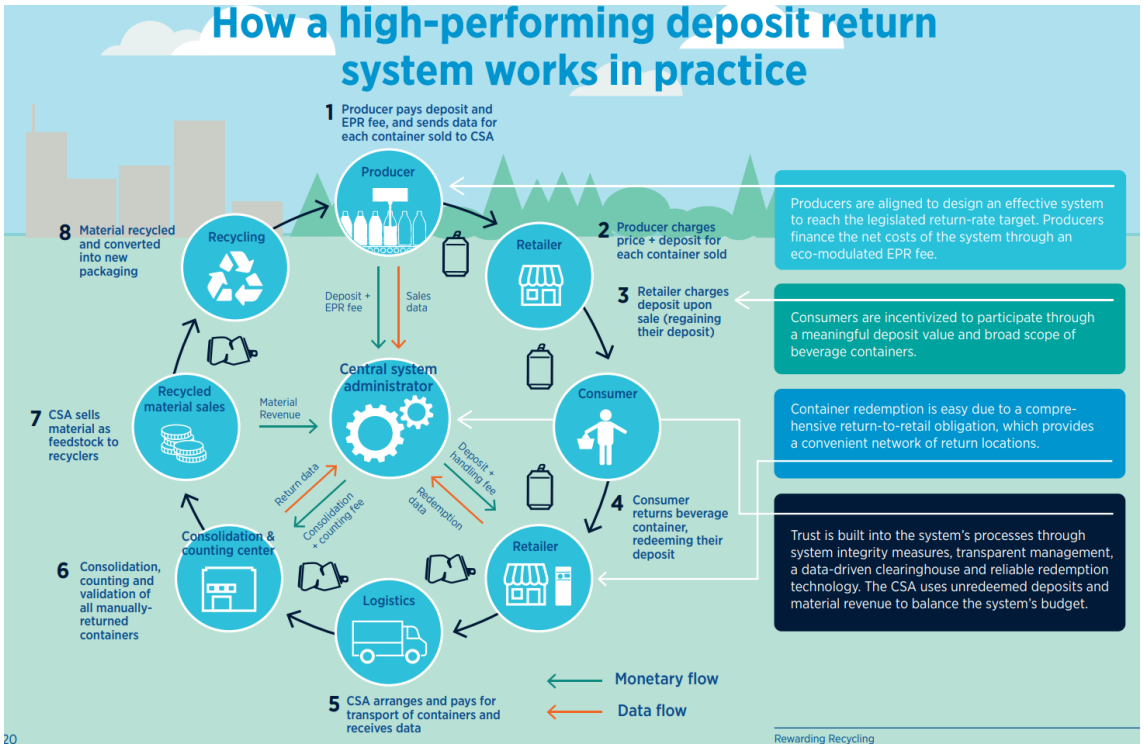


Figure 5 – Copyrights to TOMRA, 2021.

This proves that the manufacturing companies of Reverse Vending Machines (RVM) and Central System Administrators (CSA) do not recognise an actor who is clearly part of this reverse logistics. However, these companies and institutions certainly include in their calculations of the technical and economic viability of the RVM market, the successful performance of the high packaging return rates that occur thanks to these informal workers.

Of course, the Dutch Deposit-Return System is an important part of the country's efforts to meet EU recycling and waste reduction targets. By extending the DRS to aluminium cans and increasing the number of return points, the Netherlands is well placed to achieve the 90% return rate required by EU directives. However, it's important to recognise that waste collectors are a crucial part of the DRS operation and one of the reasons for its success in achieving high return rates. Their role is often overlooked or marginalised, particularly in formal circular economy frameworks. As Deposit-Return Systems expand across Europe, policy makers need to balance the need for efficient recycling systems with the livelihood needs of informal recyclers. There is growing recognition that waste pickers, particularly in the Global South, embody circular economy principles in their everyday practices. To achieve a truly inclusive circular economy, these workers must be integrated into formal systems in ways that recognise their contributions, protect their rights and support their livelihoods.

4. Waste Pickers, the Informal Recycling Sector, and connections with Deposit-Return System

4.1 Global Context of Informal Waste Picking

The role of waste pickers in municipal solid waste management systems is crucial worldwide, particularly in the Global South, where formal waste collection services, and mainly selective waste collection services, are often inadequate or nonexistent. Waste pickers typically operate outside the formal economy, salvaging valuable materials such as plastic, metal, and paper from landfills, streets, and bins. Their activities significantly contribute to the recovery of recyclables, which would otherwise be lost in landfills, and thus play an essential part in the circular economy (Medina, 2010). However, these workers often face harsh conditions, limited access to social services, and no legal recognition, making them vulnerable to exploitation and health risks.

According to the **Circle Economy Foundation (2024)**, over 60% of the global workforce operates in informal settings, with a significant portion of these workers engaged in waste management. In cities like Cairo, the Zabbaleen community processes nearly 80% of the city's waste, while in countries like Brazil and India, waste pickers form an indispensable part of the recycling system. Despite their contributions, informal recyclers are often marginalized, both socially and economically. The term "informal" can carry negative connotations, as it implies a lack of structure or regulation, further stigmatizing workers who provide essential services under precarious conditions (WIEGO, 2019).

Efforts to formalize the work of waste pickers have produced mixed results globally. In Brazil, cooperatives like ASMARE in Belo Horizonte have successfully integrated waste pickers into formal recycling systems, improving their working conditions, increasing their incomes, and providing them with social recognition (Colombijn & Morbidini, 2019; IPEA, 2020). However, formalization in other regions has led to marginalization, particularly where formal recycling companies have taken over waste streams, leaving informal workers without access to valuable materials (Maiello, 2022; IIED, 2022). This exclusion is most severe in areas where the informal sector lacks the organizational support of cooperatives, limiting waste pickers' ability to participate in formal recycling activities (Colombijn & Morbidini, 2019).

4.2. Brief overview of Extended Producer Responsibility and Waste Pickers

Extended Producer Responsibility (EPR) policies, designed to hold producers accountable for the end-of-life management of their products, are increasingly adopted worldwide as part of a shift toward circular economies. In countries with established EPR frameworks, such as Canada and Germany, the primary focus has been on reducing environmental impacts, with less emphasis on social dimensions like the integration of waste pickers. In Canada, for example, while waste pickers contribute substantially to EPR systems by collecting beverage containers for deposit returns, they are rarely acknowledged as official stakeholders. This omission limits their access to resources and leaves them vulnerable to displacement as formal systems expand (Cass Talbott et al., 2022).

Conversely, in Latin American countries like Brazil, EPR systems have incorporated provisions for waste picker inclusion due to the strong advocacy of waste picker organizations. Brazil's Sectoral Packaging Agreement, part of its EPR policy, sets explicit targets for material recovery and directly involves waste picker cooperatives. These cooperatives are compensated for their services in sorting and recycling materials, providing a model of formal recognition that improves waste pickers' working conditions and stability. This inclusion reflects years of organized advocacy, highlighting the role

that social movements can play in shaping EPR policy to support informal workers (Rutkowski, J. E., 2021).

India also provides an illustrative case of EPR's impact on waste pickers, where a large portion of waste recovery is managed by informal workers. The recent EPR guidelines in India, though aimed at reducing plastic waste, often inadvertently create barriers for waste pickers. New entrants to the waste industry, incentivized by EPR policies, increase competition, potentially pushing informal workers out of established value chains. Additionally, requirements for registration and compliance with formalized procedures pose challenges for many waste pickers, who lack the resources to meet such standards. This disconnect demonstrates the need for more inclusive EPR frameworks that address the unique circumstances of informal workers (Cass Talbott et al., 2022).

South Africa's experience shows a mixed approach: while EPR programs exist, they do not consistently integrate waste pickers as recognized actors in the recycling process. Initiatives like the Petco model, developed by the private sector for the recycling of PET bottles, have engaged some waste pickers as suppliers of recyclable materials. However, the system operates primarily within the formal sector, and waste pickers lack representation in decision-making processes, impacting their potential for long-term integration and advancement within the system (Godfrey, L., 2021).

The challenges faced by waste pickers within EPR frameworks underline the importance of designing policies that consider the socio-economic realities of informal workers. Effective EPR systems should ideally support informal waste collectors by providing pathways to formal recognition, offering fair compensation, and engaging them in decision-making processes. These measures not only bolster the efficiency of waste recovery but also ensure that the transition to a circular economy remains inclusive and equitable for all stakeholders involved (Cass Talbott et al., 2022).

4.3 Waste Pickers in the Circular Economy

Waste pickers are crucial yet often overlooked actors in the circular economy, particularly in regions where formal waste management systems are underdeveloped. They play a significant role in resource recovery by collecting and sorting recyclable materials, such as plastics, paper, and metals, thus diverting waste from landfills and contributing to material reuse and recycling. According to the Circle Economy Foundation (2024), informal recyclers recover up to 60% of urban waste in some cities across the Global South, underscoring their importance in the circular economy. Despite these contributions, their work remains largely unrecognized, and they often operate under precarious conditions without legal protection or social benefits.

In the context of a circular economy, waste pickers engage in a variety of activities that support the transition from a linear to a more circular system. These activities include the collection of recyclable materials, the repair and refurbishment of goods, and even the remanufacturing of e-waste, all of which extend the life cycle of products and reduce the need for virgin materials. For instance, in India and Egypt, waste pickers collect and process up to 80% of urban waste, showcasing how necessity-driven circular practices form the backbone of urban waste management in many regions (Scheinberg et al., 2016; Circle Economy Foundation, 2024). This work, however, often takes place under unsafe conditions, with workers exposed to health risks and exploitation by middlemen.

The integration of waste pickers into formal circular economy initiatives presents both opportunities and challenges. On one hand, their expertise in material recovery and waste sorting can enhance recycling rates and reduce environmental impacts. On the other hand, the formalization of waste management systems often sidelines informal workers, pushing them out of the market. This growing tension between formal and informal sectors highlights the need for inclusive policies that recognize the valuable role of waste pickers in circular economy practices.

Studies have also emphasized the socio-economic benefits of integrating waste pickers into formal recycling systems. Formalization can provide waste pickers with stable incomes, legal recognition, and access to social services, improving their quality of life. In Brazil, cooperatives have been established to support the integration of waste pickers into the formal recycling chain, offering them better working conditions and fairer prices for the materials they collect (Rutkowski & Rutkowski, 2015). However, formalization efforts must be carefully designed to avoid eroding the autonomy and flexibility that informal workers often rely on for their livelihoods.

In conclusion, waste pickers are indispensable to the circular economy, particularly in low- and middle-income countries. Their work supports waste prevention, material recovery, and resource efficiency, all of which are key components of circular economy frameworks. However, failing to consider waste pickers as part of formal waste flow systems, as seen with the implementation of DRS, promotes invisibility and undermines both their livelihoods and the broader goals of circularity. Inclusive policies that integrate waste pickers into formal systems — while respecting their autonomy — are crucial for maximizing the circular economy's potential.

