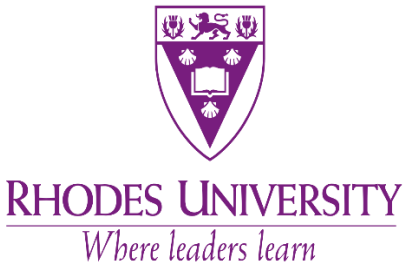

AN ASSESSMENT OF OPPORTUNITIES AND BARRIERS TO RECYCLING IN TWO MEDIUM-SIZED TOWNS OF MAKHANDA AND PORT ALFRED, SOUTH AFRICA

By

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Declaration

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Rhodes University will not infringe any third-party rights, and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

NAME: Khangelani Dlamini

DATE: 04/09/2025

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Abstract

Recycling is a sustainable waste management approach with environmental and socio-economic benefits yet recycling lags in the Global South. In South Africa, poor solid waste management is a vast urban sustainability concern, likely compounded by the projected increases in urbanization and consumption. South Africa recycles just 10% of its municipal waste, suggesting opportunities for optimizing recycling benefits are available. However, relative to big cities, empirical studies on the value of and barriers to recycling are still scarce in small to medium-sized towns. The main goal of this study was to assess the economic contribution of informal recycling activities (waste picking) and household level barriers to recycling in two medium-sized towns of Makhanda and Port Alfred, South Africa, using questionnaire surveys. The results showed that many waste pickers across both towns are in the industry due to financial need. Results indicated that low-educated and youthful newcomers dominated waste-picking activities, which indicates that the sector is expanding and is a considerable fallback for the unemployed and marginalized. The sector was instrumental in creating income opportunities, which assisted in reducing poverty levels, particularly poverty incidence and depth among waste pickers. Despite its socio-economic value, the sector faced significant issues, including the lack of storage, protective equipment, transport, buyers, and unjust trading policies with buy-back centres. On barriers, the study found a mismatch between attitudes and behaviour. Infrastructure tailored towards recycling is limited, which, when paired with limited recycling knowledge, significantly contributed to many people intending to recycle but failing to translate their intention into action. Overall, the findings indicated that recycling barriers across both towns are multi-layered and interlinked and require multifaceted interventions that address barriers holistically rather than independently. The findings of this study lay the groundwork for more work to be done in drafting and implementing recycling interventions in places outside of the bigger metropolises.

Keywords: Urban sustainability, recycling, waste picking, recycling barriers

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CHAPTER 1: INTRODUCTION

1.1 Background to the study

Improper solid waste management is a global urban sustainability challenge, especially in developing countries (Abubakar et al., 2022; Guerrero & Hoglmand, 2023; Kubanza, 2023; Zhang et al., 2024). It is associated with severe social, economic, and environmental issues (Anuardo et al., 2022), including heightened public health risks due to unsanitary conditions, mainly water and land pollution (Dlamini et al., 2019; Fadhullah et al., 2022). The forecasted increase in urbanization and urban population in the Global South (Delbridge et al., 2022; Henderson & Turner, 2020; Panday et al., 2025) means that improper waste management issues will continue to be a significant threat to urban sustainability in the future. Therefore, effective and sustainable waste management solutions such as recycling must be implemented to reduce indiscriminate waste dumping and a rapid fill up of landfills and dump sites (Kubanza & Simatele, 2018; Zhang et al., 2024).

Recycling is described by the U.S Environmental Protection Agency (2019) as the "process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products." Recycling covers a complete value chain that includes direct collection, reclamation (recovery), and reuse of waste materials (Morseletto, 2020) which according to some studies (Godfrey, 2021; National Waste Management Strategy, 2020) makes it a more comprehensive instrument in sustainable waste management than waste recovery and reuse. Examples of recyclable waste materials include paper, plastics, and glass, either in their unaltered state or after being separated and cleaned.

In the waste management hierarchy, recycling comes after prevention and reuse. The waste management hierarchy is a conceptual framework designed to guide and rank various waste management practices for both individuals and organizations (Figure 1.1). The hierarchy prioritizes waste prevention, followed by reuse, recycling, recovery, and disposal. In a nutshell, the hierarchy places a significant emphasis on preventing waste generation and reusing materials before they are discarded. It is, however, vital to note that a significant proportion of studies

suggest that in the hierarchy, recycling is the most effective strategy in moving towards a circular economy and the worldwide adoption of long-term sustainable waste management practices (Kotyal, 2024; Gonzalez-Sanchez et al., 2023). Hayelaken and Goldmann (2022) further suggest that recycling contributes the most to a circular economy because it allows materials to be continuously recovered and reused, rather than following the linear path of production to disposal. Other studies (Jiang & Beiteer, 2025; Hopewell et al., 2009; Zero Waste International Alliance, 2025) suggest that in the hierarchy, recycling is the most realistic concept, citing that reuse and reduction are ideal environmental concepts with limited practical abilities. Awino and Apitz (2023) further suggest that in most economies globally, waste cannot be prevented or reused; therefore, recycling becomes the most effective and sustainable strategy for managing waste responsibly. Overall, studies show that recycling contributes to broader and long-term sustainability agendas because it ensures that materials already in the system continue to have value, ultimately leading to a reduction in waste generation and the preservation of natural resources.

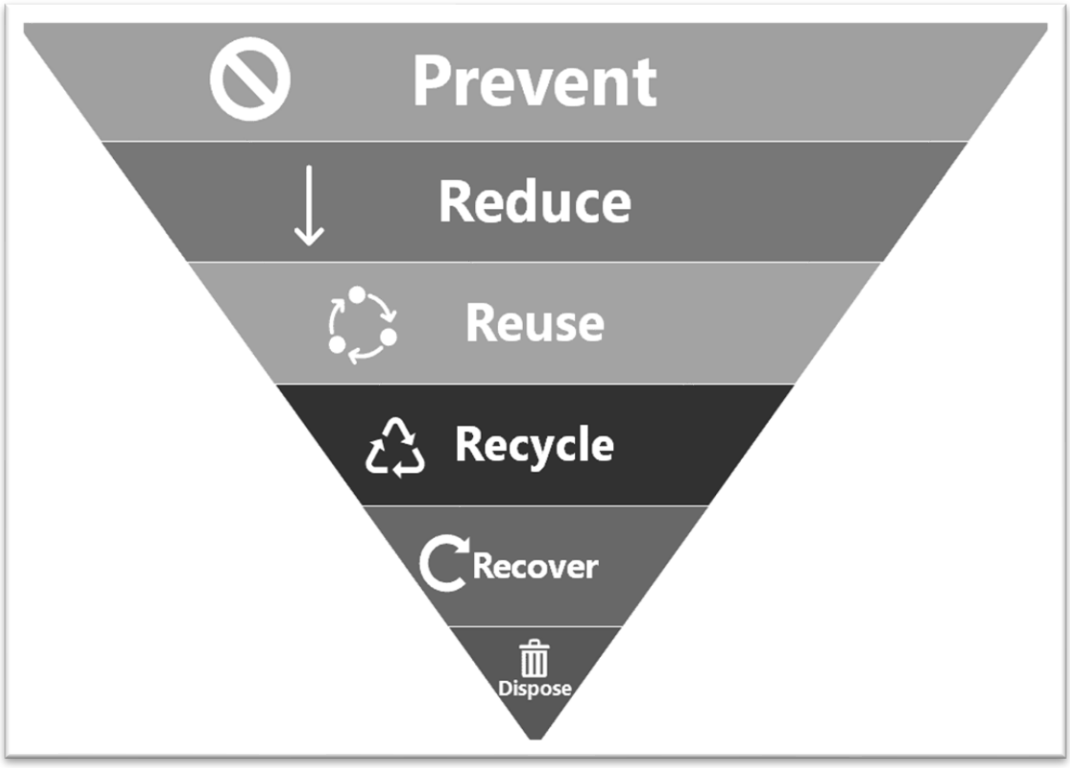

Figure 1.1: The waste management hierarchy Source: (Axil Integrated Services, 2025)

Globally, studies highlight the various economic and environmental impacts of recycling. From an environmental perspective, studies show that recycling is instrumental in reducing the use of raw materials because it requires less energy to make new products, which ultimately reduces greenhouse gas emissions into the atmosphere and associated waste disposal costs (Dlamini et al., 2017; Morseletto, 2020; Stegeman & Ekins, 2020). From an economic dimension, studies show that recycling does not just lower waste disposal costs for companies and municipalities but also provides instrumental job opportunities through waste-picking activities and formal recycling activities (Godfrey, 2021; Viljoen et al., 2016; Wilson et al., 2006). For example, companies like the Anheaser-Busch Network Brewery operating in New Jersey, USA, is reported to have recycled over 78,000 tonnes materials in 2014 and, as a result, saved over 5.4 million dollars in disposal fees (New Jersey Department of Environmental Protection, 2021) .Similarly, Swedish companies like "Sandvik Trading," supplying cutting tools and services to the metal cutting industry, highlight that recycling materials from their customers instead of relying on virgin raw materials reduces their production and disposal costs. Furthermore, the U.S Environmental Protection Agency (2020) in their recycling economic information report, highlights that recycling activities support over 681,000 jobs in the United States and generate around 5.5 billion dollars in tax revenue annually.

In spite of the various economic and environmental benefits, recycling participation levels between developed and developing countries are still vastly different (Troschinetz & Mihelcic, 2009; Zhang et al., 2024), with higher recycling rates in the former than the latter (Malhotra, 2020). European nations are leading the way in recycling and have consistently implemented strategies to increase recycling uptake. The European Environmental Agency (2018) highlights that by 2025, 55% of municipal and 65% of packaging waste produced in their states must be prepared for reuse or recycling. It further states that 25% of the states are already in line with meeting the set target. Successful recycling initiatives are achieved through policy incentives to promote household waste separation operations and recycling education initiatives. An example of these interventions includes the ban on single-use items such as plastic bags and straws.

Germany and Slovenia are some of the best-performing countries in recycling globally (European Environment Agency, 2025). In 2022, Slovenia recycled about 63% of its municipal waste, and Germany reported relatively higher rates of 69% (European Environment Agency, 2025). With the assistance of various infrastructural and behavioral initiatives, Germany reported that only 10% of its waste is disposed of in landfills, with some non-recyclable waste materials being used to create energy (Kullmann et al., 2022). Slovenia took crucial steps in improving its recycling uptake in 2014 when it committed itself to being a zero-waste country (Zero Waste Europe, 2019). Around this time, major cities such as Ljubljana started the now mandatory separate collection of bio-degradable waste, which includes separately collecting bio-degradable waste door to door. Around the same time, more plans were implemented to strengthen the already existing placement of packaging and paper waste bins at every doorstep. These waste sorting plans were also implemented with a strong focus on consistent collection schedules and locally tailored awareness initiatives (Zero Waste Europe, 2019). The country has one of the most efficient recycling systems, aided by proper waste collection systems, recycling awareness campaigns, and efficient waste sorting and separation initiatives (European Environment Agency, 2025; Zero Waste Europe, 2019).

Conversely, developing countries have some of the lowest recycling rates in the world. Medina (2008) suggests that a significant proportion of the countries with the lowest recycling rates in the world are developing countries. Numerous studies and publications (Nnorom, 2023; United Nations Conference on Trade and Development [UNCTAD], 2018; WasteAid, 2022; Zahrah et al., 2024) highlight that many countries in the Global South, including Nigeria, Ghana, Indonesia, and Kenya, recycle less than 10% of their waste. For example, according to Machira (2025), Tanzania only recycles about 5% to 10% of its waste despite having 70% recyclable waste. Similarly, some of the fastest-growing economies in the world, like Turkey and Mexico, had less than 10% of their waste recycled in 2019, and continue to lag in recycling activities (Griffin & Karasik, 2022; Karasik, 2022)

The United Nations Environmental Programme (UNEP) global waste management outlook report (2015) highlighted that developing countries still have infant recycling processes. The report details that controlled disposal rates in many developing countries are often below 50%, signaling significant recycling challenges. Ketlogetswe and Mothudi (2005) suggest that recycling in developing countries has not yielded as great results as in developed countries because of various challenges including but not limited to situational, knowledge, and attitudinal challenges. These challenges include the absence of waste separation initiatives, poor waste collection mechanisms, poor environmental awareness efforts, and poorly maintained collection vehicles and disposal sites (Kadyamadare & Samson, 2023; Ketlogetswe & Mothudi, 2005; Strydom, 2018).

1.2 The South African context

South Africa has one of Africa's largest and most developed economies (Department of International Relations and Cooperation, 2024). Similar to some of the biggest economies in other parts of the world, the country continues to experience significant population growth and urbanization, which both significantly impact waste generation levels. According to Statistics South Africa (2024), the country has a population of approximately 63.2 million people, with 69% currently residing in urban areas. This figure is projected to increase to around 80% by 2050 (United Nations Human Settlements Programme, 2018), with a direct impact on waste generation levels. According to the Smout (2022) South Africa produced approximately 108 million tonnes of waste annually in 2011. This figure grew to 122 million tonnes in 2022, and Mphatsoe (2025) estimates South African households to have produced about 125 million tonnes of waste in 2024. This increase in the volume of waste produced puts a significant strain on the already limited landfill space and further exacerbates the risks associated with improper waste management. Schoeman and Rampedi (2022) and Strydom (2022) underscore the urgent need for South Africa to implement robust initiatives such as recycling to address these waste management challenges.

South Africa's recycling data, particularly municipal recycling data, are largely limited but available data from Stats SA (2018) highlights that municipal waste recycling rates across the country are low, as only 10% of the waste produced annually is recycled. In 2015, only about 5.2%

of households participated in any recycling activities. Strydom (2018) indicates that urban areas typically report better recycling rates than small towns and rural areas. The latest statistics (2018) indicate that about 12.9% of households in big metros and cities recycled their waste, while only 3% of rural households engaged in recycling practices. Regional data further show this urban-rural divide; predominantly urban provinces like the Western Cape (20.3%) and Gauteng (12.7%) reported higher recycling rates, whereas predominantly rural provinces like the Eastern Cape (4.9%) and Limpopo (1.5%) reported the lowest rates.

1.3 Study motivation and aim

Recycling rates in South Africa are very low, especially in rural and smaller municipalities. This underscores an urgent need for more research to understand the challenges of achieving higher recycling rates. Additionally, it underscores the need for more research that explores various strategies that can be employed to increase engagement and participation in recycling activities. While there are studies on recycling barriers in South Africa, they are predominantly focused on large cities and not small to medium-sized towns and rural communities (Denner & Vermaas, 2019; Moyo et al., 2022; Strydom, 2018). This knowledge disparity could be a significant limitation in developing and implementing recycling initiatives because urban and rural contexts are different and characterized by different socio-demographic profiles, structural, and cultural factors. Further, the contribution of informal waste collection as part of broader recycling efforts is often limited to the waste collectors. However, households are the primary generators of waste and can contribute to broader recycling efforts through waste sorting and a source (Abdel-Shafy & Mansour, 2018). Waste sorting and separation at source can enable easy informal waste collection and minimize littering and illegal waste dumping (Viljoen et al. 2021). Given the importance of the household sector in the effectiveness of the broader recycling efforts, it is important to consider the contribution of informal waste collection in the context of household waste management practices. A nuanced understanding of the various situational, knowledge, and attitudinal household-level recycling barriers in different contexts is needed to advance our understanding of the impacts of contextual realities on recycling and to develop interventions that are in alignment with the specific social, cultural, structural, and geographic attributes of the intended communities.

Furthermore, careful assessment on research conducted in South Africa on recycling shows that they are more environmental centered, often missing the opportunity to highlight the economic opportunities that recycling can bring about, especially in communities facing significant socio-economic challenges such as poverty and unemployment (Abdullahi, 2024; Ezeah et al., 2013; Fischhoff & Litchfield, 2023; Medina, 2008). Globally, studies highlight that when waste is reused, or transformed effectively, it can have significant economic, social, and environmental advantages (Wilson et al., 2016; UNEP, 2016). Oteng-Ababio (2014) emphasizes the urgent need for a paradigm shift in how countries manage waste, highlighting the untapped potential of waste as a source of job creation and economic development. By recognizing waste as a resource, recycling can become a useful tool in reducing and diverting the amount of waste that lands in landfills, create job opportunities, and promote sustainable waste management practices. Studies conducted in South Africa and other regions (Blaauw, et al., 2019; Mbeng , 2013; Viljoen et al., 2016; Yu et al., 2020) have shown that the waste economy, especially the informal waste economy, has a significant impact on job creation opportunities and encouraging entrepreneurship, which contributes meaningfully to the nationwide poverty alleviation and development initiatives.