4.4 Informal Recycling in Europe and Deposit-Return Systems (DRS)

Deposit-Return Systems models have demonstrated considerable success; however, they often pose challenges for informal waste pickers who traditionally rely on access to recyclable materials as a livelihood. In countries like the United States and Canada, waste pickers contribute significantly to recycling rates, yet DRS frameworks in these regions have not adapted to support or recognize their role formally. This lack of integration has led to missed opportunities for enhancing waste collection efficiency and providing economic stability for informal workers (Cass Talbott, 2022).

In Europe, informal waste picking is less visible than in the Global South, largely due to the region’s highly institutionalized waste management systems. However, **it is estimated that in European countries up to one million people are occupied in the informal recycling and re-use sector** (Scheinberg et al., 2016). Informal recyclers still play a vital role, particularly in Southern and Eastern Europe, where economic inequalities and migration have led to the growth of informal recycling networks (Scheinberg et al., 2016). In countries like Spain, waste pickers known as *chatarreros* recover a significant proportion of recyclables such as cardboard, metals, and plastics from urban waste streams. Their activities are often conducted without formal recognition, and they face challenges similar to those in the Global South, such as exploitation by intermediaries and lack of access to social protections.

The Circle Economy Foundation report (2024) emphasizes that informal workers in Europe are critical to circular strategies. In countries like Italy and France, networks of

waste pickers operate under the radar, but their contributions are substantial, especially in the recovery of materials from urban environments. Formal recognition of their work remains limited, and there is a growing need for inclusive policies that integrate these workers into formal circular economy frameworks without stripping them of their autonomy or flexibility. Despite their contributions, these workers remain vulnerable, often working without contracts or safety protections.

The rise of Deposit-Return Systems (DRS) across Europe presents both opportunities and challenges for informal waste pickers. DRS schemes, which incentivize the return of plastic bottles and aluminum cans through Reverse Vending Machines (RVMs), have increased the availability of valuable recyclables. In countries like Germany, DRS has achieved remarkable success, with return rates reaching as high as 98% (Rhein & Sträter, 2021).

Informal recycling is particularly prevalent in Eastern and Southern Europe, but it also exists in Northern and Central regions. The rise of informal operations is partly due to circular economy initiatives like DRS, which have been implemented in ten European countries, including Sweden, Germany, and the Netherlands. **Informal workers play a crucial role in achieving the high collection rates of over 90% in these schemes, yet their contributions remain largely unrecognized** (Deloitte, 2019; EPSU, 2023).

Research reveals a significant gap in addressing informal waste management in Europe. A study from Serbia found that the informal sector accounted for 63% of all separated waste sent to recycling between 2016 and 2020, keeping substantial amounts of waste out of landfills (Jovičic et al., 2022). However, informal waste collection often conflicts with formal systems, especially in privatized sectors, where informal workers are viewed as undermining profits (Sandhu et al., 2017; Weghmann, 2020).

These workers are usually marginalized groups, including Roma, migrants, and the homeless, who often earn less than minimum wage and face significant health risks due to a lack of protective equipment (Scheinberg et al., 2016; Weghmann, 2018).

According to the results of this research, in cities like Amsterdam and Rotterdam, where DRS has been expanded to include a broader range of materials, informal waste pickers have adapted to the system by collecting recyclables from garbage bins in public spaces. Also, other population segments, such as migrants, homeless, retirees, specific ethnicities, or people excluded from the labor market, find in this new flow of reverse logistics an opportunity to enhance their income, or even have this job as the only source of income. While this provides them with a crucial source of income, the growing competition and limitations imposed by formal waste collection systems continue to pose significant challenges.

4.4 Organizing in the Informal Waste Economy

Organizing within the informal waste economy has become a significant aspect of improving the working conditions of waste pickers, a group often marginalized both socially and economically. The informal sector, comprising recyclers, waste pickers, and re-use operators, plays a critical role in resource recovery, yet remains largely excluded from formal systems of waste management in Europe. Waste pickers tend to work without any legal or social protections, and organizing efforts are essential for improving their rights, working conditions, and overall status (Weghmann, 2017).

Efforts to unionize and organize informal workers in the waste sector vary significantly across European countries. In Serbia, the formalization and organization of informal recyclers have seen significant advances, with unions playing a vital role. Waste pickers in the country have managed to collaborate with trade unions to advocate for better wages, access to materials, and more secure working environments. This collaboration has been key in giving these workers a voice and representation in policy discussions on waste management. As a result, a higher proportion of recyclers in Serbia have successfully unionized compared to other European countries (Weghmann, 2020).

In contrast, other European countries have had less success in organizing informal recyclers. In these regions, informal waste workers often face severe competition from formal recycling companies, which limits their ability to access waste streams. This competition is exacerbated by policies that prioritize formal sector engagement, leaving informal workers excluded and marginalized. Many informal recyclers rely on networks of intermediaries and wholesalers for material access and livelihood, which complicates the path towards formalization and unionization. Additionally, informal workers are often engaged in dangerous, low-paid work without protective gear, making union organizing even more challenging (EPSU, 2020).

Organizing efforts are essential for bridging the gap between formal and informal waste management systems. Integrating informal recyclers into formal systems can help improve waste collection and recycling rates, benefiting both the workers and the environment. In cities like Paris, local authorities have established collaborations between formal recycling operators and informal waste pickers, creating more inclusive and efficient systems for resource recovery. This cooperation model has provided a blueprint for organizing informal workers in other parts of Europe (EPSU, 2020).

In Paris, the waste picker organization AMELIOR illustrates the transformative power of grassroots organizations in empowering waste pickers. By advocating for the rights of *biffins* (informal recyclers) and establishing formal structures like re-use centers and monthly flea markets, AMELIOR has provided these workers with legal recognition, economic opportunities, and safer working conditions. Their initiatives have helped integrate informal recyclers into Paris's waste management system, where previously, their contributions were marginalized or criminalized (Weghmann, 2017). The creation of spaces for waste pickers to legally operate and sell their recovered goods has improved their livelihoods and fostered a sense of dignity in their work. This case demonstrates how community-driven efforts can bridge the gap between informal recyclers and formal waste management systems, making the urban economy more inclusive and sustainable (Amelior, 2017). Through such grassroots organizing, informal waste workers can gain greater visibility, rights, and a stronger voice in policy discussions.

Ultimately, organizing the informal waste economy requires a concerted effort to recognize the value of informal workers in the circular economy. By formalizing their labor, ensuring access to waste streams, and improving health and safety standards, these workers can contribute more effectively to waste recovery while enjoying better working conditions and social protections. The efforts made in some European countries to unionize informal waste pickers provide hope that the sector can be both inclusive and productive in the future.

In conclusion, waste pickers remain essential to both formal and informal waste management systems globally, contributing significantly to the circular economy by recovering valuable materials. However, their roles are often overlooked or marginalized, particularly in formal circular economy frameworks. As Deposit-Return Systems expand in Europe, policymakers must balance the need for efficient recycling systems with the livelihood needs of informal recyclers. There is a growing recognition that waste pickers, particularly in the Global South, embody circular economy principles in their everyday practices. To achieve a truly inclusive circular economy, these workers must be integrated into formal systems in ways that recognize their contributions, protect their rights, and support their livelihoods.

5. Findings

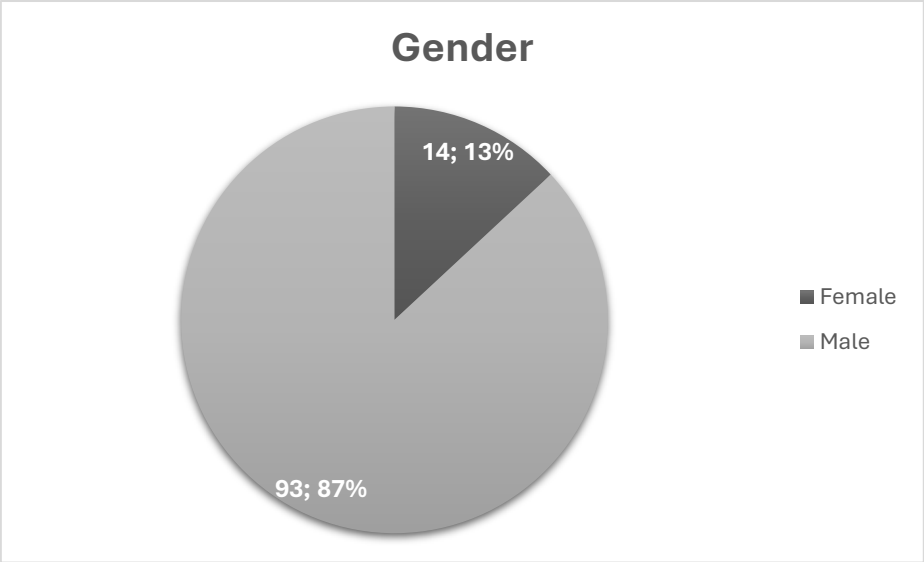
In line with current events, this field research began a few months after the launch date of the expansion of the Deposit Return System in the Netherlands. Between the exploration phase (flanêrie) and the Structured Urban Observation phase, there were 45 days of field research. During the exploration phase, which lasted 20 days, 8 cities were visited: Amsterdam, Rotterdam, The Hague, Utrecht, Delft, Apeldoorn, Zwolle, and Leiden. After this phase, the cities with the highest incidence of waste pickers were selected for the structured urban observation, which lasted 20 days. During this period, 107 waste pickers were mapped, with 30 workers in 2023 and 77 workers in 2024.

In the second phase of the Structured Urban Observation, the "fast approach" method was added to collect more precise data on age, city of birth and relevance of income with the collection of recyclables. This strategy was applied to 62 workers, out of the 107 mapped.

5.1 Observing who they are: demographic overview of waste pickers

During the structured urban observation, some demographic characteristics were collected, such as gender and approximate age range. With the addition of the "fast approach" method, it was possible to collect information on country of birth, age and, in some cases, the level of importance of income from the sale of recyclable materials.

Gender: The vast majority of waste pickers are male, with 93 (87%) men and only 14 (13%) women observed during the study.

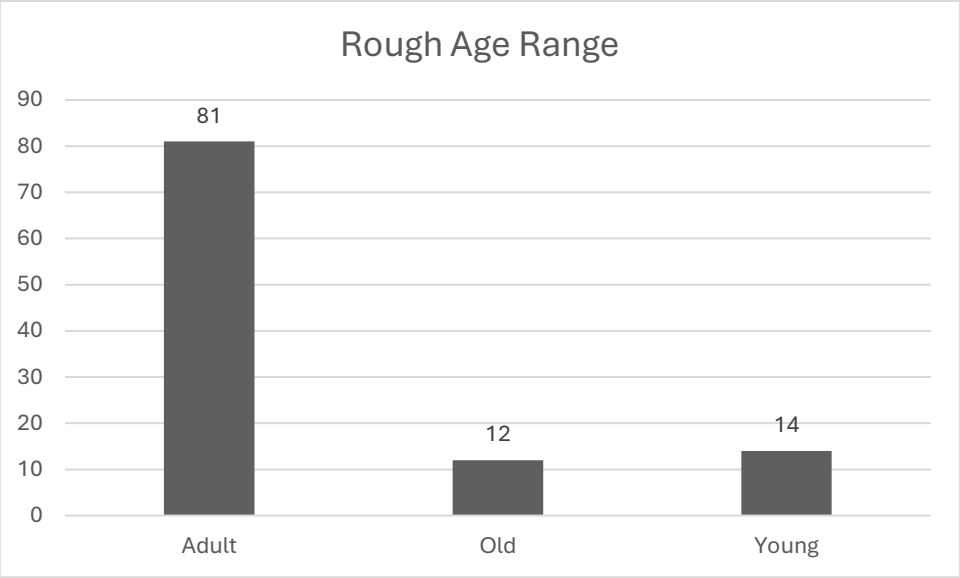


One of the potential explanations for this massive presence of men doing this kind of work is that it mostly takes place on the streets of the Dutch major urban centers. Working on the streets, particularly in informal or clandestine contexts like the one in question, can involve significant risks and insecurity — risks that are often heightened for women.

When comparing work environments, such as street-based collection versus warehouse-based sorting centers, the proportion of women increases significantly in the latter. This trend reflects the improved opportunities that arise when work is formalized and operates under structured, professional conditions. For example, in Brazil, data from the *Brazilian Recycling Yearbook* (PRAGMA, 2023) reveals that among 86,878 waste pickers organized in 2,941 cooperatives, 53.5% are women and 46.5% are men.

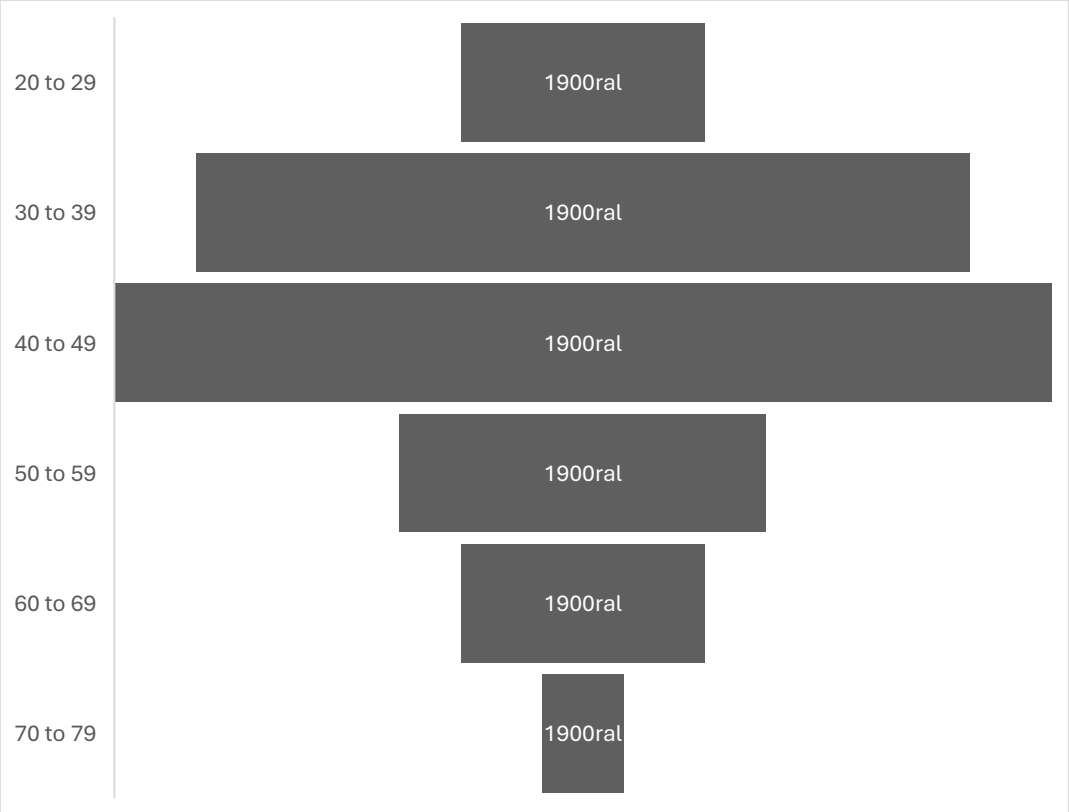
Another Brazilian report, dedicated to publishing sociodemographic data on street waste pickers, presents figures similar to those collected in the Netherlands. In the Cataki 2022 survey, carried out in the city of São Paulo, 76% of waste pickers are men and 24% are women (Pimp my Carroça, 2022). These figures prove that, when the work is organized and carried out within the structure of sorting centers, women are more frequent than when the work is carried out on the streets and informally.

Age Distribution: Regarding age distribution, two groups of data were obtained: one set of data from Structured Urban Observation, counting the 107 waste pickers mapped, in which it was only possible to identify very roughly whether they were young, adult or old.



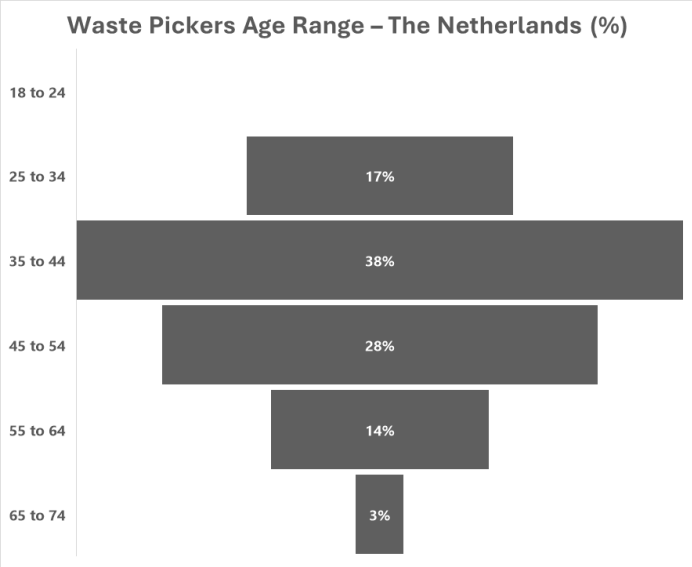
Using this method — identifying age range by observation and classifying individuals into three categories — 75.7% are adults, representing the vast majority of waste pickers.

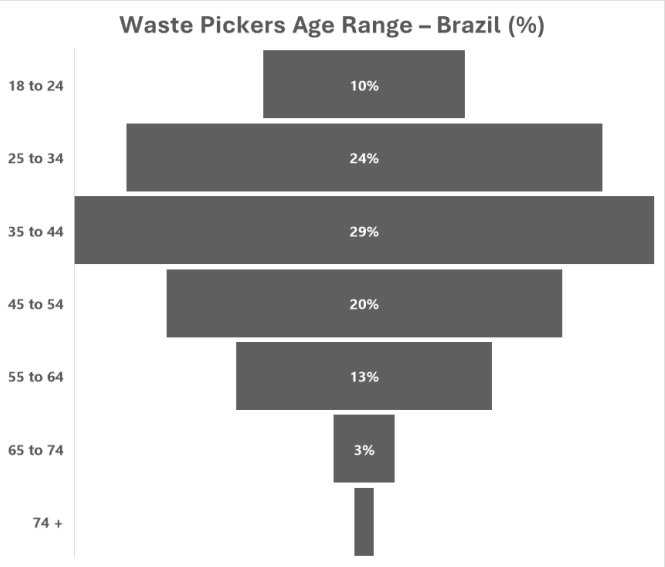
Another dataset, collected using the 'fast approach' method, precisely identified the age group of 65 waste pickers and is represented in the following graphic:



In this more accurate dataset, 78.5% of waste pickers are between 30 and 59 years old, the typical age range for the adult population. Comparing the two data collection methods revealed a 2.8% variation, supporting the validity of the urban observation method for this variable.

For the sake of comparison, the same more accurate data was parameterized with a similar graph on waste pickers in Brazil. The age groups were redistributed with the same intervals and transformed into percentages.