South Africa requires more nuanced studies to understand both barriers to and opportunities of recycling. Without context-specific research, there will be a risk of developing and implementing top-down policy approaches that do not align with the various situational, cultural, and geographic experiences of people in their communities. Given this background, the study examines the role of recycling, particularly informal recycling activities, poverty alleviation and income opportunities and the challenges encountered by waste pickers in two small to medium-sized towns of Makhanda and Port Alfred, South Africa . Key questions of the study included:

- What is the extent and state of waste-picking practices in Makhanda and Port Alfred?
- How does waste picking contribute to the livelihoods and poverty alleviation of waste pickers in Makhanda and Port Alfred?
- What challenges constrain the operations of waste pickers in Makhanda and Port Alfred?
- What are the perceived situational, knowledge, and attitudinal household-level barriers in Makhanda and Port Alfred?

1.4 Description of study towns

The study was conducted in Makhanda and Port Alfred in the Eastern Cape province of South Africa. The Eastern Cape is one of the poorest provinces in the country with high levels of poverty and unemployment. According to Stats SA (2021), the Eastern Cape had a 47% unemployment rate, with more than half (52%) of youth unemployed. The province is characterised by low education levels, with only 10% of the population with higher education and 7.2% being illiterate without formal schooling (Stats SA, 2021). According to the Eastern Cape provincial report (2022), recycling and efficient waste management systems are still in their infancy, requiring further development and growth. The report details that the province has piloted separation-at-source programs in 11 out of 31 municipalities and is yet to fully develop waste minimization and recycling plans. Waste disposal, processing, and separation-at-source initiatives are key strategies the province aims to strengthen to improve waste management.

1.4.1 Makhanda

Makhanda is a medium-sized town in the Eastern Cape province of South Africa, located at 33.3106° S, 26.5256°E. It is under the Makana local municipality and is the economic hub and the largest town of the municipality. It is about 110 km Northeast of Gqeberha (formerly Port Elizabeth) and 130 km Southwest of East London (South Africa Online et al., 2023). It is situated 55 km from the Indian ocean and is home to various vital landmarks such as Rhodes University, the Eastern Cape Division of the High Court, the South African Library for the Blind (SALB), a diocese of the Anglican Church of Southern Africa, and the South African Infantry Battalion. According to Stats SA (2011), the town has a total population of more than 70000 people (Kalina et al., 2024), with 72 % of that population being the working age (16-64 years). The town has 13 427 households, with an average household of 3.3 people (Stats SA, 2011). The town is predominantly Black, most people in the town speak the local IsiXhosa language. About 45% of the households are female-headed (Stats SA 2011).

According to Nowick (2020), Makhanda generates around 2.1 kg of waste per person per day, which means that over 249 000 kg of waste is produced daily. Improper waste management is a perennial problem in Makhanda. Makhanda's waste collection and separation operations are some

of the leading contributing factors to the waste management issue in the area (Kalina et al., 2024). The town has a single waste stream, meaning that general waste in most households and commercial spaces is mixed in one refuse bag and sent to the landfill. The municipality collects the refuse bag from each household to the disposal site, but some residents have deemed this service ineffective and inconsistent (Kalina et al., 2024). The garbage bags are left on the curbsides and in various designated collection points for days without being collected, which is attributed to inadequate personnel and infrastructure such as street sweepers, service people, and the collection and transportation staff (Nowick, 2020). This could be due to a shortage of staff and the need for more professionally qualified specialists, a common trend in small municipalities in the country (Dlamini et al. 2017). The single landfill in Makhanda receives about 90% of waste generated in the unsorted area, which indicates that the town needs to implement proper waste sorting and collection initiatives to reduce the amount of waste disposed of illegally and improve recycling initiatives in the area (Nowick, 2020).

1.4.2 Port Alfred

Port Alfred is a small town located in the Eastern Cape province of South Africa at 33° 36' 1.4220" S, 26° 53' 30.1164" E. The town lies on the Eastern Seaboard at the mouth of the Kowie River. It is situated exactly halfway between the larger cities of Gqeberha and East London, 30 km East of Cannon Rocks (South Africa Online, 2019). The town was established in the early 1820s by British settlers who were relocated to the area by Lord Charles Somerset during the conflict between the Cape Colony and the Xhosa people. Initially, it consisted of two separate towns: Port Kowie on the West Bank and Port Frances on the East Bank.

The population of Port Alfred is estimated to be around 33 964, with most residents being of working age (16-64 years). Stats SA (2011) reports that the town has about 3 213 households, with an average household size of 2.3 people. There is limited information about waste management and recycling in Port Alfred. The last available report by Stats SA (2011) indicated that waste collection services were consistent in the town, with over 80% of residents reporting that their waste is collected weekly and sent to the Port Alfred landfill site. However, little information about

Port Alfred's recycling rates is available. According to the Port Alfred Ratepayers Association (2022), the town has no formal recycling solutions, posing a significant constraint to recycling efforts since not everyone can afford private recycling services

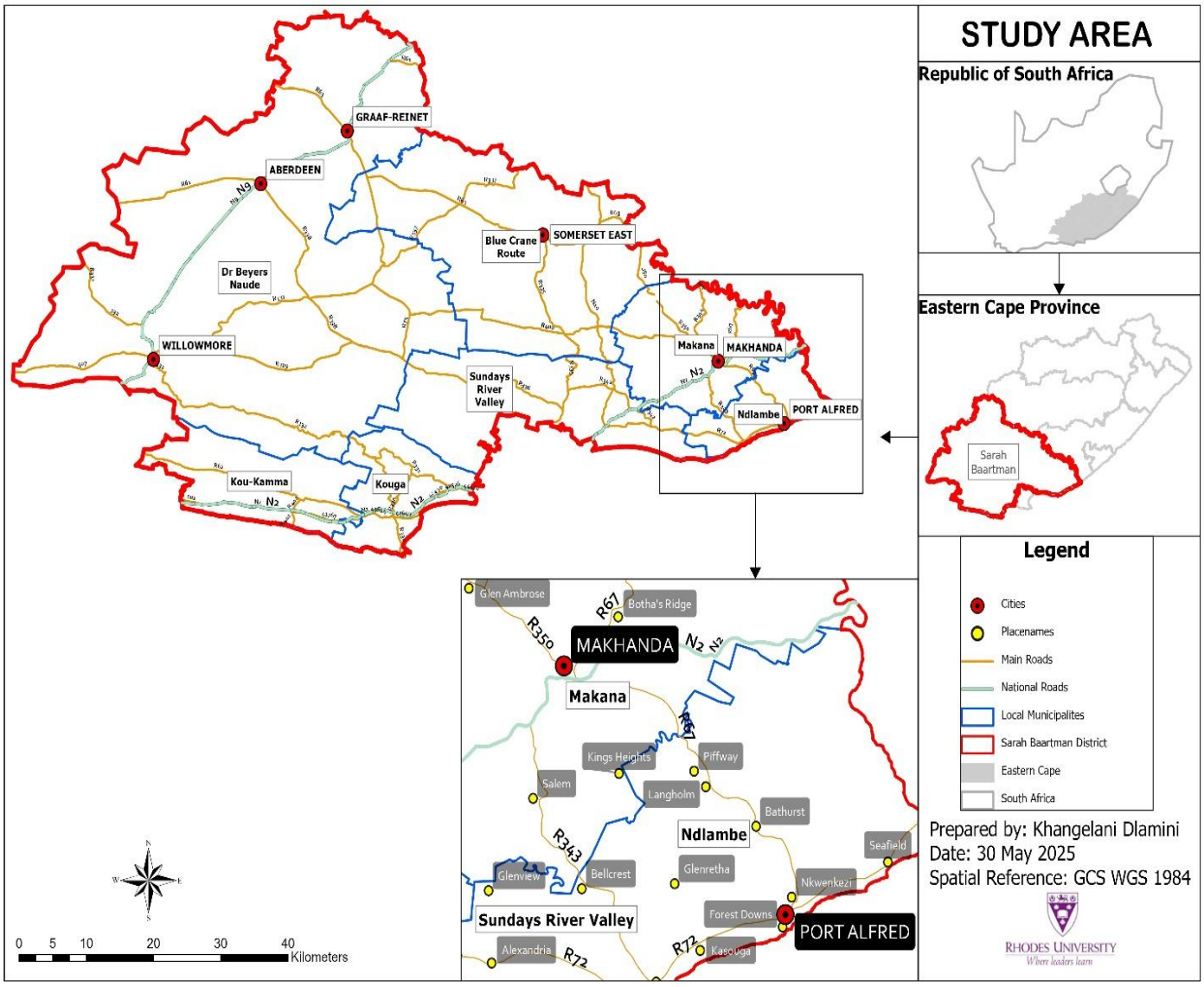

Figure 1.2: Location of Makhanda/Grahamstown and Port Alfred, Eastern Cape

1.5 Thesis outline

The thesis comprises four chapters, two of which are empirical. Both empirical chapters are written in a paper format, which includes their background, methods, results and discussion sections. The first chapter is the introduction, which provides the thesis's background, context, and overall

structure. The second chapter, titled *"Waste picking in medium-sized towns Makhanda and Port Alfred, South Africa: Livelihood contribution and challenges*", discusses the contribution of the informal waste economy to the livelihoods of waste pickers in Makhanda and Port Alfred. The third chapter, "*Perceived barriers to household-level recycling in Makhanda and Port Alfred, South Africa"* highlights the perceived barriers to household-level recycling in Makhanda and Port Alfred including situational, knowledge, and attitudinal challenges limiting recycling activities in both towns. The fourth chapter is the synthesis and recommendations chapter. The chapter provides a brief summary of the key findings and their implications, and outlines recommendations for improvement of recycling initiatives.

CHAPTER 2: WASTE PICKING IN MEDIUM-SIZED TOWNS MAKHANDA AND PORT ALFRED, SOUTH AFRICA: LIVELIHOOD CONTRIBUTION AND CHALLENGES

2.1 Introduction

Recycling for economic activities can be categorized into formal and informal recycling activities (Demaria, 2023; Littlewood et al., 2022; Wang et al., 2022). Formal recycling activities are typically registered with the government or regulated institutions and are characterized by documented structural processes for collecting, sorting, and processing recyclables (Chen & Gao, 2021). In the hierarchy of role players in recycling business (Figure 2.1) middle agents (buy-back centers), recycling companies (brokers and buyers), and manufacturing plants (industries) mostly carry out these activities. These structures are registered institutions with clear guidelines for operations, which ultimately make their operations more productive and often safer than informal activities.

In contrast, informal recycling economic activities are typically unregistered, undocumented, and less profitable. Individuals or small groups mostly carry them out and usually have no documented structure on waste collection, sorting, and processing. Informal waste pickers typically carry out these activities in the hierarchy of role players (Barford & Ahmad, 2021). As displayed in Figure 2.1, the two sectors are interconnected because they feed off each other. Waste pickers collect recyclables and send them to middle agents and buy-back centers. Buy-back centers provide recycling plants with the recyclables collected from waste pickers and recycling plants will ultimately forward the processed recyclables to manufacturing plants which will use the recyclables to manufacture new products (Barford & Ahmad, 2021). Informal waste pickers are pivotal in the recycling chain, yet their contribution is often overlooked and neglected (Godfrey, 2021; Morais et al., 2022; Velis, 2017).

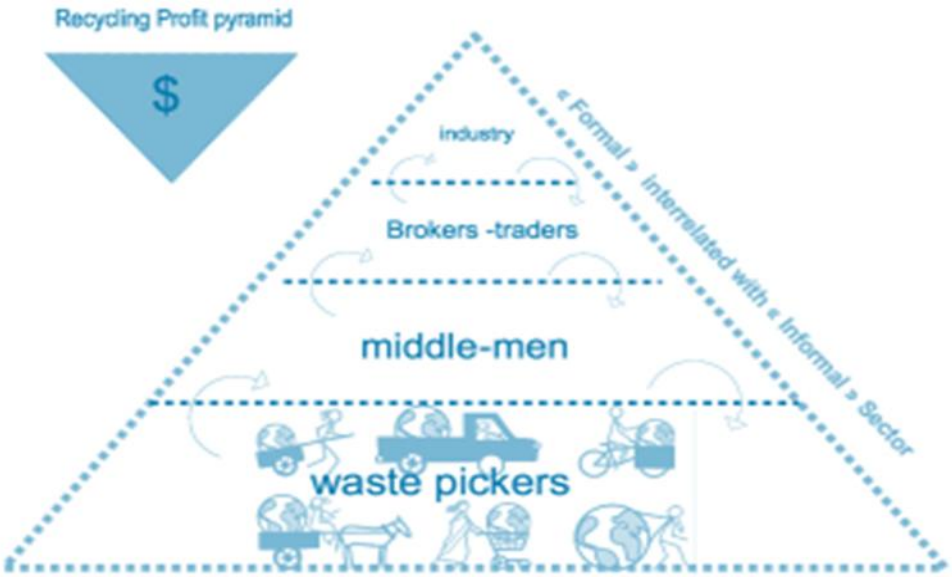

Figure 2.1: The hierarchy of role players in the recycling business. (Source: Barford & Ahmad, 2021).

2.1.1 Waste picking practices in South Africa

Waste pickers depend on collecting, sorting, and selling recyclable materials for survival (Littlewood et al., 2022; Morais et al., 2022). They collect materials thrown away as trash by people and industries including metal, food, clothes, paper, electronic waste, and plastics. Waste pickers recover and recycle recyclable materials from waste streams and ultimately reduce the amount of waste in landfills and streets. The materials are often recovered where municipal waste is discarded, mainly landfill sites, roads, and sometimes rivers and canals (Morais et al., 2022). In other parts of the world, waste pickers are labeled waste scavengers, vultures, parasites, and waste reclaimers (Dias, 2016; Nuripuoh et al., 2022). In 2008, the word "waste picker" was adopted at the first global conference of waste pickers in Bogotá, Colombia . The outcomes of this conference included creating a global network of waste pickers and rejecting derogatory words that are used to refer to waste pickers across the globe (Barford & Ahmad, 2021; Fernandez & Bonner, 2010). Consistent with other South African studies (e.g. Blaauw et al., 2019; Mkhize et al., 2014; Viljoen et al., 2018), this study uses the term "waste pickers".

Recycling uptake levels relies heavily on consistent and efficient waste collection and sorting services (Degli Antoni & Marzetti, 2019; Molinos-Senante et al., 2023). Waste pickers' daily activities allow them to be at the center of waste collection services, often at no cost to local municipalities, residents and authorities (Chen & Ijjasz-Vasquez, 2017). Therefore, this allows waste pickers to be at the forefront of providing recyclable materials to recycling companies and manufacturing plants. For example, Littlewood et al. (2022) indicate that 80-90% of the used packaging and paper collected to be recycled in 2014 was collected by waste pickers in South Africa at no cost to the government. Furthermore, in 2011, 70% of recyclable paper and 80% of plastic in South Africa were sourced from post-consumer and landfills and were separated and cleaned by waste pickers. Given the role that waste pickers play in waste management systems, particularly in waste collection and sorting, it is plausible to suggest that waste pickers are instrumental in South Africa's recycling rates.

Like in many developing countries, waste picking in South Africa is still not recognized in formal waste management systems (Banda, 2022; Godfrey, 2016). Waste pickers work independently or in small groups, often without formal contracts or employment benefits (Blaauw et al, 2019; Schenck and Blaauw, 2016). The lack of formalization of waste picking continues to undermine waste pickers' role in reducing harmful environmental impacts and promoting recycling uptake levels. The lack of formalization of the sector allows for exploitation and a lack of social protection and equity (Morias et al., 2022). Tucker and Anantharaman (2020) and WIEGO (2020) further argue that due to the lack of formalization, waste pickers continue to be used as cheap labor and further remove their voices in the implementation of policies and systems that will have an impact on profitability and the quality of their work. Tucker and Anantharaman (2020) and WIEGO (2020) draw on the example of consumer recycling initiatives, highlighting that waste pickers have little to no impact on the implementation of consumer recycling initiatives and reuse systems despite these programs having the potential to significantly reduce their earnings and the quality of their work. To create sustainable working conditions for waste pickers, waste picking should be integrated into city-wide recycling initiatives (Morias et al., 2022).

Similar to other economies globally, South Africa has drafted regulations to encourage the integration of waste pickers into formal recycling systems. For example, the extended producer responsibility regulations drafted in 2020 made it compulsory for producer responsibility organizations operating within their own schemes to incorporate informal waste pickers into the post-collection value chains. Furthermore, the regulations require the establishment of a national database for waste pickers, who are expected to join the database in order to participate in extended producer responsibility collection activities. The drafting of the database was seen as a crucial step in formalizing the work of waste pickers, as it enables them to be identified, guided, and supported, ultimately facilitating their inclusion in planning schemes and strategies that advance the informal waste economy.

Additionally, the Waste Pickers Integration Guidelines Report (2020) by the Department of Environment, Forests, and Fisheries, in collaboration with the Department of Science and Innovation, is also a typical intervention by the South African government in advocating for the inclusion and integration of waste picking into formal waste management systems. The report advocates for the integration as a structural and systematic reform that requires urgent attention. It further calls for collaboration between various waste management stakeholders, including the government, industries, and waste pickers' organizations, in mobilizing and advocating activities to improve working conditions and the participation of waste pickers in the drafting and planning stages of initiatives that will impact their work. It is, however, important to note that according to some studies (Labra Cataldo et al., 2024; Lindner, 2025), the enforcement and compliance with these regulations have been predominately weak, with limited action being taken against waste pickers, buy-back centers, and formal recycling organizations that do not adhere to the regulations. Lindner (2025) further labels this lack of compliance and enforcement as significant barriers in the movement towards the formalization of the informal waste economy

Studies indicate that the number of people entering the informal waste-picking sector is increasing and for various reasons (Chikarmane & Narayanan, 2024; Morais et al., 2022; Ntsoane, 2022). In 2014, waste pickers accounted for 0.31% of the total South African labor force, with over 60,000 individuals in this sector nationwide (Schenck et al., 2019). Of these 60,000 waste pickers, 59%

operated within landfill sites, while the remaining 41% were trolley/street waste pickers. In 2017, Godfrey (2021) estimated that the number of waste pickers increased to between 90,000 and 215,000 people. The increasing number of people entering the sector could be attributed to numerous factors; the World Bank (2024) and Aslam (2024) suggest that the increasing waste generation levels result in more people entering the sector because waste becomes more accessible and thus becomes an easy opportunity for people to achieve profit and income. The high unemployment rate in the country also plays a significant role in the sector's expansion (Marello, 2013; Mkhize, 2014; Yu et al., 2020). Waste picking provides an opportunity for people that the formal employment sector cannot absorb to earn an income to support themselves and their families. In a study by Yu et al. (2020), the authors further suggest that most waste pickers are unemployable in the formal sector due to a lack of formal skills and education, which thus pushes them to resort to waste picking for survival. Additionally, some respondents were illegal immigrants without proper documentation making it difficult for them to be absorbed into the formal employment sector. The desire to be independent and live a crime-free life is also an important factor behind the growth and expansion of the informal waste-picking sector in South Africa and other parts of the world (Manyane, 2025; Rosaldo, 2017).

Despite the nature of their operations being the same, waste-picking practices differ. Waste pickers work varying hours and days in various locations (Malele, 2022). There is limited academic literature that details the hours and days worked by waste pickers in South Africa, but few studies (Department of Environmental Affairs, 2016; Godfrey, 2021; Schenck et al., 2011; Viljoen et al., 2018; Yu et al., 2020) indicate that waste pickers typically work between 8 to 9 hours per day, starting from 07h00 am until 17h00 pm. The total number of days worked also vary depending on the waste pickers' needs and abilities (Yu et al., 2020). Godfrey (2021) suggests that most waste pickers work 5 to 7 days a week, depending on their availability, physical ability, and material accessibility. The location of collecting and sorting also varies among waste pickers (Dais & Samson, 2016; Malele, 2022). As indicated above, most waste pickers in South Africa are landfill waste pickers, who typically sort through the waste disposed of in landfills. Landfill sites are managed differently, while some are controlled, others are uncontrolled (Schenck et al., 2019). Uncontrolled landfill sites lack formal management, staffing, and operational protocols. In

contrast, controlled landfill sites have formal management and are equipped with staffing and equipment for spreading, compacting, and covering waste. These sites can be privately or government-owned and are primarily open to the public but have regulations and procedures to manage how people enter and interact with the site. The advantages of uncontrolled landfills for waste pickers include easy access to recyclables, flexibility, and better engagement with other waste pickers. However, Schenck et al. (2019) also suggest that even though these landfill sites have advantages, due to the lack of management and supervision, these sites are typically characterized by harsh working conditions and have limited access to essential services, including water, shelter, and toilets.

Furthermore, Schenck et al. (2019) suggest that competition and crime are higher in uncontrolled landfill sites due to the lack of authority. Controlled landfill sites tend to have better working conditions, improved provision of basic amenities, and an orderly approach to waste picking due to the presence of a management authority. However, waste pickers operating on these sites highlight that these sites can have discriminatory policies. For example, the same study by Schenck et al. (2019) highlighted some respondents indicated that certain landfill managers allow more women than men to enter the site because women are deemed peaceful and easy to manage.

2.1.2 Waste pickers income and welfare

Beyond aiding successful recycling initiatives, the informal waste sector can bring significant economic opportunities. Godfrey (2021) estimates that around ZAR625 million (USD34 million) and ZAR872 million (USD50 million) in 2017 were paid to the informal sector through buy-back centers. Littlewood et al. (2022) further highlights the informal sector's role in creating employment opportunities and estimates that about 100,000 people in South Africa sustain their livelihoods through waste picking activities. There are two payment structures that buy-back centers and recycling companies utilize to pay waste pickers. Informal waste pickers utilize the resource value payment structure (Schenck et al., 2019). This payment structure places a significant focus on the financial value of the collected material where waste pickers are paid based on the total volume, the quality, and the overall market demand of the materials collected. Due to the market performance of the materials being the cornerstone in this payment structure, wages

paid to waste pickers are incredibly varied and change from time to time. This is mainly because the demand for certain materials changes from time to time and is not the same for every location. For example, Godfrey (2021), reported that waste pickers suggested steel and metal recyclables as the most profitable and a desirable market value while Parker (2024) reported PET plastics as the most profitable with better exchange rates at buy-back centers. This indicates that the compensation received by waste pickers under this structure is varied and is mainly dependent on the type of materials they collect and the location they operate on.

Conversely, waste pickers working with formal recycling companies and recycling non-profit organizations are compensated using the collection value payment structure (Schenck et al., 2019). This payment structure compensates waste pickers based on their service rather than the value of the materials collected. These waste pickers typically collect a specific type of material and, therefore, get remunerated based on the days worked rather than the market value of the recyclables. Pickers paid under this structure are thus more likely to have fixed payment rates and somewhat income (Schenck et al., 2019).

The total income for waste pickers varies and depends on various market and situational factors. The quantity, quality of the materials collected, and weather conditions are some of the factors that determine the overall income of waste pickers (Blaauw et al., 2019; Viljoen et al., 2014; WIEGO, 2021). For example, at buy-back centers, waste pickers recyclables are collected and weighed on a weight scale. The rates are fixed per kilogram, which means that the higher the kilograms the scale reads, the higher the compensation paid to the waste picker. The quality of the materials collected also influences the total earnings because buy-back centers have standards and strict requirements for the materials they collect, and if the materials are unsatisfactory, they are rejected (Viljoen et al., 2014). Waste picking is essentially an outdoor activity; therefore, extreme weather and seasonal factors can impact waste pickers' productivity, ultimately affecting the income they can earn.

In South Africa, there is scarce literature on waste picking and income generation particularly in small and medium-sized towns where job opportunities tend to be limited. The Department of Environmental Affairs (2016) reported that waste pickers earned up to ZAR1430 (USD 79) monthly. Blaaw et al. (2019) in Pretoria, South Africa reported slightly lower figures, estimating monthly earnings between ZAR499 (USD28) during a typical bad week and ZAR1142 (USD63) on a good week. In a study conducted in the Free State province of South Africa by Schenck et al. (2016), street waste pickers earned approximately ZAR770 (USD42) in a good week and about ZAR290 (USD16) in a bad week, which translated to about ZAR3080 (USD170) and ZAR1160 (USD64) per month respectively. Viljoen (2018) reported a nearly similar income of about ZAR72 (USD4) per day and ZAR1430 (USD79) per month. It is important to note that a significant proportion of these figures are above the ZAR760 (USD42) food poverty line outlined by the South African government (Stats SA, 2023), highlighting the potential of waste picking in alleviating extreme poverty . While waste picking income offers a livelihood opportunity, it can be constrained by several challenges.

2.1.3 Challenges encountered by waste pickers

Tangible resources are physical resources waste pickers require in their day-to-day operations (Morias et al., 2022). These resources include but are not limited to transportation, storage, protective equipment, and shelter (Gutberlet & Carenzo, 2020; Kain et al., 2022). On the other hand, intangible resources are non-physical resources, mainly training and development resources and social cohesion initiatives among themselves and the communities in which they operate. (Morais et al., 2024; WIEGO, 2021). Providing these resources is instrumental because they allow waste pickers to perform the primary responsibilities that the job requires.

Waste pickers generally work independently, with little or no support from waste management authorities or the government. Therefore, this independence means waste pickers often rely on themselves to provide these resources (Blaauw et al., 2019; Morias et al., 2022). Studies indicate that access to tangible resources is limited. For example, a survey by Dlamini et al. (2017) notes that a significant proportion of waste pickers surveyed in the study indicated issues of insufficient storage and space to sort, clean, and pack their recyclables, further citing that due to the lack of

space they end up burning about 30% of their recyclables. The lack of space further limits productivity during rainy seasons because stored recyclables get wet and contaminated due to the lack of appropriate storage places available. Both studies by Blaauw et al. (2019) and Viljoen et al. (2016) suggest that waste pickers require substantial governmental intervention to provide resources to support informal recycling initiatives.

Poor working conditions and access to protective equipment are other challenges faced by waste pickers globally (Mlotshwa et al., 2022, Uhumamure et al., 2021). Waste pickers work long hours, and studies reveal that a significant majority of them collect, sort, and clean piles of waste materials, including hazardous waste materials, without wearing any gloves, masks, boots, or any protective material (Carenbauer, 2021; Uhumamure et al., 2021; Viljoen et al., 2016). The lack of protective material makes them vulnerable to infections, diseases, and injuries, directly affecting their ability to perform their responsibilities and reducing potential income. Waste pickers cite various reasons for the lack of protective materials, including but not limited to affordability issues, discomfort, and lack of education & training (Mlotshwa et al., 2022, Uhumamure et al., 2021).

Transport-related challenges also pose a significant risk to the livelihoods of waste pickers (Blaaw et al., 2019; Kain et al., 2022). Waste picking activities require efficient and reliable transport facilities because waste pickers can only earn an income if their collected recyclables reach buy-back centers to be weighted; therefore, reliable transport from home to collection points and buy-back centers is paramount in the economic cycle of informal waste pickers. Studies highlight that transport facilities for waste pickers are limited (Blaauw et al., 2019; Department of Environmental Affairs, 2016; Viljoen et al., 2012); the income waste pickers earn does not allow them to own their transport, which forces them to rely on public transport or walking. A study by Ramelelle and Xweso (2022) conducted in the Free State province of South Africa, highlights that many waste pickers cited walking long distances from collection points to buy-back centers and, as a result, some of them were diagnosed and received medication for various fatigue-related conditions and arthritis. The impact on their health ultimately negatively affected their ability to collect materials and by extension generate income.

The provision of intangible resources is also vital to the livelihoods of waste pickers. To fully optimize the opportunities brought by waste picking, comprehensive theoretical and practical education initiatives for waste pickers are essential. The United Nations Development Programme (2020) and Schenck et al. (2019) highlight that waste pickers' training initiatives generally should provide an in-depth understanding of various waste management systems, occupational health and safety issues, and the economic and social impacts of recycling. Other training programs include critical practical concepts such as waste segregation and protective equipment handling techniques (Pachauri & Singh, 2022). Studies, however, indicate limited access to these resources (Samson, 2020; Viljoen et al, 2018). Due to the lack of formalization of waste picking services, waste pickers often cannot afford to access these services by themselves and, as a result, rely on each other to learn about the job and on peer education and training systems to share knowledge and skills.

The growing number of people entering the informal recycling sector in South Africa calls for more research work on the opportunities and challenges of this sector on the livelihoods of waste pickers. Literature on recycling in South Africa indicates a minimal number of studies conducted in rural areas and small-medium towns. A substantial proportion of studies have been conducted in big cities and towns (Blaauw et al., 2019; Schenck, 2011; Yu et al., 2020) which is vital because there tend to be higher numbers of waste pickers available, which could provide an in-depth picture of the state of waste picking in the country to inform policy decisions and waste management development strategies. However, the existing body of knowledge must be inclusive and contextually relevant to different parts of the country. Small to medium-sized towns have their own socio-economic structures, waste management systems, and poverty alleviation strategies. Given this background, the main aim of the study was to examine the contribution of waste picking to the livelihoods of, and challenges encountered by waste pickers in two medium-sized towns of Makhanda and Port Alfred in the Eastern Cape province of South Africa. Key questions of the chapter included:

- What is the extent and state of waste-picking practices in Makhanda and Port Alfred?
- What is the contribution of waste picking to the livelihoods and of waste pickers in Makhanda and Port Alfred?

- What challenges constrain the operations of waste pickers in Makhanda and Port Alfred?

2.2 Methods and materials

2.2.1 Sampling and data collection

Data collection took place in Makhanda and Port Alfred between April and July 2024, using a mixed research approach. Data were collected using a quantitative survey coupled with qualitative questions, which required in-depth participant explanations and discussions. Waste pickers were selected using a convenience sampling approach and snowballing. Convenience sampling involved selecting respondents who were located near the study area and willing to participate (Nikolopoulou, 2022). Snowball sampling involved identifying a small group of initial respondents who met the study criteria and through referral, allowed interviewing of other waste pickers (Nikolopoulou, 2022). In both towns, waste pickers were approached at the landfill sites and buy-back centers. A total of 85 waste pickers participated in the study across the two study towns.

Section A of the questionnaire was designed to capture the socio-demographic profile of the waste pickers including age, gender, household size, education level, social grants status, employment, household size, number of dependents, and income sources. Section B of the questionnaire captured waste picking practices. The first part of section B captured the motivation for waste picking, total hours and days waste pickers worked, the location of their collection services, the type of materials they collected, the total volume of materials collected daily, the price of materials at buy-back centers and the income earned per week or month. The second part of section B captured the waste pickers' daily experiences, including the challenges they encountered in collecting, transporting and selling the collected waste. Interviews were conducted during weekdays between 08h00 and 17h00 and took between 60 to 90 minutes to complete. The surveys were printed in both IsiXhosa and English and when required translations were provided with assistance of a research assistant. Direct observations were used to assess the waste materials collected and the working conditions of the waste pickers. Ethical approval for this project was granted by the Rhodes University Ethics Committee (Review Reference No 2023-7532-8258).