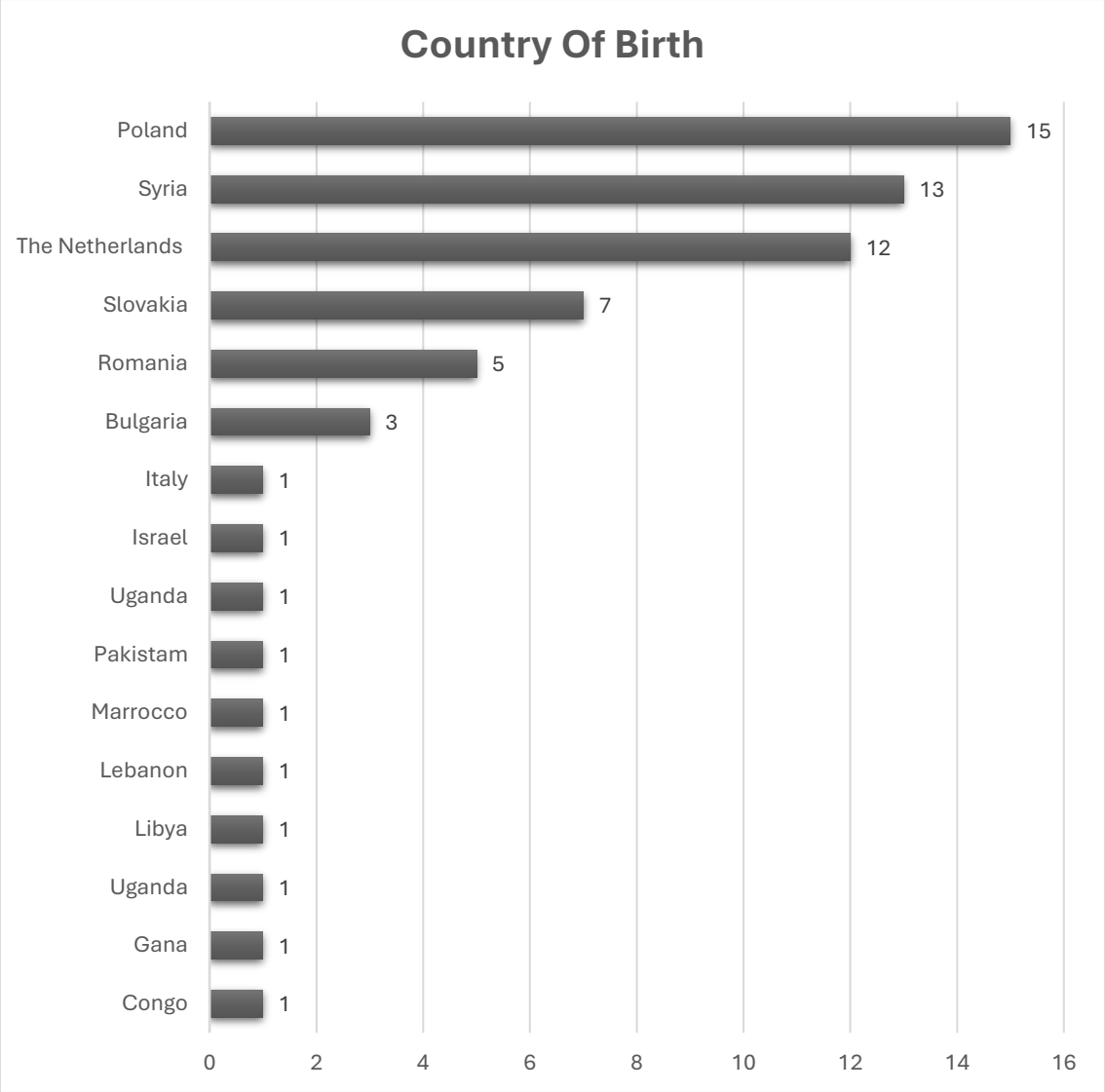


In this comparison, Brazil has a significant proportion of younger waste pickers, with 34% aged between 18 and 34. In the Netherlands, this same age group represents only 17% — half of Brazil's figure. Several factors may explain this difference, but one likely interpretation, in terms of the labor market, is that young Brazilians who might otherwise enter formal employment are turning to informal work instead, suggesting limited job opportunities.

In contrast, the largest share of waste pickers in the Netherlands falls within the 35 to 54 age group, accounting for 66%. Unlike in Brazil, this trend may reflect not a lack of initial job opportunities, but rather the loss of previously held employment. This suggests that many Dutch waste pickers may have once been formally employed but turned to informal work after struggling to re-enter the labor market.

Country of Birth: hese differences in labor market analyses may help shape future inclusion policies, focusing on job training initiatives and mapping existing professional skills to better guide workers toward formal employment opportunities. The workforce included individuals from various countries, such as Poland, Slovakia, Romania, and Middle Eastern and North African nations like Syria, Morocco, and Libya. The largest

group was from Poland (15 individuals), followed by Syria (13) and Slovakia (7).



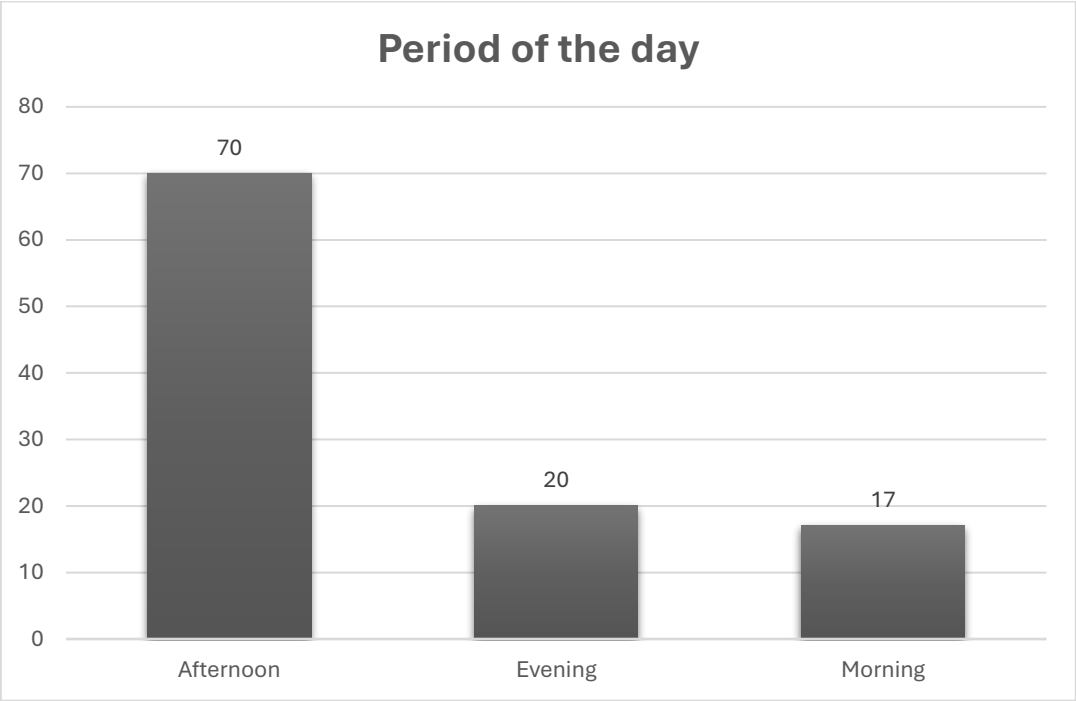
When grouping the data, it becomes evident that 35 waste pickers come from Eastern European countries (Poland, Slovakia, Romania, Bulgaria), accounting for 43% of the total. This indicates that the majority are not immigrants from outside the European Union, but are EU nationals. The next step, which was not addressed in this research, would be to explore the reasons for migration, legal status, living conditions, and educational and professional backgrounds. With this information, it would be possible to better understand the factors that drive these workers into the informal recycling sector and develop strategies for improved social and labor market inclusion.

5.2 Observing how they work: socioeconomic characteristics

Since the beginning of the field research, it has been possible to identify how waste pickers structure their daily work. Strategies include the tools used to collect beverage containers from bins, methods of carrying the containers, the increased frequency of collection at certain times of day, and specific collection routes. All of these strategies contribute to the unique working style of each street worker. This section will highlight some of these strategies, demonstrating that this type of work, like any other, involves specialized knowledge.

The Peak Time: with real-time observation, registering data each time a waste picker was identified, it was possible to establish the peak time they were on the streets. During the 18 days of structured urban observation, the researcher observed waste pickers during the three periods of the day (morning, afternoon, and evening) to catch the peak hours of work.

As the following graph shows, of the 107 waste pickers mapped, the afternoon is the peak time with an incidence of 70 workers, followed by the evening (20) and the morning (17):

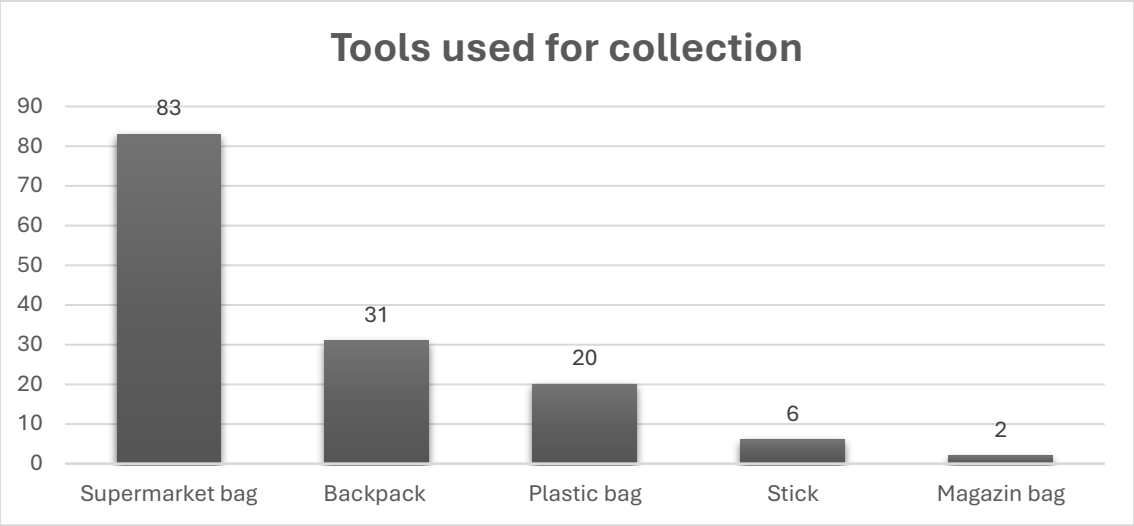


To better understand this routine, it's necessary to look at a few nuances. The first is that there are clearly visible differences between waste pickers in Rotterdam and Amsterdam when it comes to choosing collection times.

In the case of Rotterdam, the highest incidence is during lunchtime, mainly because the greatest concentration of these waste pickers is in commercial or office areas. In these areas, lunchtime is the time when the streets are most crowded with people having lunch or shopping. Times when there are more people on the streets eating or shopping also mean that there is more consumption of drinks in single-use packaging. These factors certainly attract waste pickers to collect the most packaging in the shortest time.

In the case of Amsterdam, which has a higher incidence of tourist habits, the peak hours are broader, starting from lunchtime right through to the evening without interruption. Even so, of course, in Rotterdam's tourist areas it is possible to identify small variations, such as collectors working all afternoon in the Binnenrotte plein area.

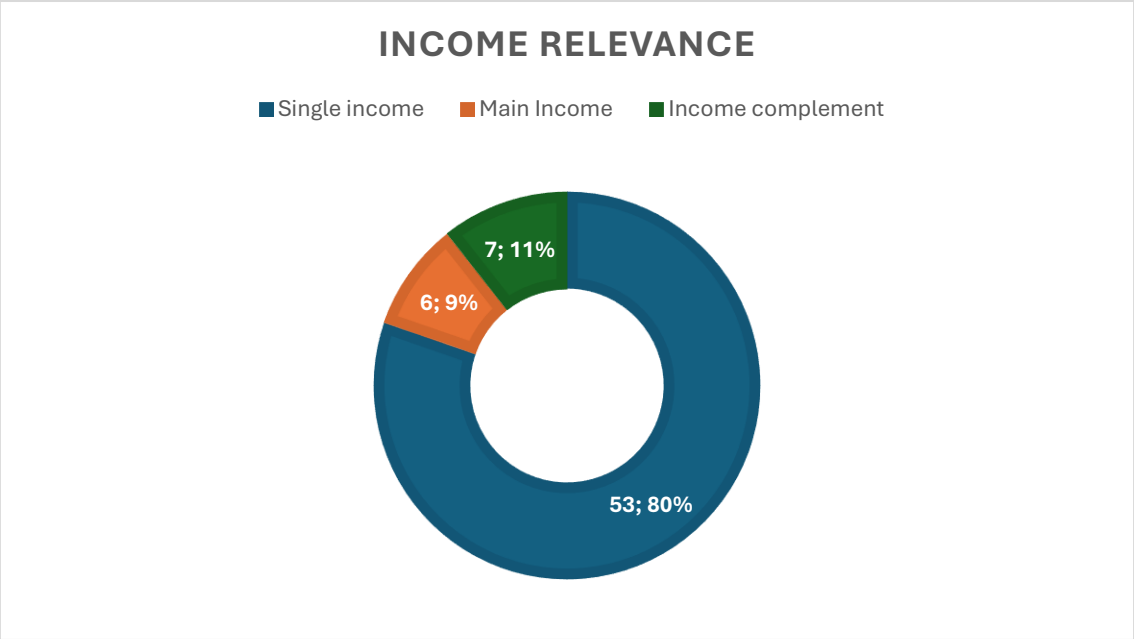
Tools and Equipment: Waste pickers use a variety of tools for collection, including supermarket bags, backpacks, plastic bags, and sticks. The most common tool was the supermarket bag, identified 83 times. Some of workers use also combined tools like supermarket bag, backpack and stick to reach packages inside bins.



One reason market bags are more common is that supermarkets are the primary source of returnable packaging. Using these bags allows waste pickers to blend in with regular customers, both inside supermarkets and on the street.

Among other tools, plastic bags are worth mentioning. These are the big 100-litre bags, usually blue or black. In 2023, only 2 of the 30 workers mapped used this type of bag, while in 2024 another 18 workers were mapped using large plastic bags to store packaging. Although 77 waste pickers were recorded in 2024, it is noticeable that the percentage of this type of tool stands out, with 23% of workers using it. This may represent an increase in the efficiency of this work, with waste pickers managing to collect more packaging and preferring to store more of it to increase their income, rather than using supermarket bags to avoid being identified as waste pickers when entering supermarkets or walking down the street. A bigger bag also means fewer trips to put the packaging in the reverse vending machines.

Income Generation: For most waste pickers, collecting recyclables is their main source of income. The income generated varies significantly, ranging from €5 to €60 per day, depending on the amount of material collected and the efficiency of their collection routes. The data shows that 53 workers relied solely on waste picking for income, while 7 used it as a complement to other sources.



It's important to note that of the group of waste pickers who do this as a supplement to their income, most are older Dutch people, probably retired. In total, of the 12 Dutch people identified in this research, 6 do this as a supplement to their income and are also elderly.

During the structured urban observation, especially during the 'fast approach' strategy, it wasn't possible to systematically collect data on income figures from this activity, but some of these workers (22 waste pickers) ended up mentioning these figures spontaneously. The number does not allow us to draw a reliable average percentage, but it can be mentioned that in the case of homeless waste pickers, the daily income does not exceed 20 euros per day. On the other hand, waste pickers who said they had a house and a family reported incomes of between 60 and 100 euros per day. It is also worth noting that of the 22 waste pickers who reported an income, 15 were homeless, while the remaining seven reported having a home and family.

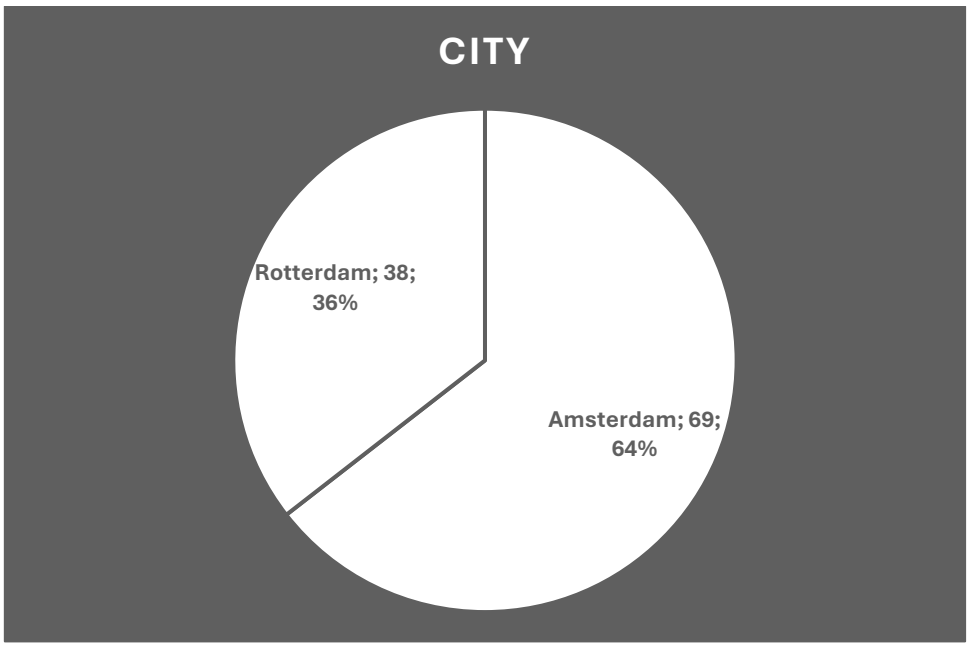
Based on these differences in income between homeless waste pickers and waste pickers who mention having a home and a family, some quick reports and observable habits show that the higher-earning waste pickers have more structured work routines, such as: routine schedules, established routes, earnings targets, improved collection techniques and tools.

These higher income margins show that a waste picker with a structured activity has the potential to earn more than the national minimum wage. However, it was not possible to gauge how many hours and days of work per week are required to achieve an income higher than the minimum wage.

5.3 Observing where they are: spatial distribution and routes

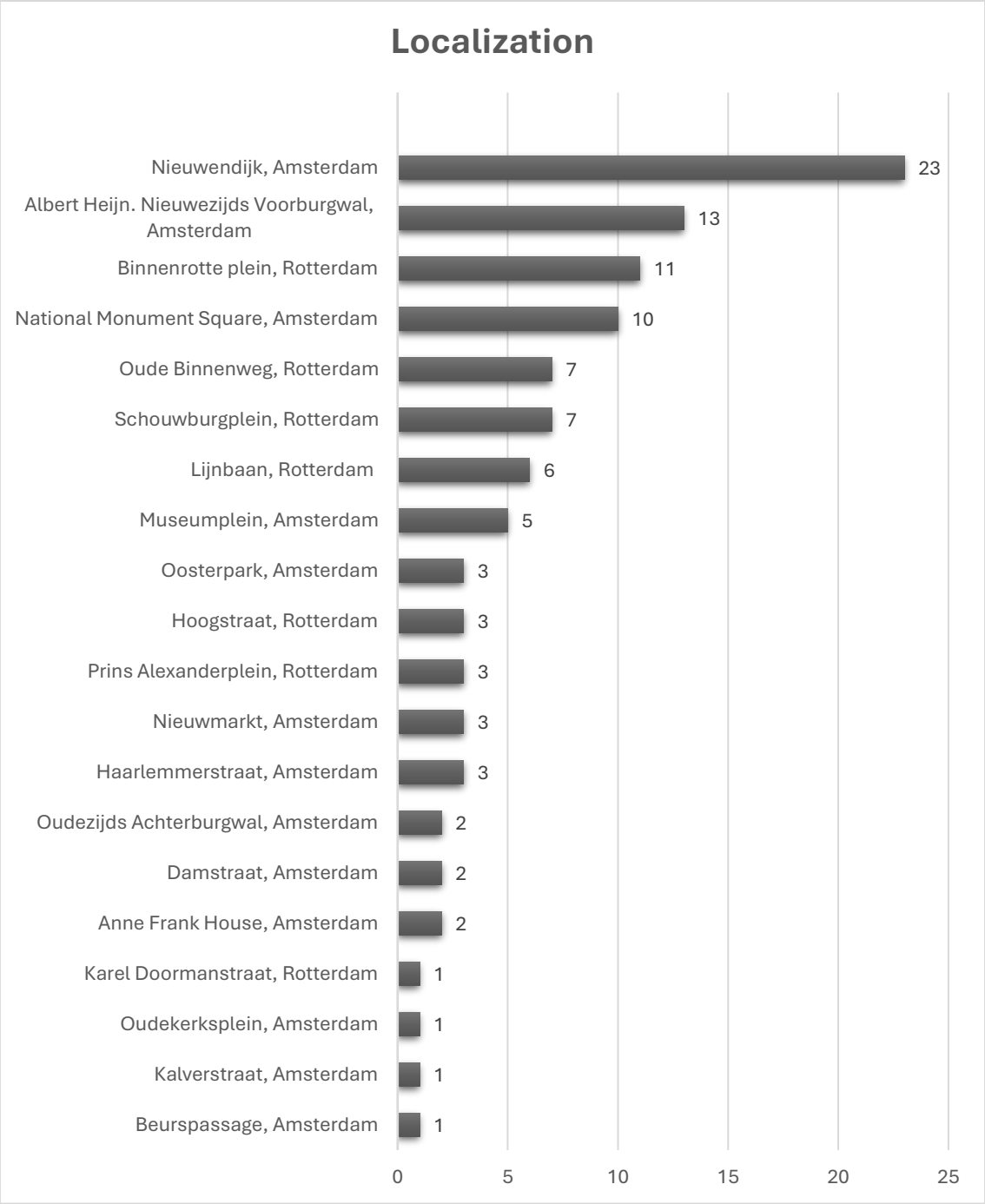
The first key observation is the total number of waste pickers identified in Amsterdam and Rotterdam. In Amsterdam, 69 workers were identified, representing 64%, while in Rotterdam, 38 workers were identified, making up 36%. Since most of the workers are immigrants, it can be inferred that Amsterdam has a higher incidence due to its tourist visibility. This suggests a greater presence of tourist areas and pedestrian zones, which

likely leads to higher consumption of single-use beverage packaging and, consequently, more waste in street bins.