2.2.2 Data analysis

Data were analyzed using STATISTICA (Version 13). Socio-demographic data were summarized in tables to provide an overview of the profile of the waste pickers in both towns. Non-parametric tests (e.g., Mann-Whitney *U* tests) were used to check if there were statistically significant differences in some socio-demographic variables and income levels between waste pickers. All income values were reported in South African Rands (ZAR) with a USD equivalent. At the time of analysis (2025), the rate of exchange between the South African Rand (ZAR) and the US Dollar was about USD 1.00 = ZAR 18.17. To examine the impact of waste picking on poverty alleviation, particularly extreme poverty alleviation, a poverty headcount index and poverty gap index were calculated. A poverty head count index and poverty index were used to estimate the proportion of waste pickers below the poverty line and the extent of poverty with and without waste collection income respectively. There are varied poverty measures in the poverty literature, but this study aimed to highlight the potential of waste picking on alleviating subsistence level poverty. Therefore, the study used the food poverty line of ZAR 760 (USD 42) per capita per month in line with the Statistics South Africa National Poverty Line report (2023). Estimated net monthly incomes (waste collection income + social grants + side hustles, if applicable) and the estimated income solely from waste collection were utilized for the calculations. Both reported income figures, with and without waste collection, were converted to a per capita basis. This aligns with previous studies on environmental resources on poverty alleviation and household welfare (e.g., Blaauw et al., 2019; Thondhlana & Muchapondwa, 2014).

A Spearman correlation analysis was performed to test the relationships between waste collection income and various explanatory variables such as days worked per week, weight of waste collected, gender, and number of hours worked per day. The qualitative responses were transcribed and analyzed through thematic analysis. This analysis followed the six-phase framework of Braun and Clarke (2006). The first step included reading and carefully examining all the responses to become familiar with the dataset. Occurring keywords that speak to research aims and objectives were then noted and highlighted in the dataset to identify potential themes. The next step involved grouping similar keywords into themes. The following step involved reviewing and refining themes, ensuring that the identified themes were accurate, and eliminating those not fully sustained

by the data. Lastly, all the themes were named and defined according to the key concepts and ideas behind the themes. Quotes were used where relevant to illustrate findings and ideas, consistent with qualitative analysis (Sandelowski, 1994).

2.2.3 Limitations of the study

The main limitation of the study relates to the non-probability sampling approaches employed in this study (convenience and snowball sampling), which are prone to sample selection bias (Boyd et al., 2023; McCombes, 2023; Nikolopoulos, 2023). Further, the informal waste economy is highly variable (Blaauw et al., 2019) therefore the reported income figures are subject to income fluctuations. Therefore, the findings cannot be generalized but provide useful and transferable insights relating to waste picking's potential contribution to well-being in small to medium-sized towns.

2.3 Results

2.3.1 Socio-demographics of the respondents

In both Makhanda (71%) and Port Alfred (73%), there was a higher proportion of male waste pickers than females (Table 2.1). The average age of waste pickers was slightly higher in Makhanda (39±12) than in Port Alfred (36±17), but the difference was not statistically significant ($Z= 1.650$; $p > 0.05$). The education level of waste pickers was generally low across both towns, but waste pickers in Makhanda had higher education levels than in Port Alfred. Only 6% of waste pickers in both towns had achieved a tertiary level education, and more waste pickers in Port Alfred (62%) than in Makhanda (46%) had some primary-level education. Fewer waste pickers in Port Alfred (23%) than in Makhanda (44%) had secondary-level education.

Less than half of the waste pickers across both towns received government social welfare grants, though there were slightly more social grant recipients in Port Alfred (42%) than in Makhanda (37%). A significant proportion of waste pickers across both towns indicated that they were the breadwinners of their households, though Makhanda (81%) had a significantly higher percentage than Port Alfred (58%). Most waste pickers were single (96%), with only a few (8%) indicating they were married. A significant proportion (82%) of waste pickers across both towns were

unemployed, citing waste picking as their only income opportunity. The remaining 18% reported employment from the Community Work Programme (CPWP) and part-time domestic work in the neighboring suburb of Sunnyhill in Makhanda and the CBD in Port Alfred. The average number of dependents per waste picker in Makhanda (3±2) was slightly higher than in Port Alfred (2±2), the difference however, was not statistically significant ($Z= 1.320$; $p > 0.05$).

Table 2.1: Socio-demographic information of waste pickers

Attribute	**Makhanda (n=59)**	**Port Alfred (n=26)**	**Total sample (n=85)**
Gender (%)			
Male	71	73	72
Female	29	27	28
Age (mean±SD)	39±12	36±17	38±14
Level of education (%)			
No education	6	15	6
Primary school	46	62	46
High school	44	23	44
University	5	0	6
Marital status (%)			
Single	92	92	92
Married	8	8	8
Employment status (%)			
Employed	20	4	18
Unemployed	80	96	82
% receiving social grants	37	42	39
% of breadwinners	81	58	74
Number of dependents (mean±SD)	3±2	2±2	3±2

2.3.2 Waste collection practices

Work experience and motivation

Waste pickers were asked about their work experience and daily working hours. The average years of experience were seven years in both Makhanda and Port Alfred, the minimum being two months and the maximum being 40 years. A sizeable proportion of the waste pickers in both Makhanda (59%) and Port Alfred (62%) reported work experience of less than five years, and only a few waste pickers (less than 5%) reported having an experience of more than 20 years, with slightly more waste pickers in Port Alfred (5%) than in Makhanda (3%).

Concerning the motivation for waste picking, all the surveyed waste pickers in Makhanda and Port Alfred cited financial difficulties as the primary reason for waste picking, stating that waste picking earned them money and enabled them to support their families as illustrated in the statement below:

> "I was unemployed for the whole of 2021, and around December (2021) a friend of mine asked me to come here (Makhanda landfill site) and see if I could find anything. I collected cans with him and went to sell them at Chicks, and we made about ZAR150 that day. From that day, I never stopped till today. I had to make a plan because no one would rescue me" (Makhanda waste picker).

> "Station Hill has no jobs, bhuti (brother), so to make a few rands to buy a few things around the house, I collect cans and buy what is needed. You cannot always ask from people; people will be tired of you, so I must do something for myself" (Port Alfred waste picker)

Types of materials collected

A substantial percentage of waste pickers (93%) across both towns collected recyclables at the local landfill site. In Makhanda, a substantial proportion (92%) of the waste pickers collected waste from the landfill site, but they also sometimes collected from streets on waste collection days in high-income residential areas. The remaining proportion (8%) were only collecting in the streets, mainly along the main roads, particularly the R67 and smaller streets in the Joza township Similarly, the majority (96%) of waste pickers in Port Alfred collected waste at the municipal Port Alfred landfill site while only 8% collected both at the landfill site and along the streets. Street waste pickers in Port Alfred cite the R67, R72, and other small streets in the residential neighbourhood of Stone Hill to be their collection points.

Respondents were asked about the various materials that they collected and sold. In both towns, tin cans were the most collected than other materials because they were easy to find and light enough to carry to the nearest buy-back centre. As evident in the statement below, waste pickers collected tin cans because they were easy to find, allowing them a reliable and consistent opportunity to make an income at the end of the day.

"Chicks is open Monday to Friday, so you can make more money with tin cans than the paper guy who comes once a week. You do not even know if he will take your paper and how much he will give you. By collecting tin cans, you can get something like ZAR60 to a ZAR100 per day depending on your luck" (Waste picker, Makhanda).

The tin cans were primarily from energy drinks, fizzy drinks, and cleaning materials collected daily from the local municipal dump sites and along the streets. The tin cans were squashed, packed into black bags, and transported to buy-back centres, where they were weighed and compensated based on the weight. Nearly two-thirds of the respondents (63%) indicated tin cans were the most profitable material for them to collect (Figure 2.2).

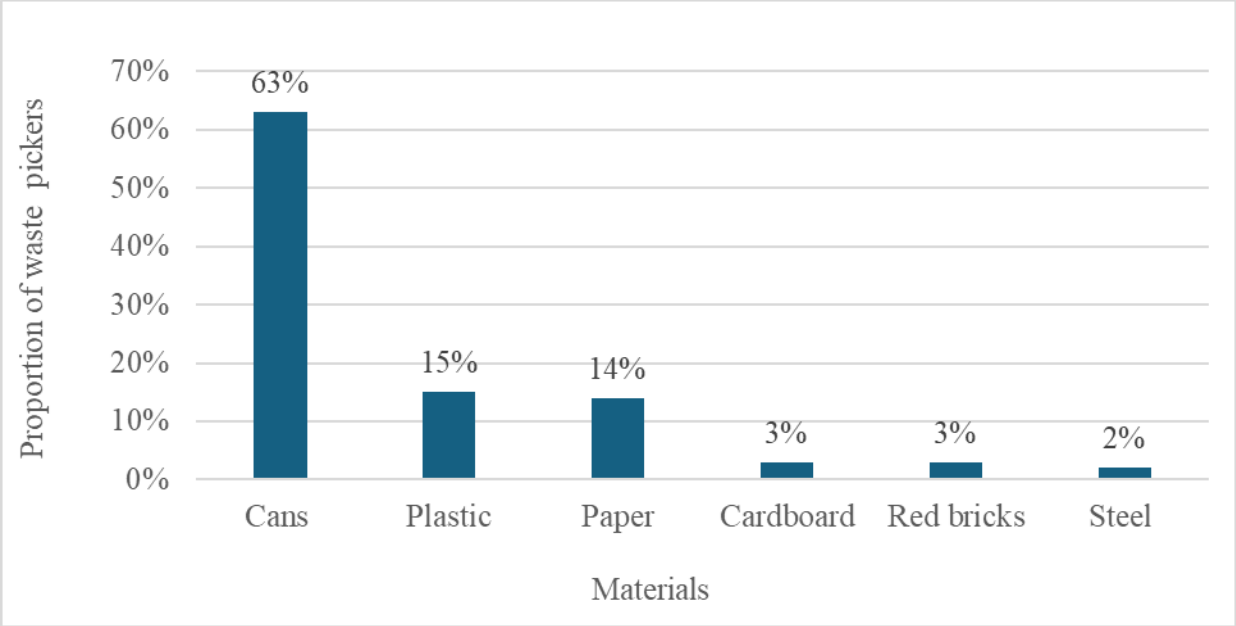

Figure 2.2: Waste materials perceived to be profitable by Port Alfred and Makhanda waste pickers

There were differences in the reasons behind the focus on collection of tin cans between the two towns. In Makhanda, about 60% (Figure 2.3) of waste pickers said they collected cans because they fetched more money at the buy-back centre's rates, while in Port Alfred, about half of the waste pickers focused on cans collection because they were readily available. The least collected materials in both towns were steel (1%) and red bricks (2%), with waste pickers reporting that these materials were rare to find at landfill sites and tended to draw competition between waste

pickers. Cooper materials mainly referred to cooper wires, cables, pipes, and other cooper containing materials that waste pickers collected. The waste pickers in Makhanda reported that red bricks fetched high returns at buy-back centres, but waste pickers tended to fight over them.

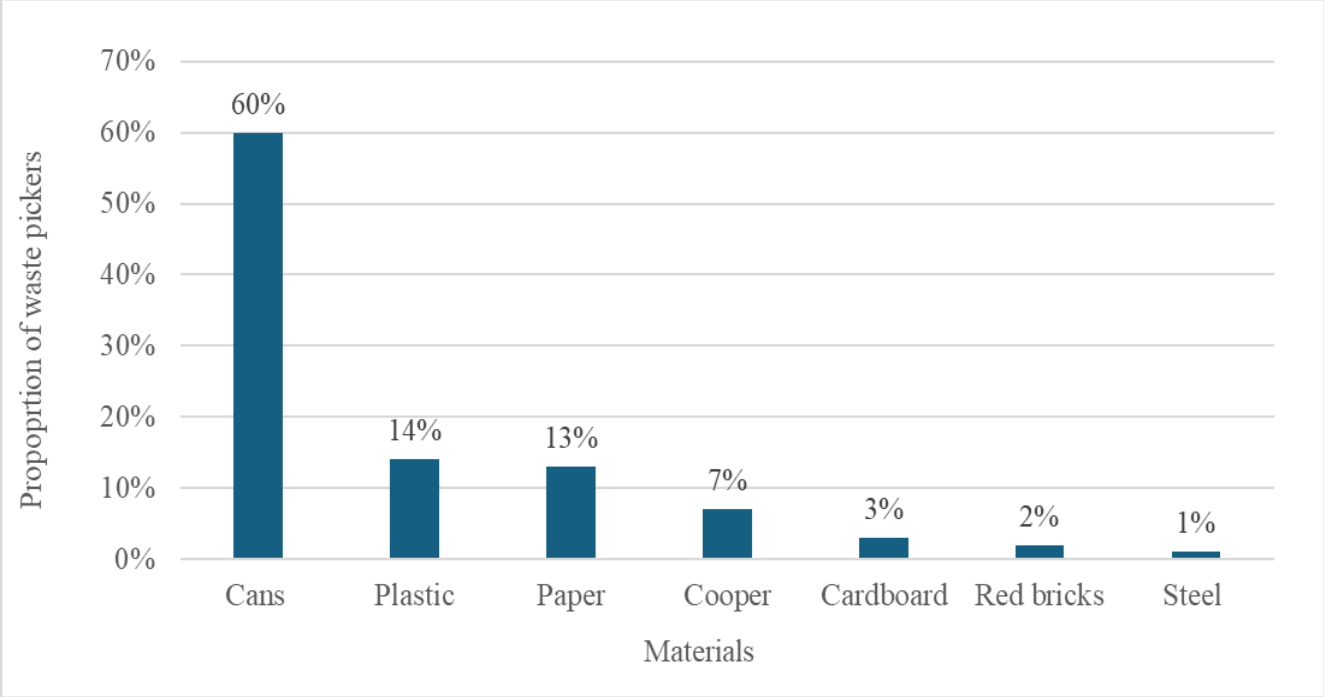

Figure 2.3: Materials collected by Makhanda and Port Alfred waste pickers

On average, waste pickers worked about five days a week, ranging from 1 day to 7 days. Nearly half (46%) of the total sample reported working for five days (Monday to Friday), stating that the working days corresponded with those for buy-back centres. About 21% of the waste pickers worked for all days of the week, stating that weekends allowed them to collect more materials without competition. This is evident in the following statement by a waste picker,

> "On Saturday, the site is empty, and there is no competition. Even though no trucks are coming, I can look for materials without interference. People drink from many cans on weekends, so I get to pick them up when I go home and prepare for Monday; it makes my life easier". (Waste picker, Port Alfred)

The remaining proportion of waste pickers had varied numbers of working days ranging between a day and six days per week. The average hours worked by waste pickers in both towns was 8 hours per day, ranging from just 2 hours to 15 hours, with collection mainly between 8:00 am and 4:00 pm. The mean number of hours worked by waste pickers was similar in both Makhanda (8±1.5) and Port Alfred (8±3.4) ($Z = -0.138$; $p > 0.05$).

2.3.3 Waste collection income and household welfare

A substantial proportion (80%) of waste pickers across the sample reported that the amount of waste they collected fluctuated and depended on how much was brought to the landfill site. Waste pickers indicated that more waste was collected during municipal waste collection days. The average amount of waste collected by waste pickers across both towns was 16±25 kg daily with statistically insignificant differences between Port Alfred (18±23 kg) than Makhanda (15±25 kg) ($Z = -0,219$; $p>0.05$). A sizeable proportion of waste pickers in both Makhanda (38%) and Port Alfred (42%) collected less than 5 kg of waste per day, respectively. About 31% of the waste pickers in Makhanda and 34% in Port Alfred collected between 5 kg and 10 kg of waste per day. The remaining few waste pickers reported collecting at least 20 kg of waste per day. When the reported total weight collected was considered by gender, there were no significant marked difference between males (16±26 kg) and females (15±18 kg) ($Z = -1,001$; $p > 0.05$).

The average income from waste collection across both towns was estimated at ZAR1418 ± 1326 (USD78) per month. Waste pickers in Makhanda reported higher income (ZAR1472 ± 1270) (USD81) than those in Port Alfred (ZAR1298 ±1463) (USD71), but the difference was statistically insignificant ($Z = 1.497$; $p >0.05$). Provided mean number of days and hours worked, the estimated mean weekly and daily income of waste pickers across both towns was ZAR398 (USD22) and ZAR80 (USD4) respectively. When waste income was considered by gender, males reported about 28% more income (ZAR1536 ± 1420) (USD 84) than females (ZAR1102 ± 1048) (USD 60) but the difference was not statistically significant ($Z = 1.465$; $p > 0.05$). A Spearman correlation analysis was performed to explore the relationship between waste collection income and various explanatory variables (Table 2.2). Only two factors, days worked per week and weight of waste,

yielded a significantly positive but weak relationship with waste collection income. Though not significant at the 5% level, gender and the number of hours worked per day showed a positive association with waste collection income. Age and experience yielded a statistically insignificant negative relationship with waste income.