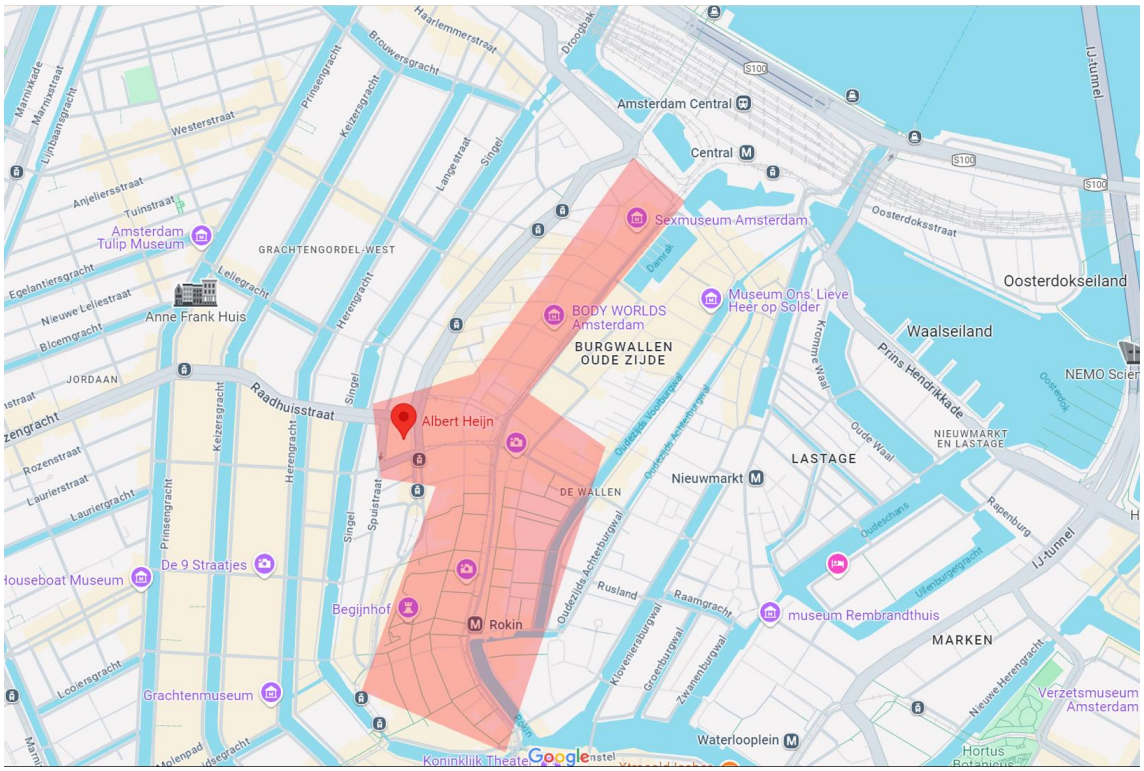
During the field research exploration period, the main areas of work for waste pickers were identified. This observation laid the foundation for the structured urban observation in the second phase. Several criteria were established for the observation route: 1) The observation would begin at the city's central train station; 2) From the train station, the route would proceed on foot to the main shopping streets; 3) The route would then cover some of the branch roads off the shopping streets; 4) Promenades and squares with tourist attractions, such as museums and monuments, were also included; 5) Another key observation point was the supermarket areas with Reverse Vending Machines (RVM) and their surroundings; 6) Finally, residential areas were observed to provide a contrast.

During the 18 days of systematic observation, these criteria were followed and it was possible to determine the points with the highest incidence of waste pickers and their surroundings. The following graph shows this list of streets and the frequency with which waste pickers were identified working:

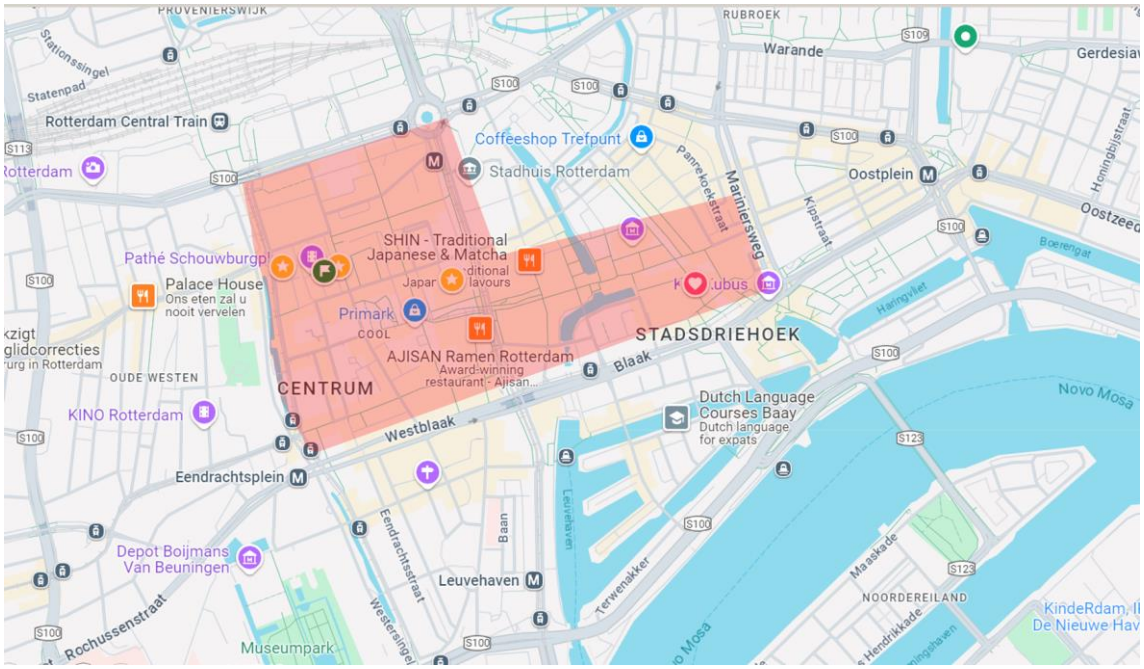


The following maps present a more comprehensive systematization highlighting the areas of greatest incidence in Amsterdam and Rotterdam, respectively.

Amsterdam Area



Rotterdam Area



Waste pickers were mapped at key locations in Amsterdam and Rotterdam. In Amsterdam, the highest waste picker activity is concentrated in key areas of the city centre, particularly around popular commercial and tourist areas: **1. Nieuwendijk, Albert Heijn on Nieuwezijds Voorburgwal, and National Monument Square** - Located in the busy shopping, commercial and walking areas close to the city centre, Nieuwendijk recorded the highest frequency (23 sightings), followed by Albert Heijn on Nieuwezijds Voorburgwal (13 sightings). These are prime locations due to the high pedestrian traffic, which is likely to increase the availability of recyclable waste. It is worth noting that at

Albert Heijn - Nieuwezijds Voorburgwal, a reverse vending machine is located, and it is common to find groups of waste collectors sitting outside the supermarket throughout the day. The National Monument Square had 10 sightings, making it another significant area for waste picker activity. **2. National Monument Square and Museumplein** – Museumplein, with 5 sightings, is also a notable spot, likely due to its high tourist traffic near major museums and cultural landmarks. There were just two visits in this region that deserves more observation; **3. Oosterpark and Other Streets** – Oosterpark, a well-known public park, had 3 sightings, and smaller streets like Oudezijds Achterburgwal, Damstraat, and Anne Frank House also showed activity, albeit at lower frequencies (1-2 sightings each). These streets are scattered around central Amsterdam, indicating that waste pickers frequent areas with both high tourist and local traffic. Overall, waste picker activity in Amsterdam is concentrated in the central, high-traffic commercial and cultural areas, reflecting their strategic choices in seeking places with abundant recyclable materials.

In Rotterdam, similar patterns emerge, with activity clustered in central areas: **1. Binnenrotte Plein** – This location recorded 11 sightings, the highest in Rotterdam, and is centrally located near markets and shopping streets, making it an ideal spot for waste pickers to find recyclable materials; **2. Oude Binnenweg and Schouwburgplein** – These areas, with 7 sightings each, are in Rotterdam's central shopping and entertainment districts. The Oude Binnenweg is a historic street, while Schouwburgplein is a large public square that draws both locals and tourists. **3. Lijnbaan** – With 6 sightings, Lijnbaan, one of Rotterdam's main shopping streets, is another important area for waste pickers. The availability of recyclables here is likely due to the high concentration of stores and foot traffic. 4. **Other Streets** – Lesser frequented streets, such as Hoogstraat, Prins Alexanderplein, and Karel Doormanstraat, showed 1-3 sightings each. These areas are spread out within the central region, indicating lower but consistent activity in various parts of Rotterdam's city center.

Regarding waste pickers' work locations, patterns in both Amsterdam and Rotterdam show that waste pickers focus on busy, central areas with high pedestrian traffic and commercial activity, such as major shopping streets, public squares, and tourist hotspots. In Amsterdam, the Nieuwendijk area and its surrounding streets in the city center see the most activity, while in Rotterdam, Binnenrotte Plein and nearby streets in the central business district are the most frequented. These observations suggest that waste picker activity is strongly influenced by the availability of recyclable waste in high-density, public spaces, highlighting the significance of these areas in both cities for potential recycling initiatives or waste management policies.

6. Analysis of the Challenges Faced by Waste Pickers at the DRS context

The expansion of the Deposit-Return System (DRS) in the Netherlands has brought about a significant shift in the collection landscape with the appearance of informal workers. Waste pickers, who traditionally rely on retrieving recyclable materials from public bins and other waste disposal points, are now increasingly interacting with DRS machines. While these machines present new income opportunities, they also introduce several challenges.

The relationship between informal waste pickers and Deposit-Return Systems (DRS) in Europe has highlighted a critical tension: while DRS initiatives are highly effective in

increasing recycling rates and reducing litter, they also inadvertently position waste pickers as unacknowledged suppliers within the recycling value chain. DRS relies on high return rates, which informal waste pickers often help to achieve, yet the sector lacks formal recognition, secure working conditions, and a voice in decision-making processes. In many cases, informal recyclers effectively supply DRS with sorted and returned materials without compensation or formal status within the system. This dynamic has generated substantial inequalities as waste pickers face health risks and financial instability without the protections afforded to formal sector workers (Weghmann, 2017).

Countries with robust DRS, such as United States of America and North-European countries, experience high return rates that are often attributed to formalized systems, yet these numbers would be far lower without the input from informal collectors. However, “this can benefit waste pickers, but it can also inhibit their advancement into aggregation and buying if they remain outside of the EPR system” (Cass Talbott, et al., 2022).

Legal and social exclusion further complicates the situation. In many European cities, waste picking is either unregulated or criminalized, placing informal workers in direct conflict with private waste management companies. Companies often perceive waste pickers as competitors who reduce their potential profits, leading to restrictive policies that limit access to recyclables. Furthermore, Extended Producer Responsibility (EPR) frameworks often reinforce this disparity, as they transfer control over waste streams to private actors, leaving informal recyclers out of the formal flow and exposing them to even greater economic precarity (Cass Talbott, 2021).

Some research shows that waste picking is a physically demanding and potentially hazardous occupation. Informal workers often handle sharp objects, broken glass, and contaminated materials without adequate protective gear. In the context of the DRS, while the risk of injury from traditional waste streams has decreased, the competitive nature of the work has led to longer hours and extended exposure to outdoor conditions. During the field observation, some waste pickers reported working up to eight hours a day, often in harsh weather conditions, to earn a sufficient income.

The lack of integration also means that waste pickers receive no financial support from the DRS value chain despite their essential role in achieving high recycling rates. Reports indicate that even as these individuals are critical to DRS success, their labor is frequently undervalued, and they operate under unsafe conditions, particularly in urban centers where they handle potentially hazardous waste items. This creates a dynamic where waste pickers are both integral to and exploited by the system (Cass Talbott, 2022).

In conclusion, the current DRS and EPR frameworks in Europe present challenges for waste pickers who are essential to the circular economy but lack formal inclusion and protections. Although DRS is effective in promoting recycling, it currently operates in a way that excludes informal workers from fair participation in the value chain. Structural reforms that integrate waste pickers into formalized systems and ensure equitable treatment are crucial for addressing these disparities and creating a truly inclusive circular economy.

7. Proposed Solutions and Opportunities for Inclusion

To address the challenges faced by waste pickers, several solutions can be explored to integrate these informal workers into the formal circular economy. Given their significant contribution to recycling efforts, particularly through the DRS, waste pickers should be seen as valuable stakeholders in achieving the Dutch sustainability goals.

7.1 Formal Recognition and Support

One of the key steps toward improving the conditions of waste pickers is **formal recognition in the recycling value chain**. There are few reports of initiatives by waste picker organizations in European countries, be they cooperatives, associations or trade unions. Some organizational strategies of this kind have been registered in Eastern European countries, but with negligible results in terms of the category's representativeness (Scheinberg et al., 2016). Therefore, solutions that refer to an attempt to organize waste pickers as a professional category, while very popular in the global south, don't seem to have much traction in Europe.

However, local governments could develop targeted programs to provide waste pickers with access to training, health services, and legal aid. Such programs could be run in partnership with NGOs or labor cooperatives of other kinds, similar to models in other countries.

7.2 Improve Working Conditions and Logistics for Waste Pickers

The structure of Deposit-Return Systems (DRS) in the Netherlands, primarily designed around supermarket Reverse Vending Machines (RVMs), poses logistical and social challenges for informal waste pickers, who are often excluded from the formal circular economy but play an essential role in material recovery. Waste pickers who collect significant quantities of recyclables encounter hostile environments in commercial spaces, as supermarkets prioritize their regular clientele and often restrict large-volume users like waste pickers. The time-consuming process of depositing individual containers also creates long queues, leading to latent conflicts with customers and waste pickers. This system reflects a broader pattern in DRS implementation across Europe.

A potential solution lies in creating dedicated logistics spaces tailored to waste pickers, allowing them to process recyclables efficiently and safely. These spaces would go beyond RVMs by serving as specialized collection hubs that provide immediate cash payments, particularly important for waste pickers who rely on daily earnings. In the Netherlands, the prevailing cashless policy poses barriers for informal recyclers, who often lack bank accounts. To circumvent these challenges, local governments could collaborate with social or philanthropic organizations to manage these spaces, thus addressing waste pickers' reluctance to register formally while still facilitating their access to services and safe working conditions.

Moreover, these dedicated spaces could offer support services such as vocational training in organized waste collection, safety protocols, and the distribution of essential protective equipment. Cooperative models across Europe have demonstrated the potential for informal workers to improve their conditions through training and collective organization. In turn, these hubs could foster a more organized waste collection system, helping to minimize issues like vandalism and litter associated with bin scavenging.

One difficulty to consider for these dedicated spaces is that they must be distributed throughout the city, since, in the current model, using RVMs in supermarkets, waste pickers do not need to walk long distances to be reimbursed for the packaging collected.

Incorporating spaces dedicated to waste pickers within the DRS framework would address the inequalities faced by informal recyclers and enhance the circular economy's inclusivity. By reducing the need for informal collectors to use traditional RVMs and instead providing them with streamlined access to collection facilities, municipalities could create a fairer system that acknowledges waste pickers' contributions while maintaining efficiency in material recovery.

Tests of new bin designs with dedicated compartments for drink containers or displays beside the bins for depositing beverage containers in Dutch cities aim to offer a promising approach, as they increase accessible recyclables without forcing waste pickers to resort to potentially hazardous scavenging practices. However, it is necessary to consider that facilitating access to these recyclables implies allowing any citizen to collect them and not just those who are forced to remove them from the bins as a necessity for survival. This is a problem that remains unanswered, to date.

7.3 Collective organization

Collective organization offers another promising solution. Many waste pickers expressed a preference for independent work, but there was also interest in organizing into **cooperatives**. Waste picker cooperatives have proven successful in other countries, particularly in Latin America, where they have been integrated into formal waste management systems. In a cooperative model, waste pickers could pool their resources and share profits, allowing for more equitable distribution of income and improved working conditions.

Such models could be piloted in cities like Rotterdam and Amsterdam, where the density of waste pickers is highest. The creation of cooperatives would not only empower waste pickers but also provide a more efficient and organized approach to recycling, aligning with the broader goals of the circular economy.

In exploring effective models to formalize and support waste pickers, cooperatives have often been proposed to improve working conditions, create access to resources, and strengthen waste pickers' position within the recycling value chain. However, cooperative structures may not always align with the preferences of all waste pickers, as they require adherence to collective decision-making processes, a high level of organization, and often place demands on individual independence. Alternatives, such associations that support but do not fully formalize collectors' roles, offer flexibility and may be more effective for engaging certain groups of workers (Samson et al., 2020; Roberson, 2022).

The **African Reclaimers Organization (ARO)** in Johannesburg is a successful example of an association model that promotes flexibility and allows waste pickers to retain their autonomy while benefiting from collective support. ARO was founded to address the exclusion of waste pickers from Johannesburg's formal recycling initiatives, particularly around policies that diverted materials from their access without providing compensation. Instead of relying on a formal cooperative structure, ARO organizes as an independent association, advocating for rights and facilitating direct collaboration between waste pickers, residents, and city officials to negotiate fair access to recyclable materials. This

structure preserves the individuality of its members while strengthening their collective bargaining power (Samson, 2020; Roberson, 2022).

Similarly, The **Pimp My Carroça** initiative in Brazil is an impactful model for organizing informal waste pickers without requiring their integration into traditional cooperatives. This project, founded to empower *carroceiros* (independent recyclers who use handcarts), focuses on improving the visibility, safety, and dignity of waste pickers through direct support and public awareness campaigns. Pimp My Carroça refurbishes and customizes the carts used by *carroceiros*, adding visibility with vibrant designs and practical modifications, including increased durability and safety features. Additionally, the initiative provides personal protective equipment (PPE), reflective vests, and training on safe recycling practices, addressing both functional needs and promoting social respect for waste pickers' contributions (Silva, 2015).

Beyond material support, Pimp My Carroça leverages social media and crowdfunding to raise awareness about environmental and social justice, highlighting the essential role of waste pickers in Brazil's circular economy. This approach contrasts with cooperative models by preserving the independence of waste pickers, allowing them to maintain control over their work while still receiving community-backed resources and advocacy. The project demonstrates that an association model can be highly effective, especially for workers who may be reluctant to join a cooperative due to bureaucratic requirements or the necessity of a collective structure (Silva, 2015).

Both the ARO and Pimp My Carroça models highlight the potential of association-based organizing as an alternative to cooperatives. These associations provide a structure for collaboration and mutual support without requiring a full integration into formal cooperative systems, which can sometimes be restrictive or bureaucratic for workers accustomed to independent operations. They also offer vocational training, advocacy, and resource access without sacrificing the autonomy that many waste pickers value (Roberson, 2022; Samson, 2020).

Ultimately, association-based models like ARO and Pimp My Carroça may offer a promising alternative or complement to cooperatives for waste pickers in the circular economy. By balancing flexibility with support and advocacy, these organizations can enhance the visibility and working conditions of informal recyclers, addressing the unique needs of waste pickers who seek to maintain their autonomy within a structured system of support.

8. Conclusion

The study adopted a multidisciplinary approach, blending observational and ethnographic methods to explore the impact of the Deposit-Return System (DRS) expansion on informal waste pickers in Amsterdam and Rotterdam. Utilizing methodologies such as flânerie, urban observation, and fast approach strategy allowed the researcher to deeply engage with the socio-economic dynamics of waste picking, revealing intricate interactions between waste pickers and urban spaces. By drawing on the concept of the flâneur, the research achieved a nuanced understanding of how waste pickers navigate public spaces, contributing to a street-based methodological framework that captures the unstructured, experiential aspects of urban life (Benjamin, 2006; Calliari, 2024). This approach underscores the value of open-ended observation in socio-

environmental studies, especially for understanding informal economic activities that may not align with structured data-gathering methods.

The data gathered through urban observation yielded critical insights into the demographics and working practices of waste pickers, revealing who these workers are who entered the city's urban landscape. They are usually men, aged between 30 and 49, and from Eastern Europe, the Middle East or North Africa. They usually work on foot in commercial or tourist areas, carrying supermarket bags or 100-litre plastic bags. Many are homeless and most earn just enough to survive from day to day, between 5 and 20 euros. However, during the 2024 structured urban observation, some waste pickers were identified earning a considerable daily income of up to 100 euros.

Urban observation remains a powerful tool in understanding socio-environmental interactions in cities, particularly concerning informal economies like waste picking. By combining structured observation with the fast approach technique and ensuring ethical rigor, this study has provided valuable insights into how waste pickers operate within the framework of the DRS in Amsterdam and Rotterdam. However, this brief diagnosis about waste pickers and the connection with DRS is only a first approach of what research, surveys and data analyses can offer to describe, understand and deal with this social phenomenon in an inclusive way.

Cass Taylor (2022) highlights this scarcity of data and research on the impact of Extended Producer Responsibility (EPR) on informal waste workers presents a major barrier to understanding its influence on labor and business structures within the waste sector. Existing studies note the complexities of implementing EPR alongside the informal economy (Davis & Garb, 2015; Gupt & Sahay, 2015; Henzler et al., 2018; OECD, 2016; Ojino, 2016; Scheinberg et al., 2016) and emphasize the importance of involving informal workers in EPR design and execution (OECD, 2016; Rutkowski, 2020; StEP, 2020). Henzler et al. (2018) and Scheinberg et al. (2016) highlight the need for comprehensive mapping and research to identify stakeholders before proposing EPR. Without regular studies to capture the waste sector’s labor dynamics, it becomes difficult to measure EPR’s effects, particularly for the informal economy, which often goes unrecorded. This data gap results in what some researchers call “data injustice” (Cass Taylor, 2022), where the impacts of EPR on informal workers—such as job loss or lack of fair opportunities—are obscured, hindering the sector’s ability to advocate for their needs (ILO, 2015).

As an example, **future research might benefit from complementing structured methods with more quantitative data, and qualitative approaches. Concerning quantitative data, it would still be necessary to carry out a survey in front of Reverse Vending Machines, registering users in general about their profession, the purpose for which the packaging is returned - for example, whether it is for reimbursement or to generate income - and the volume deposited in the machine.** This could be used to estimate the real contribution of informal workers to the success of DRS's packaging recovery programs. Qualitative approaches could complement the data gathered such as interviews with waste pickers and RVM users or ethnography, to deepen the understanding about this context.

A key finding of this study is the tension between the DRS structure and the needs of informal waste pickers. While DRS initiatives have successfully increased recycling

rates, they have also restricted waste pickers' access to valuable recyclables by centralizing collection in reverse vending machines at supermarkets. This centralization has created hostile environments for waste pickers who, when returning large quantities of containers, face logistical difficulties, social stigmatization, and occasional conflicts with security personnel. These challenges emphasize the need for DRS policies that account for the role of informal recyclers and incorporate them into the circular economy more equitably.