Table 2.2: Spearman's rank correlation analysis between waste collection income and various factors

Variable	**Spearman (*rho*) value**	***p*-value**
Age	-0.057	0.603
Gender: dummy 1 = male; 0 = female	0.167	0.127
Experience	-0.165	0.132
Hours worked per day	0.117	0.287
Days worked per week	0.277	0.010*
Weight of waste	0.286	0.011*

* Denotes significant difference

Analysis of poverty incidence and depth using the 2023 Statistics South Africa national food poverty line of ZAR760 (USD43) is presented in Table 2.3. The results show that the proportion of waste pickers below the poverty line tends to be lower with waste collection incomes, as indicated by lower poverty headcount indexes. Across the total sample, the mean per capita income with waste income was ZAR1172 (USD64) per month. Poverty incidence and depth were estimated at 28% and 12% respectively with waste income. Without waste income, the mean per capita income dropped to ZAR250.00 (USD14) per month, and poverty incidence and depth increased to 88% and 78%, respectively. Analysis of poverty incidence and depth by town revealed similar trends, with noticeable increases in poverty incidence and depth without waste income. For example, poverty incidence would increase by 51% and 39% while poverty depth would increase by 64% and 38% in Makhanda and Port Alfred respectively, reflecting a high contribution of waste picking on income generation and extreme poverty alleviation.

Table 2.3: Poverty gap and headcount index among Makhanda and Port Alfred waste pickers

Unit of analysis	With waste collection income			Without waste collection income		
	Mean income (ZAR) per capita	Poverty headcount index (%)	Poverty gap index (%)	Mean income (ZAR) per capita	Poverty headcount index (%)	Poverty gap index (%)
All waste pickers	1172	28	12	250	88	78
Makhanda	581	41	18	91	92	82
Port Alfred	588	42	19	239	81	57

2.4 Waste picking working experiences and challenges

Respondents were asked about their working conditions and experiences, including access to safety bags, protective equipment gear such as gloves and safety masks, collection storage area, and access to training opportunities.

2.4.1 Poor support infrastructure

In Makhanda, over three-quarters (76%) of the waste pickers had sufficient bags to place their recyclables after collection. About 72% of the waste pickers indicated they had access to sufficient collection storage areas to store and keep their recyclables. It is, however, worth noting that despite the availability of these storage facilities, they were reported as not always functional and habitable. The facilities allowed them to store, sort, and clean their materials. However, in the event of rain and wind, their materials were contaminated and blown away because the facilities did not have shelter or had open walls (Figure 2.4). Waste pickers that particularly collect paper and cardboard, indicated that they did not come to the site during rainy days because the materials they collected would be wet and rejected at the buy-back centres. Only 17% of respondents reported access to protective gear such as gloves and masks. In Port Alfred, all the waste pickers had access to sufficient storage bags but most of them (92%) did not have access to protective equipment/gear and sufficient storage space (96%). Direct observations in Port Alfred also showed that all waste pickers did not use protective equipment and had limited storage post-collection.

Figure 2.4: A storage facility in the Makhanda landfill site Source: Grocotts Mail (2023)

2.4.2 Lack of training

When asked if they had received informal or formal training on collecting recyclables, most of the sampled waste pickers (93%) had not received any training but had learned from others through observations and peer support. Only 7% of the waste pickers in Makhanda reported some formal training covering safety and the value of waste picking. These waste pickers reported that they were members of the National Arts Festival recycling project a few years ago. Just over half (53%) of the waste pickers reported challenges related to lack of transparency in the waste-picking payment system, stating that they did not know how much the buy-back centers charged them per kilogram of waste, as evident in the following statement:

> "I do not know how much cash a kilogram of the materials (cans) I collect can give me because the man does not show us the scale and the number; we just see the money. I sometimes collect two bags of cans, and I am unsure how much they weigh on the scale, I just know that I mbwill get close to R60 for them"– (Waste picker, Port Alfred).

2.4.3 Weather challenges

Other challenges reported related to seasonality and the impact of weather. For example, about 80% of the sampled waste pickers said working on their sites and in the streets during rainy days was challenging because there were no sorting shelters. Apart from potential health problems such as flu and colds, rain contaminated their recyclables and in turn, the collected wet waste was rejected buy-back centres. This was a concern for waste pickers collecting paper, cardboard, and plastic. It was also reported by about 80% of the sampled waste pickers that during rainy days, the dump sites became muddy and slippery, making it difficult for trucks to enter and waste pickers to walk around and pose danger to both equipment and people. Wind was the second most mentioned weather challenge, with 18% of the waste pickers stating that strong winds blew away potential recyclable waste. Strong winds also raised dust, making visibility poor and limiting mobility around the dump site. High temperatures were also mentioned by only a handful of waste pickers (4%), stating that hot weather brought different types of insects and snakes, threatening their health and safety. High temperatures also made working on the dump sites complex, often resulting in sunburns. While some waste pickers wore sun hats on scorching days, they were insufficient to protect them from the sun's U.V. rays. Sunscreens were said to be too expensive to buy. Altogether, these weather events negatively impacted the waste picker's collection capacity and income for the day.

2.4.4 Market challenges

Market challenges were centered on the limited availability of buy-back centres, which constrained their bargaining powers. For example, there were only three buy-back centres in Makhanda but only one bought paper and cardboard. However, this centre had since closed. Figure 6 shows the closed paper buy-back centre in Makhanda. Waste pickers cited that this site was instrumental in collecting papers and cardboard; but the site was burnt down and was closed for business. Therefore, paper and cardboard waste pickers had to find new buyers and often had to compete over one centre in town that accepts cardboard and paper.

The limited number of buy-back centres was perceived as limiting the waste pickers' potential to make more waste income because it exacerbated competition between pickers, allowing for lower rates and rejection of materials by the buy-back centre. Pickers of tin cans indicated that due to the

high number of pickers collecting tin cans in town, the buy-back centre sometimes did not take the tin cans because they had enough for the day. Hence, waste pickers they had to get to the buy-back centre earlier than everyone else to sell their waste, but they reported this was sometimes challenging due to the lack of reliable transport to the site. For example, all the waste pickers surveyed in Makhanda rarely used public transport, and those who did only got to the town's central business district for an onward journey to the site on foot. One of the buy-back centres in Port Alfred weighed waste materials on the site, reducing their transport costs but only for paper and cardboard waste.

Figure 2.5: A burnt down buy-back centre in Makhanda Source: Grocotts Mail (2023)

2.4.5 Negative perceptions by the community

Waste pickers were asked if they thought their community understood their work and accepted them as vital members of society. Over half of the respondents (54%) indicated that they felt the community understood their work and cited a good and healthy relationship with the community. These waste pickers suggested that the community understood the type of work that they did and their motivations for their job. The waste pickers indicated that community members welcomed them because they appreciated their efforts to make an honest living. Some waste pickers said some community members collected materials in the street and around their houses on their behalf.

However, other waste pickers (39%) felt the community did not accept them, citing hostile perceptions and abuse towards them. They state that they are often labelled as criminals and drug addicts and are frequently at the receiving end of mistreatment and verbal abuse. Though the waste pickers acknowledged that some of them were involved in crime, they do, however, emphasize that it's not all of them. A small proportion (10%) of waste pickers indicated they did not pay attention and had no interest in understanding how the community perceived them because they felt the community had no impact on their lives or the income they made.

2.5 Waste pickers' perspectives on the future

Notwithstanding the challenges above, a substantial proportion of the waste pickers surveyed (66%) expressed their intention to remain in the profession in the next five years. Notably, more waste pickers in Port Alfred (81%) expressed a desire to remain in the industry than in Makhanda (59%), but the difference was not statistically significant ($Z = 1.221$; $p > 0.05$). Only a few waste pickers (11%), all from Port Alfred, were unsure whether they would be in the industry. Lack of education, criminal records, and the desire to be self-employed were behind the waste picker's decision to stay in the industry. As evident in the statement below, some waste pickers believe that due to their lack of education, waste picking is the only way they can make a living because the formal sector requires high levels of education and skill.

> "I probably will still be here: Grade 10 will not take me anywhere. These days, you cannot even get anything proper with Matric. Imagine me with Grade 10. I always tell these young ones that they need to go to school; otherwise, they are going to end up here and die here like us" (Wate picker, Port Alfred).

A significant majority of the sampled waste pickers (81%) indicated that they would recommend waste picking to someone else, stating that waste picking had allowed them to be independent and provide for their families and themselves. About 19% of all the surveyed waste pickers indicated they would not recommend waste picking to someone else, citing complex challenges, including limited and unreliable income, making it very difficult to make a living.

2.6 Discussion

Relative to larger cities, limited information is available about the economic contributions of recycling to waste pickers in small to medium-sized towns in South Africa. Therefore, this study aimed to fill this knowledge gap by assessing the economic contributions and the challenges of waste picking activities in the small to medium-sized towns of Makhanda and Port Alfred, South Africa. This chapter discusses the findings of the study on waste picking practices, waste picking income and contribution to poverty alleviation, and the challenges encountered by waste pickers across the two towns.

2.6.1 Profile of waste pickers

The findings show that a youthful demographic group practiced waste picking across the two towns, though the waste pickers in Port Alfred were slightly older on average (39 years) than those in Makhanda (32 years). The prevalence of younger waste pickers is consistent with various studies conducted in South African cities like Pretoria and Cape Town that suggest that due to the high youth unemployment rates, young people are forced to seek alternative sources of income including waste picking (Blaaw et al., 2019; Samson, 2019; Uhumamure et al., 2021). Both Makhanda and Port Alfred are in the Eastern Cape province, which has one of the highest youth unemployment figures in South Africa. Thus, it is plausible to suggest that waste picking provides an alternative source of income for survival. Beyond being located in one of the poorest provinces, Atkinson (2008) suggest that compared to bigger cities, small to medium-sized towns have limited access to resources, infrastructure, and economic opportunities which can therefore contribute to the younger populations seeking alternative income sources.

The study also found waste pickers across the two towns to have low education levels, with only 6% of the sample population indicating that they had tertiary level education and less than 50% have achieved secondary and primary school education. Notably, Makhanda showed higher education levels than Port Alfred. This could be attributed to the presence of Rhodes University in Makhanda, which encourages education initiatives and provides better education opportunities in the community. However, this is not an issue in Makhanda and Port Alfred only; waste pickers national education levels are generally low (Schenck et al., 2019; Blaaw et al., 2019). For example,

a study by Blaauw et al. (2019) in Pretoria, South Africa indicated only 1% of the sample population had achieved matric, while only 13% had completed primary school education. The low education levels of waste pickers in small to medium-sized towns are a significant barrier to waste pickers' growth and development because small to medium-sized towns already have limited economic opportunities therefore waste pickers operating in these towns are less likely to find better job opportunities and resources. They are more likely to remain in the informal economy, which is characterized by low wages and dangerous working conditions (Schenck et al., 2019). Furthermore, low education levels pose a major challenge in education initiatives as they limit their ability to comprehend and implement significant training concepts to optimize their operations (Ibelli-Bianco et al., 2022; Schenck & Blaaw, 2011; Sibanda et al., 2023).

The findings also indicated that the sector across the towns is mainly made of newcomers with a considerable proportion of waste pickers in the waste-picking business for less than five years. The relatively short waste collection experience reported in the study suggests that waste picking is a new livelihood strategy amid limited economic opportunities. Other studies conducted in South African cities and towns also share similar findings, reporting higher percentages of newcomers. For example, a study by Mkhize (2014) in Durban found that about 55% of the respondents had less than two years of experience in the waste-picking sector. Uhunamure et al. (2021) also found that a considerable proportion of the waste pickers in Cape Town had one to three years of experience, with only 29% having six or more experience. Viljoen et al. (2016) and Marello (2016) suggest that the increasing unemployment and poverty levels result in many people resorting to waste picking as a means of survival and an accessible fallback in times of financial distress. This highlights that waste picking is pushed by economic necessity and further suggests that waste picking is heavily influenced by challenges of unemployment and poverty.

2.6.2 Type of materials collected

Almost all the surveyed waste pickers in the study collected and sold tin cans to buy-back centers. Respondents indicated they mainly collected tin cans because they were easily accessible and had better exchange rates at buy-back centers. Additionally, tins cans were easy to carry in bulk because after collecting them, they squash them and compact them into black bags ready to be weighed at

the buy-back center. This sentiment is consistent with waste pickers surveyed in studies by Morais et al. (2022) and Kwarteng et al. (2020) who shared that waste pickers were more inclined to collect materials that were easily accessible in the waste stream, whether in illegal dumpsites, streets, or in landfill sites. Mkhize et al. (2014) similarly asserts that waste pickers prefer light materials that can be carried easily. Blaauw et al. (2019) and Marello (2013) emphasizes the importance of the market performance of a material that waste pickers collect, indicating that waste pickers prioritize materials that can be sold at reasonable prices to formal recycling institutions like buy-back centers and recycling manufacturing plants. The findings of this study lend support to research highlighting market demands, accessibility, ease of collection, and transportation as vital factors behind the type of waste materials collected.

Interestingly, despite the tin cans being the most collected and having better prices compared to other materials, they did not have the highest prices at buy-back centres. Waste pickers indicated that the most lucrative materials were red bricks and steel. The exchange rates at buy-back centers of the two materials were almost similar in both towns, with Makhanda having slightly higher rates than Port Alfred. The findings of a study conducted by Viljoen et al. (2012) on South African buy-back centers show similar sentiments that metal, steel, and copper are among the most profitable materials. Prices of Scrapmetals.com (2025) further support this finding, highlighting that steel metals in Johannesburg can range between ZAR 10 (USD 0.5) and ZAR 46 (USD 3) per kilogram, while copper materials can range from ZAR 112 (USD 6) to ZAR 151 (USD 8) per kilogram. In contrast, no studies conducted in South Africa indicate red bricks as lucrative materials to collect, indicating that the market performance of recyclables varies from location to location and is influenced by local buyers and industries (buy-back centers and recycling companies) (Blaauw et al., 2019).

Despite brick and steel materials having better rates, they were hardly accessible and had higher competition levels among waste pickers. Respondents indicated that they hardly came across them in the waste stream, and when they did, they attracted a large number of waste pickers, which usually resulted in conflicts on the site. Such competition among waste pickers is also documented

in a study conducted in Durban by Mkhize et al. (2014), which indicated that over 50% of the respondents cited a rise in competition over the years, resulting in conflicts among waste pickers. WIEGO (2021) suggests that the high competition rates among waste pickers are exacerbated by price fluctuations of recyclables and the dependency of waste pickers on intermediaries such as buy-back centers and recycling plants. In small to medium-sized towns like Makhanda and Port Alfred, the competition among waste pickers is more likely to be exacerbated by the limited volume and variety of waste, which thus calls for waste pickers to seek high-value materials to maximize their earnings. Navarrete-Hernandez (2018) further suggest that due to the lack of organized cooperatives and support structures in the recycling business, intermediaries in small to medium-sized towns can exacerbate competition by offering fluctuating prices and unjust changes in the market of recyclables. Overall, the findings suggest that the competition over lucrative materials is not a localized issue but rather a broader issue in the informal waste sector and calls for significant measures to mitigate competition and foster collaborations among waste pickers to improve the industry's efficiency and profitability.