In response to these challenges, the study suggests that dedicated collection hubs for waste pickers could improve their working conditions, providing both logistical support and social services. This solution aligns with successful association-based models seen globally, such as the African Reclaimers Organization (ARO) and Brazil's Pimp My Carroça initiative, which enhance the autonomy and social visibility of waste pickers without forcing them into rigid cooperative structures (Samson, 2020; Silva, 2015). By acknowledging waste pickers as key players in the recycling process, policymakers can foster an inclusive approach that balances efficiency with social justice.

In sum, this research contributes to the understanding of how DRS policies intersect with informal waste economies, advocating for an inclusive approach that respects waste pickers' autonomy while offering practical support. As cities increasingly adopt circular economy models, integrating informal waste pickers will be essential to achieving environmental goals without exacerbating social inequalities. Through these insights, the study underscores the importance of inclusive and adaptable policy design in the pursuit of sustainable urban environments and an inclusive circular economy.

References

Afvalfonds Verpakkingen. (2022). Afvalfonds Verpakkingen Policy. Retrieved from https://www.verpact.nl/sites/default/files/2023-05/Policy%20Afvalfonds%20Verpakkingen%20English%202023.pdf

Besluit kunststofproducten voor eenmalig gebruik [Single-Use Plastics Decree - SUP]. (2021, June 17). Retrieved from the Dutch government publication platform.

Bryman, A. (2016). *Social Research Methods* (5th ed.). Oxford University Press.

Byrne, J. A. (2021). *Observation for Data Collection in Urban Studies and Urban Analysis*. In *Methods in Urban Analysis*. Singapore: Springer, pp. 127–149.

Cass Talbott, Taylor, Pinky Chandran, Cecilia Allen, Lakshmi Narayan and Owusu Boampong. (2022). Extended Producer Responsibility (EPR) and Waste Pickers. WIEGO Technical Brief No. 15. Manchester, UK: WIEGO.

Cass Talbott, Taylor. (2021). Oregon's Bottle Bill: Opportunities and Challenges for Inclusive Waste Management. The Global Alliance of Waste Pickers and WIEGO.

Cass Talbott, Taylor. (2022). Extended Producer Responsibility: opportunities and challenges for waste pickers. In: Social Contracts and Informal Workers in the Global South. Edited by Laura Alfers, Martha Chen, and Sophie Plagerson. Published by Edward Elgar Publishing Limited. Cheltenham, UK; Northampton, MA, USA

Centenaro, A. P. F. C., Beck, C. L. C., Silva, R. M., Andrade, A., Costa, M. C., & Silva, E. B. (2021). *Recyclable waste pickers: life and work in light of the social determinants of health*. Rev Bras Enferm, 74(6), e20200902. https://doi.org/10.1590/0034-7167-2020-0902:contentReference[oaicite:9]{index=9}.

Circle Economy Foundation. (2024). *Circularity & Informality: Redefining Narratives*. Circle Economy Foundation.

Colombijn, F., & Morbidini, M. (2019). Pros and cons of the formation of waste-pickers' cooperatives: A comparison between Brazil and Indonesia. Decision, Springer.

Davis, J. M., and Y. Garb (2015), 'A Model for Partnering with the Informal E-waste Industry: Rationale, Principles and a Case Study,' Resources, Conservation and Recycling, 105, S. 73–83.

Deloitte (2019) Deposit-Refund System (DRS). Facts and Myths. Available at:

Envipco. (2024). Flexible deposit return solutions. Retrieved from https://www.envipco.com/.

Eunomia Research & Consulting. (2021). *Deposit Return in the Netherlands: An Assessment of the Afvalfonds Proposal for Beverage Can Collection*.

European Commission. (2018). *Packaging and Packaging Waste Directive* (Directive 94/62/EC).

European Commission. (2019). *Single-Use Plastics Directive* (Directive (EU) 2019/904).

European Federation of Public Service Unions (EPSU). (2023). *Waste Management in Europe*.

Gehl, J., & Gemzøe, L. (1996). *Public Spaces, Public Life*. The Danish Architectural Press.

Gibson, T. (2009). *Urban Spaces and User Behavior: A Methodological Guide*. Journal of Urban Research, 35(2), 145-162.

Godfrey, L. (2021, September). Quantifying economic activity in the informal recycling sector in South Africa. South African Journal of Science, 117(9/10).

Gupt, Y., and S. Sahay (2015), 'Review of Extended Producer Responsibility: A Case Study Approach,' *Waste Management & Research*, **33** (7), 595–611.

Henzler, M., F. Eisinger, M. Hemkhaus, S. Satish, P. Mahesh and G. Mehra (2018), *Creating Successful Formal-Informal Partnerships in the Indian E-Waste Sector: Practical Guidance for Implementation under the Indian E-Waste Rules*, Circular Economy Briefing Series, Bonn: Deutsche Gesellschaft für Internationale Zusammenarbeit.

ILO (International Labor Organization) (2015), 'R204: Recommendation Concerning the Transition from the Informal to the Formal Economy,' Geneva: resolution adopted by the ILO at its 104th conference session.

Instituto de Pesquisa Econômica Aplicada (Ipea). (2020). Situação social das catadoras e dos catadores de material reciclável e reutilizável – Brasil. Brasília: IPEA.

International Institute for Environment and Development (IIED). (2022). Supporting waste pickers in Brazil's cities: What's needed and what needs to change? Retrieved from https://www.iied.org

Jovičic, M. et al. (2022) Assessment of the Fragility of the Municipal Waste Sector in Serbia Using System Dynamics Modelling. Sustainability. Vo. 14, No. 862.

Maiello, A. (2022). In, out or beyond? Waste pickers and policy networks: A story from Jardim Gramacho (Rio de Janeiro). Sustainability, 14(24), 16977.

Medina, M. (2010). *Informal Recycling and Collection of Solid Wastes in Developing Countries: Issues and Opportunities*. United Nations University.

Nzeadibe, T. C., Anyadike, R. N. C., & Njoku-Tony, R. F. (2012). A mixed methods approach to vulnerability and quality of life assessment of waste picking in urban Nigeria. *Applied Research in Quality of Life*, 7(4), 351-370. https://doi.org/10.1007/s11482-012-9171-0:contentReference[oaicite:10]{index=10}.

OECD (Organisation for Economic Co-operation and Development) (2016), *Extended Producer Responsibility: Updated Guidance for Efficient Waste Management*, OECD Policy Highlights report. www.oecd.org/env/extended -producer -responsibility-9789264256385 -en.htm

Ojino, J. (2016), *EPR as a Mechanism for Integrating the Informal Sector: An Evaluation of Post-Consumer PET Waste Management in South Africa*, thesis for the fulfilment of the Master of Science in Environmental Management and Policy, International Institute for Industrial Environmental Economics, Lund, Sweden.

Packaging Europe. (2023). The Netherlands expands national deposit return system to include aluminium and steel beverage. Retrieved from https://packagingeurope.com/news/the-netherlands-expands-national-deposit-return-system-to-include-aluminium-and-steel-beverage-cans/9618.article

Pimp My Carroça. (2022). Pesquisa Cataki 2022: *Contexto de catadores autônomos e impacto do Cataki em São Paulo, Rio de Janeiro e Belo Horizonte.*

Regeling kunststofproducten voor eenmalig gebruik [Single-Use Plastics Regulation – SUP Regulation]. (2022, January 1).

Reloop. (2021). What We Waste: Tracking 20 Years of Growth in International Drinks Container Wastage, and How Refillables and Deposit Return Systems Can Reverse This Trend. Reloop Platform.

Reloop. (2022). Global Deposit Book: An Overview of Deposit Return Systems for Beverage Containers. Reloop Platform.

Rendon, M., Espluga-Trenc, J., & Verd, J.-M. (2021). *Assessing the functional relationship between the formal and informal waste systems: A case-study in Catalonia (Spain)*. Waste Management, 131, 483-490.

Rhein, S., & Sträter, K. F. (2021). *Intended and unintended effects of statutory deposit return schemes for single-use plastic bottles: Lessons from the German experience*. *GAIA - Ecological Perspectives for Science and Society*, 30(4), 250-256.

Roberson, E. (2022). *Integrating Unorganised Waste Reclaimers into Formal Recycling Systems: The Positive Role of Key Actors*. WIEGO.

Rosa, R., & Cirelli, G. (2018). Informal Recycling and Its Contribution to the Circular Economy: The Case of Southern Europe. *Journal of Waste and Resource Management*, 22(3), 120-132.

Rutkowski, J. E. (2021). Case Study: Reverse Logistics for Packaging – Brazil's EPR Mode. The Global Alliance of Waste Pickers and WIEGO. Retrieved from https://epr.globalrec.org/case-study/brazil/

Rutkowski, J. (2020), 'Inclusive Packaging Recycling Systems: Improving Sustainable Waste Management for a Circular Economy,' *Detritus*, **13**, 29–46.

Rutkowski, J. E., & Rutkowski, E. W. (2015). Expanding recycling in Brazil: The role of waste pickers. *Waste Management*, 45, 16-27.

Samson, M. (2020). *Integrating Reclaimers into Our Understanding of the Circular Economy*. University of the Witwatersrand, Johannesburg.

Samson, M. et al. (2020). *Final Report: Johannesburg Technical Report on Waste Reclaimers*. WIEGO.

Sandhu et al. (2017) Between hype and veracity; privatization of municipal solid waste management and its impacts on the informal waste sector. Waste Management. Vol. 59, pp. 545-556.

Scheinberg, A., et al. (2016). *From collision to collaboration: Integrating informal recyclers and reuse operators in Europe*. *Waste Management & Research*, 34(9), 820-839.

Silva, C. M. S. (2015). *Informação, consumo e inovação no paradigma da crise ecológica: estudo de caso de um projeto para os catadores de lixo*. Universidade Federal do Rio de Janeiro.

Skinner, J. (2012). *The interview: an ethnographic approach*. Berg Publishers.

StEP (Solving the E-waste Problem) (2020), *Case Studies and Approaches to Building: Partnerships between the Informal and the Formal Sector for Sustainable E-Waste Management*, Vienna: StEP.

Thiollent, M. (2011). Action Research and Participatory Research: An Overview. *International Journal of Action Research*, 7(2), 157-173.

TOMRA. (2021). *Rewarding Recycling: Lessons from the World's Highest-Performing Deposit Return Systems*.

Verpakkingsverordening Productschap Dranken [Packaging Management Decree]. (2003)

Weghmann, V. (2017) Waste Management in Europe. Good Jobs in the Circular Economy? European Public Services Union (EPSU).

Weghmann, V. (2020) Safe Jobs in the Circular Economy. A new EPSU report | EPSU.

Zisopoulos, F. K., et al. (2023). Informal recyclers as stakeholders in a circular economy. *Journal of Cleaner Production*, 415, 137894.