Landfill sites were the preferred collection points across both towns. The main push factor towards collecting materials in landfill sites was convenience, as the landfill allowed them to gather large quantities of waste in a single location. The municipalities collected waste every week, and all the materials collected landed at the landfill site, which made it easy for them to go through the materials and retrieve recyclable materials swiftly. This sentiment is consistent with Morias et al.'s (2022) findings that waste pickers prefer landfill sites as collection places because they allow them to collect materials in large quantities, facilitating better rates at buy-back centers. In a study by Schenck et al. (2016) in South Africa, the authors similarly highlight that the average income of a significant proportion (85%) of street waste pickers was around ZAR58 (USD 3), which was way below the ZAR404 (USD 22) income reported by landfill waste pickers despite working for the same number of days weekly. Blaauw et al. (2019) also share similar sentiments, highlighting that landfill waste pickers tend to earn more than street waste pickers, arguably because of the higher quantity of waste that landfill waste pickers can retrieve compared to street waste pickers. Another study by Mudavanhu (2019) on South African landfill sites further suggests that waste pickers prefer to work in landfill sites because they have better access to essential services such as water,

toilets, and shelter. This could be the case for the Makhanda and Port Alfred sites because access to both landfill sites was controlled by the municipality. However, direct observations did not show shelter facilities on the site, with most built structures damaged and uninhabitable. This discrepancy aligns with studies (Mlotshwa et al., 2022; Mkhize, 2014; Schenck et al., 2019) that suggest the provision of utilities is inconsistent across controlled landfill sites. Overall, they all stress the need for interventions to improve infrastructure and management practices in controlled landfill sites.

Findings indicated that the work routine of waste pickers in Makhanda and Port Alfred is characterized by long hours. On average, waste pickers across both towns indicated working 8 hours daily. The daily working duration recorded in the study is consistent with other studies conducted in South Africa and other countries. In a study by Chitaka et al. (2022) in Cape Town, South Africa, waste pickers worked an average of 9 hours per day, with most waste pickers working for five days a week. In Sau Paulo, Brazil, Bouvier and Dias (2021) highlighted that both informal and formal waste pickers worked long hours with informal waste pickers averaging between 12 and 14 hours per day while formal waste pickers had fixed working hours that exceed 10 hours per day, especially on peak waste collection time. This study, however, suggests that a considerable proportion of waste pickers (21%) operated during weekends. Respondents working on weekends reported waste collection in the streets, storing the materials over the weekend, and preparing to sell them on Monday when the buy-back centers are open. This suggests that despite waste pickers in small to medium-sized towns working similar hours to waste pickers in larger cities and towns, they do need to apply unique mechanisms to maximize their earnings. Due to their size, waste generation levels are not as high, and thus, waste pickers are required to apply special working practices to access high-value recyclables. This includes working on weekends and diversifying their collection points (Dias, 2016).

2.6.2 Contribution of waste picking to extreme poverty alleviation

The estimated mean weekly and daily income of waste pickers across both towns was ZAR398 (USD22) and ZAR80 (USD4), respectively. The earnings reported in this study were slightly lower than those listed in other studies conducted in South Africa. In a study by Libera (2024) conducted

in Johannesburg, waste pickers reported earning between ZAR300 (USD17) and ZAR600 (USD33) per week. Chitaka et al. (2022) conducted a study among e-waste pickers in Cape Town and reported a mean weekly income of ZAR537 (USD30). Furthermore, Viljoen et al. (2016), in a study conducted in all nine provinces of South Africa, reported an average weekly income of ZAR500 (USD28), with about half of the sampled waste pickers receiving less than ZAR300 (USD17). Schenck et al. (2016) also reported higher figures for landfill waste pickers, reporting a mean weekly income of ZAR435 (USD24). Additionally, Blaauw et al. (2019) also report higher figures, with the mean income per capita of a bad week and a good week ranging from ZAR449 (USD25) to ZAR1142 (USD63), respectively.

Studies by Blaauw et al. (2019) and Yu et al. (2020) suggest that the income of waste pickers is location variable, suggesting that specific locations allow waste pickers to achieve higher income returns than others. The findings of this study support this suggestion as waste pickers in this study earned slightly less than those operating in metropolitan areas. Despite the advantage of small- to medium-sized towns having less saturated waste-picking markets and reduced competition among waste pickers, WIEGO (2021) highlights that bigger cities and towns tend to have better access to markets and support available to waste pickers. Dias (2016) suggests that due to the size of metropolitan areas, they tend to have a higher volume of waste, thus allowing for a broader range of recyclables to be collected and sold. The findings of this study suggest that the opposite occurs in small and medium-sized towns due to limited variety of materials that waste pickers can collect and sell. Furthermore, compared to larger cities, small to medium-sized towns have fewer buy-back centers. This limits the available buyers and can significantly impact the prices of recyclables. Due to the limited buyers, waste pickers lose their bargaining power and are often vulnerable to unfavourable prices and unjust trading systems (Viljoen et al., 2012).

Consistent with studies highlighting limited economic opportunities in small to medium-sized towns (Nhundu, 2017) waste pickers in Makhanda and Port Alfred indicated that they were the primary breadwinners of their households, with 74% of respondents assuming this critical role. The higher percentage of waste pickers assuming breadwinner roles in Makhanda and Port Alfred is consistent with findings of other studies conducted in South Africa and other countries such as

Brazil and India. In a study by Mkhize (2014) in Durban, South Africa, 61% of the respondents indicated they were breadwinners and depended on waste collection income for basic needs. Crivellari et al. (2008) also showed that 70% of the respondents in Sao Paulo, Brazil were sole breadwinners and waste picking as their primary income source. Dias (2014) indicates that over 50% of the waste pickers in various cities in India were primary breadwinners. This indicates that the reliance on waste-picking income for survival among waste pickers is not limited to small to medium-sized towns only but is a global trend affecting waste-picking markets of all sizes. This, however, has proven to be problematic, given the various factors that influence waste collection income. The income can become inconsistent and results in financial insecurity.

Makhanda and Port Alfred waste pickers utilize social grants to alleviate this vulnerability. A sizable proportion of waste pickers in this study indicated that in addition to the waste collection income, they also receive social grants such as child support, disability grants, or old age pensions. These grants provide a reliable and steady source of income, offering much-needed financial stability, especially during months when earnings from waste collection are lower. In a study by Sasaki et al. (2014) in Indonesia, waste pickers also cited similar sentiments, indicating government grants supplemented their monthly income to meet basic needs. Another study by Schenck et al. (2016) in the Free Sate province of South Africa noted that 23.7% and 9.6% of the surveyed landfill and street waste pickers relied on social grants as part of their income strategy. Therefore, it is plausible to conclude that for many households, the combination of waste-picking income and social grants ensures that households meet their basic needs, reducing the risk of falling deeper into poverty.

A common characteristic of waste pickers is that most of them live in extreme poverty, which is induced by various factors, including but not limited to low income, job insecurity, and resource instability (Blaauw et al., 2019; McLean, 2000; Morias et al., 2022). The findings of this study indicated that waste picking in Makhanda and Port Alfred was a substantial buffer against extreme poverty. Income figures indicate that waste pickers' financial situation would deteriorate significantly without waste collection income. The poverty headcount index, which measures the proportion of people living below the poverty line, decreased by about 60% when waste collection

income was considered. Likewise, the poverty gap index, which measures the severity of poverty, increased by about 66% when waste collection income was excluded, suggesting the important role of waste picking income in livelihoods and reducing extreme poverty. The findings of this study are consistent with findings of other studies conducted in South Africa (Blaauw et al., 2019; Schenck et al.,2016), highlighting waste picking as an important tool that could be utilized to provide income opportunities and provide food on the table in many marginalized communities. Overall, the findings indicate that despite the waste collection industry in small to medium-sized towns being smaller than that of big cities and towns, it remains a critical buffer to extreme poverty and can contribute significantly to these towns' broader development and transformation plans.

2.6.3 Factors influencing waste collection income

The findings indicated a strong positive association between the number of days worked and waste collection income. This means that waste pickers who work frequently are more likely to collect and achieve higher waste income than infrequent waste collectors. This finding is logical considering that the surveyed waste pickers that worked on weekends highlighted waste collection during weekends allowed for better income opportunities because there was less competition and easy access to materials, which enabled them to collect larger quantities of recyclables for the week. This is consistent with studies elsewhere in South Africa (Mkhize, 2016; Viljoen et al., 2016; Viljoen et al., 2018), indicating a correlation between frequency of waste collection and waste income. Furthermore, the findings of this study suggest that waste pickers in small- and medium-sized towns must be strategic and consistent to maximize their earnings. Less-dense waste streams are more likely to influence this in small towns than in larger cities and towns.

The positive correlation between the weight of the waste and income means that heavier materials collected have higher returns at buy-back centers. Viljoen et al. (2018) highlight that waste pickers are paid based on the kilograms they pull up on the scaling machines at buy-back centers. Studies by Blaauw et al. (2018) and Makgetla (2022) highlight that heavier materials bring higher income returns. However, it is vital to note that the correlation in this study is relatively weak, indicating that the weight of the materials alone will not always impact waste income collection. Viljoen et al. (2018) and Mkhize (2014) suggest that other crucial factors such as the quality of the materials,

and the type of material collected, can have a significant influence on the overall income that waste pickers can make. Therefore, waste pickers must be supported to ensure that they collect high waste volumes and that the materials they collect have better exchanges at buy-back centers and are of good quality. This support could be through proper training on the strategies to sort high-value materials, the provision and training on the appropriate use of protective materials, and further investments in building storage and shelter facilities.

The initiatives mentioned above underscore the importance of formalizing the sector and integrating waste pickers into the municipal local waste management systems. Initiatives like "Pickitup" are one example how waste pickers can be integrated into formal broader waste management systems. "Pickitup" is a municipal waste management initiative in Johannesburg, tasked with waste collection and disposal (Pikitup Johannesburg SOC Ltd., 2024). The initiative illustrates the development and regional support waste pickers receive when integrated into formal waste systems. The initiative recognizes waste pickers as an integral part of achieving its mandate of waste collection. As a result, they have included waste pickers in their systems and have contributed to supporting waste picking activities by providing protective gear, initiating training initiatives, and providing waste collection resources such as trolleys and bags (Pikitup Johannesburg SOC Ltd., 2024). Initiatives like "Pickitup" in small to medium-sized towns could be instrumental in addressing the already limited earning potential.

Though there were no significant differences in waste income when analyzed by gender, male waste pickers earned 28% more than their female counterparts, which is arguably a substantial difference in marginalized contexts. Income disparity by gender was also noted in studies by Wilson et al. (2022) and Devex (2024) in Johannesburg, South Africa, and Bengaluru, India, respectively. Both studies report that male waste pickers earned up to 22% and 33% more than their female counterparts despite working in the exact location and similar hours. Similarly, Mkhize (2016) in Durban, South Africa, also reported that male waste pickers had higher income turnovers than their female counterparts. These findings suggest that female waste pickers could work for similar hours as their counterparts, but the total materials and income earned might not be equivalent to those of their counterparts. Blaauw et al. (2019) and WIEGO (2021) note that

waste picking requires physical strength to move around and swiftly through waste piles effectively and quickly. Female waste pickers in the study highlighted that male waste pickers had a physical advantage in separating and collecting recyclables in the waste stream. Furthermore, male waste pickers found it easier to jump into trucks as they arrived, thus giving them an advantage in collecting heavier volumes of recyclables and materials with higher exchange rates at buy-back centers. This is corroborated by direct observations across both landfill sites, which showed that men were more likely to collect high-value materials such as red bricks and steel than women, due to their physical abilities to carry them and jump on trucks before they offloaded materials for everyone else to collect.

Compared to larger towns and cities, small to medium-sized towns are more likely to follow conservative and traditional lifestyles (Lueders, 2018). The adoption of traditional lifestyles can further contribute to the income disparity, as studies (Marello, 2013; Mlotshwa et al., 2022) have shown that male waste pickers are more likely to earn more in traditional societies because they are more likely to work longer hours and days due to limited domestic responsibilities compared to their female counterparts. The findings of this study, however, painted a different picture because when working hours were considered by gender, they were relatively similar. This thus suggests that in Port Alfred and Makhanda, the income disparity is not caused by the longer working hours but rather by the quality of the materials that male waste pickers collect. Overall, the findings of this study on gender income disparity underscore the importance of implementing significant support systems tailored to female waste pickers. The findings highlight the need to implement systems that reduce reliance on physical strength for safer and more efficient waste collection activities. This could include the provision of trolleys, carts, and other machines to maximize their collection and sorting techniques. In addition, landfill sites could implement pro-female entrance rules and policies (Wilson et al., 2022). This will allow for reduced competition and ultimately have the potential to improve earnings among female waste pickers. The findings call for gender to be considered a valuable factor when designing waste-picking policies and support systems.

Although statistically insignificant, older waste pickers reported lower incomes than their younger counterparts, consistent with a study by McLean (2000) in Durban that found that younger street waste pickers earned more than older ones. A regression model on income and age in a study by Viljoen et al. (2018) found that for every additional year of age, waste pickers' income could decrease by between ZAR0.21 (USD 0.01) in the lower income quantities and ZAR2.65 (USD0.15) in the higher quantities. McLean (2000) and Viljoen et al. (2018) highlights physical demands influence the negative correlation between age and income for many waste pickers. Naturally, as people age, it becomes more difficult for them to perform intense physical activities. Waste picking is a physically demanding job that requires a lot of walking, bending, and lifting, which can place younger waste pickers at an advantage because their bodies allow them to work frequently and collect heavier materials than older waste pickers. Thus, the finding calls for age to be considered a significant factor in the implementation of support systems for waste pickers. This includes providing resources to reduce the need for physical strength; resources such as ergonomic tools such as lightweight trolleys and mechanical aids could be instrumental in ensuring an inclusive and equitable sector for waste pickers of all ages.

Interestingly, there was a negative but insignificant association between experience and income among waste pickers suggesting that experienced waste pickers did not always earn more than new waste pickers. Blaauw et al. (2019) and WIEGO (2021) highlight that despite their experience, waste pickers are still subjected to external factors outside of their control such as the lack of markets, unfavourable markets, and extreme weather conditions. These factors all have an impact on their potential earnings and affects all waste pickers despite their years of experience.

2.6.4 Waste collection challenges

Storage facilities are paramount to the operations of informal waste pickers because they allow for an easy collection of materials in larger quantities and protection against theft or any other risks post-collection and sorting. The findings of this study indicated that storage facilities across the two towns were limited, and the available few were not in a good condition to be utilized. Similarly, a study conducted by Mkhize (2014) in Durban, South Africa also revealed the lack of storage space for gathering and organizing waste materials, for more than 60% of waste pickers sampled

in the study. Unlike waste pickers in Port Alfred and Makhanda, those in Durban also faced frequent theft of materials due to the lack of secure storage. This also aligns with the findings of Chan et al. (2024), where a considerable proportion of the respondents highlighted challenges related to storage insufficiency and theft incidences. Interestingly, studies conducted in larger cities show a strong association with storage insufficiency with theft, which is different from what was noted in the study sites. This could largely be attributed to the fact that the informal waste sector is much smaller in small to medium-sized towns than in large towns and cities (Wilson et al., 2006). However, despite the differences, all waste pickers, including those in this study, agreed that storage affected their profit negatively and in turn, their livelihoods. There is an urgent need to improve the infrastructure in the informal waste sector, including secure storage and overall improved working conditions for waste pickers.

Buy-back centres are the cornerstone of the economic cycle of the informal waste sector (Roth, 2023; Viljoen et al,2012). They play an instrumental role in the industry because they facilitate the remuneration of waste pickers and the movement of recyclables along the recycling chain. The findings indicate a shortage of buy-back centers, which means that waste pickers have limited buyers and choices in the face of unattractive prices. Further, the lack of sufficient buy-back centres means that waste pickers' waste might not be collected and processed in time for payment purposes. The delays in payment have serious negative impacts on waste pickers' livelihoods, which are already vulnerable. There were reports of collected, and sorted waste materials that never weighted and, in some instances had to be discarded or burnt. The lack of buy-back centers or buyers is not an issue for places with smaller recycling markets only such as in the study towns but has also been reported in bigger cities and metropolitans.

This challenge is corroborated by studies elsewhere. For example, Mkhize (2014) show that about most waste pickers in Durban, South Africa cited availability of buyers as a key challenge, indicating that they often walked for long distances to the nearest buy-back center. WIEGO (2024) highlights the same issue in Brazil, highlighting that waste pickers that collected low-value materials were most likely to face problems related to the availability of buyers, which in turn, limited their earning potential. The lack of buy-back centres can result in completion among waste

pickers which collectively reduce their bargaining power to fetch better prices for waste. Strengthening the sector requires significant measures to enhance the network of buyers and improve the infrastructure, mainly the development and revitalization of buy-back centers. Overall, the findings highlight the vital role that buy-back centers play in the lives of waste pickers and calls for a strong focus on developing and expanding a network of buyers in the Makhanda and Port Alfred informal waste economy.

2.7 Conclusions

This study examined the role of waste picking on the livelihoods of waste pickers in two small to medium-sized towns in South Africa. The findings indicate that waste picking is significantly driven by economic necessity. Though the income reported here is lower than those reported in bigger cities and towns of South Africa, waste collection income plays a significant role in the livelihoods of waste pickers, as seen it its role in poverty incidence and depth reduction. Considering the waste pickers' dependence on waste picking income, addressing the constraints encountered by waste pickers such as storage, access to protective equipment, transport, lack of buyers and fluctuating prices could improve their incomes, and livelihoods. Another consideration is that the differentiated waste picking income should be factored in local municipalities' recycling efforts. In particular, female waste pickers should be supported to reduce the particular challenges they encounter in waste picking activities. In a nutshell, we argue as others have (Chitaka et al., 2022; Dias & Samson, 2016; Littlewood et al., 2022; Singh et al., 2023; Yu et al., 2020) that waste picking presents an income opportunity for vulnerable members of towns and cities. Therefore, local municipalities should factor in support for this demographic group as this contributes to broader transformation and social justice imperatives. Careful planning might mean that the recyclable waste that often finds its way to the landfill sites, will be reduced through waste picking, and in turn, reduce the costs incurred by municipalities in transporting waste. Thus, we argue that recycling efforts and waste picking present a 'low-hanging fruit' for advancing broader transformation and development efforts of small to medium-sized towns.

CHAPTER 3: PERCEIVED BARRIERS TO HOUSEHOLD-LEVEL RECYCLING IN MAKHANDA AND PORT ALFRED, SOUTH AFRICA

3.1 Introduction

In many developing countries, the largest source of municipal waste comes from private households (Datta, 2022; Kumar, 2016; Smith, 2020). Households are considered as the first point of waste generation, therefore making them crucial in the composition and volume of the waste that enters various waste management systems across the globe (Delgado et al., 2019; Deshpande et al., 2024, 2020; Smith, 2020, Zhang et al., 2024). In South Africa, the National Waste Management Strategy report (2020) highlighted that in 2017, private households produced about 12.7 million tonnes of waste. Out of 12.7 million tonnes, about 3.67 million tonnes of that waste were not collected and treated through formal systems and ultimately ended up in landfill sites and illegal dumps. Given households' impact on increasing waste production and improper waste management activities, South Africa has set out specific waste management goals to reduce illegal waste disposal and landfilling (Department of Forestry, Fisheries and the Environment, 2020). One of these goals includes prioritizing recycling activities at the household level.

Recycling rates in South Africa are low, with only 10% of municipal waste recycled (Siwawa, 2024). The latest data show that household recycling participation levels in the country are even lower, with only 4% of South African households indicating they recycled their waste in 2010 and 7.2% in 2017 (Strydom, 2018). Through the National Waste Management Strategy (NWMS), the country aims to divert 40% of waste from landfills by 2025, 55% by 2030, and 70% by 2035 by prioritizing waste reduction initiatives, including reuse, recycling and recovery. These targets are all centered around waste minimization and ensuring that limited waste reaches landfills and illegal disposal sites. Unfortunately, there has been limited information on the progress of these targets, with available information suggesting recycling targets have not been achieved (Schoeman & Rampedi, 2022; Strydom, 2018). The low level of participation in recycling has been attributed to several barriers.

The literature defines recycling barriers as factors preventing individuals, households, or communities from participating in recycling activities (Jessen & Stone, 2009; Roy et al., 2023; Strydom, 2018). Oluwadipe et al. (2022) highlights that these factors are varied, including social, physical, community engagement, human, economic, and policy constraints. Timlett and Williams (2008) grouped recycling barriers into infrastructural, services, and behavioral (ISB) factors. Infrastructural factors primarily speak to the accessibility and availability of recycling facilities, which include waste disposal and sorting bins, buy-back centers, recycling plants, recycling bags, and other vital recycling resources. Services refer to how waste is collected and the procedures followed in processing that waste, while behavioral refers to factors of people's habits, attitudes, and willingness to recycle. The authors suggest that people first need access to the necessary equipment and facilities to store, clean, and sort their recyclables for positive recycling outcomes. Further, they should also have their waste materials consistently collected and processed. Additionally, they should have positive attitudes and perceptions towards recycling and express a desire to recycle their materials (Timlett & Williams, 2008).

Similarly, other studies categorize recycling barriers into infrastructural, knowledge, and attitudinal & behavioral barriers (Barr, 2007; Conke, 2008; Kattou et al., 2019; McDonald & Oates, 2003). These studies highlight that recycling participation is influenced by internal factors (what people understand and feel about recycling) and external factors (the availability of recycling resources). In a nutshell, these studies broadly categorize recycling barriers into situational (availability and accessibility to recycling facilities), knowledge related (awareness of practical and theoretical concepts of recycling), and psychological barriers (attitudes, beliefs, social norms, and behavioral patterns to recycling). Although categorizing recycling barriers has been criticized for being too simplistic, overly broad, and having poorly defined abstractions (Oluwadipe et al., 2022), it remains useful in explaining the various types of barriers and their interlink. Overall, studies (Jessen et al., 2004; Oluwadipe et al., 2022) suggest that grouping recycling barriers make it easy to organize diverse and complicated data across different regions and time periods, which is instrumental for researchers to compare findings and provide recommendations. Given this background, the study will categorize recycling barriers into similar categories as the one mentioned above.

3.2 Situational barriers

Situational barriers are physical barriers centered around individual's surroundings and location (Conke, 2018). These challenges include the lack of availability and accessibility of crucial recycling resources and services such as waste collection services, waste disposal bins, sorting bins, recycling centers, and insufficient recycling space and storage. Recycling is a physical process that requires physical activities such as waste cleaning, sorting, and sometimes shredding. Therefore, some studies (e.g., DuTiot and Wagner, 2020; Yakob et al., 2020) highlight access to physical recycling resources and facilities as a vital component in encouraging recycling participation. Timlett and Williams (2008) highlight that in many places that do not have sufficient recycling resources, people tend not to be motivated to recycle. Similarly, in a study conducted by Schoeman and Rampedi (2022) in Johannesburg, South Africa, over 60% of the respondents did not recycle, with a significant proportion of them citing a lack of access to waste disposal and sorting bins. Similarly, in a study across various provinces in South Africa, Haywood (2021) found that a substantial of respondents did not recycle, citing lack of access to waste disposal bins and other vital recycling facilities as a limiting factor to their recycling activities.

South Africa aims to have at least 50% of all households in metropolitan municipalities sorting their waste at home by 2030 (Department of Forestry, Fisheries and the Environment, 2020). However, the resources needed to facilitate this shift have been limited (Mokoena, 2020). Studies (CSIR, 2021; Haywood, 2021; Kubanza, 2024) conducted in South Africa highlight that access to household waste sorting bins is a significant barrier to achieving the waste separation at source targets. Elsewhere beyond South Africa, Donacho et al. (2023) noted that only about 21% of households in Eastern Ethiopia separated at source due to the lack of availability and access to waste sorting bins. In a review of poor solid waste management on health in developing countries, Ziraba et al. (2016) similarly noted that insufficient access to household waste disposal and sorting bins was a common barrier to recycling initiatives, citing that less than 30% of urban waste was collected and disposed of correctly.

Inconsistent waste collection is also a common challenge for South African households (Strydom, 2018). Recycling rates in South Africa are hugely impacted by ineffective waste collection systems (Dlamini et al., 2017; Haywood, 2021). Proper and efficient recycling activities depend on the availability of recyclables. Therefore, proper waste collection systems ensure recycling facilities have enough recyclables to process. Furthermore, Rodzi et al. (2023) and Richard (2024) note that inconsistent waste collection impacts recycling participation because it disrupts recycling habits which impacts the ability of households to participate in recycling activities consistently. The authors suggest that in many cases where waste is collected inconsistently, people resort to burning or dumping their waste due to limited available space in their residential homes to store the accumulated waste. Kwakye et al. (2023) further suggest that if waste is not collected on time, chances of recyclables being contaminated by non-recyclables are quite high because, in most cases, they are stored close to each other. Overall, all the studies mentioned above suggest that waste collection is crucial for recycling activities because when waste is not collected, people are more likely to lose trust in the system because despite their materials being separated and cleaned, they still end up in landfill sites anyway.

Other situational barriers relate to the lack of recycling space, distance to recycling facilities, and internal storage space. The collection and sorting of recyclable materials require space. Diaz Meneses and Vikaite (2020) suggest that space availability makes recycling convenient, which is instrumental in encouraging and improving willingness to recycle. The authors suggest that a person could have the intention and the willingness to recycle but be constrained by internal and external space. Du Toit and Wagner (2020) use this understanding to explain why people who own houses recycle more than those in rented and shared apartments. It is also argued that people who live in apartments tend to have limited space, which limits their ability to recycle compared to people who own houses (Du Toit and Wagner, 2020). House owners usually have a lot of available space and additionally do not share these spaces with anyone. People in rented apartments usually share spaces which can be a limitation because, naturally, people have different views and priorities, and therefore, recycling activities can bring about inconvenience and discomfort to others (Du Toit and Wagner, 2020; McDonald and Oates, 2018).

The availability of recycling resources is vital; however, it is vital to note that the accessibility of these resources is also just as vital. Li et al. (2020) note that waste sorting bins and recycling centers could be available in an area, but if they are located far from people, their functionality becomes restricted. In a study in Nanjing, China, Li et al. (2020) noted that households located further away from recycling centers and bins were less likely to participate in recycling activities than those who lived close by. In a South African study, Strydom (2018), found similar patterns, noting that long distances between recycling facilities and households tend to discourage participation. Similarly, Oluwadipe (2022) suggests that if the distance between people and recycling resources is long, it makes recycling inconvenient and creates a significant barrier in adopting consistent recycling practices into people's daily lives. Overall, Timlett and Williams (2008) argue that the lack of recycling resources and facilities contributes significantly to making recycling an inconvenient and tedious activity, which ultimately brings about discouragement and unwillingness among households. Overall, studies (Du Toit & Wagner, 2020; McDonald & Oates, 2018; Oluwadipe, 2022; Strydom, 2018) suggest that the provision of recycling facilities and resources is a significant step in improving recycling participation levels and should be prioritized by waste management authorities to achieve the set national waste minimization targets.

3.3 Knowledge barriers

Knowledge barriers stem from a lack of theoretical and practical recycling knowledge (Conke, 2018; Strydom, 2018). Theoretical knowledge barriers are centered around the lack of understanding and comprehension of recycling and broader waste management issues. For example, a South African study Fadhullah et al. (2020) found that about 96% of the respondents could not define improper waste management and indicated being unaware of the implications of improper waste management on the environment and human lives. McDonald and Oates (2018) suggest that the lack of waste management knowledge can impact recycling participation because it can influence people's willingness to be proactive. If people do not understand waste management challenges, then they are less likely to implement solutions like recycling because they do not see nor understand the problem in the first place (Johansson, 2016; Wu et al., 2022).

Additionally, Mmereki et al. (2016) suggests that developed nations tend to have higher recycling rates because their awareness campaigns are primarily technical, focused mainly on raising awareness about waste sorting techniques and providing clear instructions on what can be recycled and how it can be recycled. On the other hand, studies by Mensah (2020) and Debrah et al. (2021) suggest that awareness initiatives in developing countries tend to prioritize sanitation and adopt a more theoretical approach. While theoretical understanding of recycling and waste management is important to spark interest and engagement, the lack of practical knowledge can constrain long term positive recycling behavior (McDonald & Oates, 2018). People could recognize the benefits of recycling and understand what non-participation can do to their lives and the environment but if they are not equipped with clear practical instructions and steps to store, clean, and sort their recyclables recycling uptake levels will remain low.

3.4 Attitudinal & behavioral barriers

Attitudinal barriers are rooted in perceptions, beliefs, and narratives surrounding recycling. Various studies (e.g., Abd'Razack et al., 2016; Kurz et al., 2007; Tucker, 1999) have identified that positive recycling attitudes can influence participation. Similarly, a study by Mmereki et al. (2016) further emphasizes that one of the significant differentiating factors between nations that recycle and those who do not recycle is their attitude, highlighting that people who recycle tend to have positive and welcoming attitudes toward recycling and tend to successfully incorporate recycling into their everyday routines, often as a social norm. For example, in Finland, recycling is deeply integrated into social practices, with families starting to practice recycling habits at a very young age, including reprimanding friends and families that do not adhere to the stipulated recycling procedures such as waste sorting and separation protocols (Reijonen et al., 2021; Czajkowski et al., 2014). These social and cultural norms become instrumental in building and sustaining the willingness and the ability to recycle (Reijonen et al., 2021). Similarly, Tucker et al. (2001) also found that social and cultural norms have a significant role in shaping recycling behaviour in Scotland. Overall, the above-mentioned studies indicate that attitudes play a vital role in enabling or constraining recycling participation.

However, it is crucial to note that even though data show that positive recycling attitudes bring out positive recycling participation, some studies indicate that positive attitudes do not always bring about positive recycling behavior (Pearson et al., 2012; Strydom, 2012). This is attributed to a significant intention-action gap, meaning that despite positive recycling attitudes, the actual recycling rates can still be very low. A study by Wilcox (2014) notes that despite positive attitudes, some respondents did not recycle at all due to factors related to convenience and recycling space. Similarly, Roy et al. (2017) note that most of the respondents in their study thought recycling plastics was vital and needed for the community recycling but lack of access to recycling facilities and awareness constrained their ability to translate their desire into action. Schoeman and Rampedi (2021), also note that over 70% of respondents in Johannesburg, South Africa highlighted recycling as valuable and needed. However, their participation was constrained by time, space, and their knowledge of how to recycle. Strydom (2018), also in South Africa, highlights that recycling attitudes across the country are generally positive, but the actual participation is hindered by a lack of awareness, inconvenience, and insufficient infrastructure. Overall, the findings of the above-mentioned studies indicate that despite positive recycling attitudes being vital in encouraging recycling participation, they are less likely to translate into action if they are not complemented with adequate knowledge and resources. Overall, it can be argued that recycling barriers are interconnected and thus should be addressed simultaneously rather than individually.

Understanding barriers to recycling, especially in developing countries, is a crucial aspect of developing and improving recycling uptake levels. Studies including that of Abubakar et al. (2022), Debrah (2018) and Strydom (2018) suggest that Global South needs more literature that produces empirical evidence to highlight the various issues that result in low recycling uptake levels. Conke (2018) suggests that before solutions are designed for improving recycling activities, proper assessments of the various constraints are necessary. It is for that reason rigorous studies of the various issues constraining the recycling sector in different countries are imperative for evidence-based decision-making in the waste management sector that could in turn steer countries towards achieving their respective environmental targets. Recycling barriers vary from place to place (Dlamini et al., 2017; Rodzi et al., 2023; Strydom, 2018) hence a diverse range of studies must be conducted in various areas of varying sizes to provide empirical evidence in different parts

of the world, covering diverse scales including in big cities, medium-sized towns, small towns, and rural communities.

In South Africa, recycling participation levels are still very low and below set targets. The number of empirical studies conducted on recycling barriers in South Africa is minimal, especially in small to medium-sized towns. Small to medium-sized towns have distinctive socio-demographic attributes, waste management systems, and social norms and standards compared to bigger cities and towns. Therefore, studies must be conducted in different towns of varying sizes to establish the varied recycling constraints in different communities across the country. Given this background, the main aim of this study was to assess the perceived barriers to recycling among households in two medium-sized towns of Makhanda and Port Alfred in the Eastern Cape province of South Africa. The key question of the study was: What are the perceived situational, knowledge, and attitudinal barriers in Makhanda and Port Alfred?

3.5 Methods and materials

3.5.1 Sampling and data collection

Data collection occurred in Makhanda and Port Alfred between April and July 2024. The study used structured questionnaires with a combination of closed-ended quantitative and open-ended qualitative questions. A randomized GIS approach was employed to select 120 households in Makhanda and 121 in Port Alfred for the surveys. The randomization process involved the identification of homesteads in the selected towns using Google Maps. The homesteads were allocated numbers, and a simple selection of target households was conducted using the RANDBETWEEN (1,2) function in Microsoft Excel. The randomly selected households were then identified for the surveys in the field. If the randomly selected household was unavailable, the next available household was approached for the survey. Once the households were selected, the researcher and the research assistant visited the households with informed consent and asked the household head for their participation. If not available, the eldest member of the household was asked to participate. Each survey took between 40 minutes and an hour to complete. All the

questionnaires were printed in IsiXhosa and English, and verbal translations from English to IsiXhosa when necessary were done with the assistance of the research assistant.

The first section of the questionnaire was designed to capture the socio-demographic profile of the respondents including age, gender, household size, education level, social grants status, employment, household size, number of dependents, and income sources. The second section of the questionnaire captured responses related to access to waste management resources, recycling knowledge, recycling attitudes and perceptions, and the overall constraints encountered by households in recycling. The design of the questionnaire survey drew on previous studies. Specifically, the study adopted Barr's (2007) method of categorizing questions into situational, knowledge, and psychological barriers. Furthermore, the study adopted the design by McDonald & Oates (2003) and Kaciak & Kushner (2009) of including open-ended questions to gain detailed insight into the various constraints mentioned by respondents. The study further applied Strydom's (2018) method of including Likert scales and presenting questions that require respondents to pick answers that mostly resonate with their reality and circumstances. Ethical approval for this project was granted by the Rhodes University Ethics Committee (Review Reference No 2023-7532-8258).

3.5.2 Data analysis

The data were analyzed using STATISTICA (Version 13). Socio-demographic data were summarized in tables to provide an overview of the profile of the waste respondents in both towns. Chi-square tests were used to check for association between recycling participation and socio-demographic factors, access to waste management resources, and recycling knowledge factors. Mann-Whitney U tests were performed to check if there were statistically significant differences in some socio-demographic factors with recycling participation, specifically for continuous variables such as income and age. The qualitative responses particularly on knowledge and attitudinal barriers were transcribed and analyzed through thematic analysis. This analysis followed the six-phase framework of Braun and Clarke (2006). The first step included reading and carefully examining all the responses to become familiar with the dataset. Occurring keywords that speak to research aims and objectives were then noted and highlighted in the dataset to identify potential themes. The next step then involved grouping similar keywords into themes. The

following step involved reviewing and refining themes, ensuring that the identified themes were accurate, and eliminating those not fully sustained by the data. Lastly, all the themes were named and defined according to the key concepts and ideas behind the themes. Direct quotes were used to support claims and provide social contours to the findings.

3.5.3 Limitations of the study

The study's reliance on self-reported recycling behavior presents a potential social desirability bias. Nikolopoulou (2022) explains this type of response bias as one that arises when respondents provide socially acceptable answers which might not be in line with their genuine opinions, experiences and practices. In recycling studies, respondents might overstate their recycling activities and provide answers that will paint them as socially responsible people (Vesely and Klockner, 2020). Therefore, the findings should be considered with caution.

3.6 Results

3.6.1 The socio-demographic profile of the respondents

Table 3.1 summarizes the socio-demographic characteristics of respondents. Out of the sample population (n=241), there was a significant difference in gender distribution of the respondents between the two towns, with Makhanda having a higher proportion of males (72%) and Port Alfred having a higher proportion of females (63%) ($\chi 2$ =5.742, p = 0.219). The average age of respondents was significantly higher in Port Alfred (43±16) than in Makhanda (32±13) (Z = -5.62, $p < 0.001$). The level of education across both towns was generally high, but Makhanda had higher education levels than Port Alfred ($\chi 2$=57.67, $p < 0.001$). More than half (52%) of the respondents in Makhanda indicated having some university-level education but more respondents in Port Alfred (75%) had some secondary school education than Makhanda (42%). Fewer respondents in Makhanda (5%) and Port Alfred (13%) had primary school education only.

Table 3.1: Socio-demographics of the respondents

Attribute	Makhanda (n=120)	Port Alfred (n=121)	Total sample (n=241)
Gender (%)			
Male	72	37	32
Female	27	63	67
Prefer not to say	1	0	1
Age (Mean ± SD)	32±13	43±16	38±15
Race (%)			
African	95	76	85
Coloured	4	24	14
White	1	0	1
Employment status (%)			
Employed	36	26	31
Unemployed	25	56	41
Student	35	7	21
Self-Employed	0	2	1
Retired	4	9	6
Marital status (%)			
Single	92	65	78
Married	4	28	16
Divorced	3	1	3
Widow	1	6	3
Level of education (%)			
No education	1	5	3
Primary education	5	13	10
Secondary education	42	75	58
University education	52	7	29
Length of stay Mean ± SD	20±16	33±18	27±18
Mean net monthly income (ZAR)	3028 ± 4646	1953 ± 3674	2488 ± 4212

Most of the respondents in Makhanda (95%) and Port Alfred (76%) were African, but Port Alfred had a statistically significantly higher proportion of Coloured respondents (24%) than Makhanda (4%) ($\chi 2 = 20.29$, $p < 0.001$). Nearly half of the sample population was unemployed (41%), but comparisons between the two towns show that Port Alfred had significantly more unemployed respondents (52%) than Makhanda (25%) ($\chi 2 = 43.71$, $p < 0.001$). The average duration of residency across both towns was generally high (27±18), but Port Alfred had a significantly longer

duration of residency (33±18) compared to Makhanda (20±16) ($Z = -5.36$, $p < 0.001$). The average monthly income across both towns was ZAR2488±4211 (USD134). Makhanda respondents reported higher mean monthly incomes (ZAR3028 ± 4646) (USD167) than Port Alfred respondents (ZAR1953 ± 3674) (USD107), but the difference was statistically insignificant ($Z = 0.49$, $p = 0.622$). Port Alfred had a slightly higher number of respondents (49%) earning below the food poverty line (ZAR760 per month) (USD42) compared to Makhanda (42%).

3.6.2 Recycling participation

The results show that recycling participation was low in Port Alfred and Makhanda, with only 8% of the households participating in recycling activities. Most households that indicated to recycle dropped their recyclables to a private recycling company or repurposed materials instead of throwing them as trash (Figure 3.1a and 3.1b). Relatively more households in Port Alfred (94%) than in Makhanda (76%) did not recycle but the difference was insignificant ($\chi2 = 16.021$, $p = 0.063$). All the non-recycling households said they needed support to recycle.

An examination of recycling participation rates by gender shows that females (58%) reported greater involvement in recycling than males (42%) in both towns, but the difference was not statistically significant (Table 3.2). Respondents with university education (50%) and secondary education (47%) demonstrated significantly higher recycling participation compared to those with primary school education (1%). In terms of employment, unemployment (33%) and students (36%) reported the highest level of recycling participation, while employed (25%), self-employed (3%), and retired (3%) respondents were less engaged. Additionally, when examined by race, African respondents (85%) reported greater involvement in recycling, compared to Coloured (15%) and White respondents (5%). Chi-square tests showed that education, employment status, and race were significantly associated with recycling participation, while marital status and gender showed no significant associations (Table 3.2). A Spearman correlation test showed that income ($rho = -0.146$; $p = 0.024$) and age ($rho = -0.141$; $p = 0.029$) were weakly and negatively associated with recycling participation, suggesting that households with high income levels and younger members were less likely to recycle.

Figure 3.1: Figure 3.1a and 3.1b: Recycled materials by Makhanda and Port Alfred respondents

Source: Researcher (2024)

Table 3.2: Association between recycling participation and socio-demographic variables

Socio-demographic variable	**χ2 value**	***p*-value**
Gender	2.072	0.722
Education	10.065	0.018*
Marital status	7.421	0.060
Employment status	14.947	0.011*
Race	6.011	0.050*

*Denotes statistically significant difference

3.6.3 Perceived barriers to recycling in Makhanda and Port Alfred

Access to waste management resources in Makhanda and Port Alfred

The accessibility and availability of waste management resources are vital in conducting and maintaining effective recycling initiatives. Respondents in each town were asked about the

accessibility and availability of resources, mainly waste collection services, refuse bags, sufficient disposal bins, buy-back centers, and waste sorting bins. Waste collection services were consistent across both towns, with 83% of the respondents indicating that waste was collected by the local municipality once a week, However, significantly more respondents in Port Alfred (94%) than in Makhanda (70%) reported consistent waste collection (χ^2 =31.40, p<0.001). Even though waste was consistently collected weekly, almost all the respondents (90%) across the sample indicated that they did not have refuse bags to place their waste and recyclables. Respondents across both towns indicated that the municipality used to provide them with free refuse bags a few years ago but this practice has stopped, with households now having to buy own bags at a retail price of about ZAR40 – 50 (USD2 -3) per pack. Access to disposal bins was also limited across the towns, as only 23% of the sample population reported access. The respondents also indicated that the overall number of bins available in the town is insufficient to support the amount of waste produced. They indicated that most disposal bins were in the central business district, with very few in the town's township and outskirts, . This is reflected in this statement by a respondent in Port Alfred:

> "Stone Hill does not have the same bins as town. In town, every corner has a bin, but here you hardly see any bin on the street. You will see that not even one house here has a bin; those who have them bought them themselves." (Respondent, Port Alfred)

Access to waste sorting bins was also limited across the two towns, with 86% of the sample population indicating they did not have access to them. Port Alfred had significantly more respondents (87%) citing no access than Makhanda (69%) (χ^2 = 19.02, p < 0.001). Makhanda respondents stated that waste sorting bins were only available to high-income areas and well-off parts of the town, as indicated in the statement below by one of the respondents. Port Alfred respondents shared a similar sentiment: Only the CBD and affluent parts of town can access waste sorting bins.

> "The only time I have seen the bins with different colours is at St Andrews and all these other private schools you find in town. Where I am (Joza Extension 10), you will never see anything like that; you hardly even see a normal bin". (Makhanda, respondent)

The provision of waste management services and resources to South African citizens is the responsibility of local municipalities, as outlined by the National Environmental Management: Waste Amendment Act 26 of 2014. The respondents were asked if they were satisfied with how their respective municipalities overseen waste management and recycling activities. A considerable proportion (62%) of the sample population indicated dissatisfaction with the municipality's performance in providing waste management and recycling resources. As evident in the statement below from a Port Alfred respondent, despite the municipalities providing consistent waste collection services, efficient waste sorting and single waste stream prevention measures are not as active.

> "The municipality five years ago gave us those two bins you see there, one green and one yellow. The yellow is for regular waste disposal, while the green is for collecting recyclable materials. When the trucks come on Monday, the drivers will mix the waste and recyclable materials into the same truck. (Port Alfred, respondent)

Other reasons for the dissatisfaction ranged from lacking waste management resources, poor recycling awareness initiatives, and dysfunctional infrastructure.

Recycling knowledge in Makhanda and Port Alfred

The results indicated a limited understanding of recycling across the two towns. Respondents were asked about their understanding of the term "recycling," ranging from no knowledge to advanced; over half (76%) indicated that their understanding was basic, with 17% reporting a moderate understanding and only 7% claiming to have an advanced understanding. As evident in the statement below from a Makhanda respondent, basic understanding means respondents have a general idea of recycling and understand its importance but do not know the steps to be followed to recycle. Respondents with moderate understanding stated that their understanding was enough for them to participate in recycling initiatives. However, they also recognized that there is still much to be educated about. The respondents with advanced understanding highlighted an in-depth understanding of recycling and waste management concepts.

> "I understand what recycling is because they talk about it at work, but if you came here and asked me to recycle my stuff, I would not know what I am doing; it would be difficult." (Makhanda, respondent)

About 31% of respondents indicated having an issue in understanding how to sort waste, citing difficulties in understanding what materials are recyclable and what the assorted colors mean in waste sorting bins. As evident in the following statement from a Port Alfred respondent, the lack of education and the use of English in recycling tools constrain understanding of waste sorting and appropriate waste disposal. Other respondents indicated that it goes beyond not understanding how to dispose of and sort their waste, highlighting that they did not understand the purpose of recycling and its impacts. They stated that they did not understand what happened to that material once it was separated at home and collected by a recycling company. There is a general lack of understanding of the entire life cycle of the recycling process.

> "I can barely read what is written on those bins. I do not know what goes where and what the different colours mean. They need to write it in IsiXhosa and come and show old people like us how they work and what we need to do" (Port Alfred respondent)

The findings reveal that recycling awareness initiatives were limited in both towns, with only 9% of the sampled population reporting participation in education or awareness programs related to recycling. When comparing the two towns, Makhanda had a slightly higher percentage (12%) of respondents participating in awareness initiatives compared to Port Alfred (5%), but the difference was not significant (χ^2 =1.101, p = 0.577). Makhanda respondents indicated that the Makana municipality facilitated the awareness initiatives, while all Port Alfred respondents indicated that the Buffalo metro municipality conducted the initiatives before they moved to Port Alfred. They detailed that the sessions taught them about recycling and the various waste management concepts, including appropriate waste disposal methods and sorting techniques. About 20% of the respondents indicated they had attended four sessions, while the remaining 80% indicated they had attended one. Interestingly, however, despite 91% of the sample population indicating that they have never attended any recycling awareness initiative, a significant proportion of

respondents (78%) indicated willingness to participate in a recycling awareness initiative should they be afforded an opportunity to participate. A chi-squared analysis showed that only the level of recycling knowledge yielded a statistically significant association with recycling participation (χ^2 =25.118; p = 0.015).

Table 3.3 Perceived vital factors to be considered to improve recycling awareness initiatives in Makhanda and Port Alfred

Perceived vital factors to be considered to improve recycling awareness initiatives	**Proportion (%) of respondents**
Identify and fill knowledge gaps ✓ Highlight the benefits of recycling ✓ Provide practical knowledge on recycling procedures – Waste disposal and waste sorting	34
Provision of waste management resources ✓ Bring disposal bins and waste sorting bins ✓ Bring plastics for people to place their waste	25
Make them consistent and often ✓ Awareness sessions should be conducted frequently	22
Offer incentives to those who participate ✓ Provide food vouchers to those who attend the awareness sessions ✓ Financially compensate those who attend	11
Languages and learning styles ✓ Conduct awareness sessions in local Indigenous languages ✓ Accommodate various learning styles; text and diagrams to be utilized	7

Given the limited recycling initiatives across both towns, respondents were asked about their opinions about critical factors for successful and efficient recycling awareness initiatives within their communities. Table 3.3 provides a summary of the factors mentioned. About 34% of the respondents would like awareness sessions to address recycling knowledge gaps; they would like to know more about the benefits of recycling and to further understand essential recycling procedures such as appropriate waste disposal and sorting. A further 25% indicated that waste management resources such as bins and plastics were paramount in accompanying recycling awareness initiatives. As evident in the statement below from a Makhanda respondent, the provision of waste sorting bins, plastics, gloves, and other vital materials would encourage respondents to learn about recycling and holistically encourage pro-active recycling behavior. The

remaining respondents listed various factors, including consistency, using indigenous languages, and providing incentives to those who are actively participating in the initiatives.

> "They should come with the bins and plastics for us to come back and recycle at home. We need to see what we are learning about " (Makhanda, respondent)

Recycling attitudes in Makhanda and Port Alfred

The respondents were asked questions to assess their attitudes towards recycling on a 5 Likert scale ranging from strongly agree (5) to strongly disagree (1). Overall, the results indicated that attitudes in Makhanda and Port Alfred were generally positive towards recycling; however, provided the limited understanding of recycling highlighted across both towns, the findings suggest that the scores provided are generally drawn from general narratives and social cues rather than detailed personal experiences and functional knowledge. Table 3.4 summarizes the various observed variables' mean and standard deviation scores

Table 3.4: Recycling attitudes in Port Alfred and Makhanda

Attitudes of recycling in Makhanda and Port Alfred	**Mean±SD**
When buying new products, I consider recycling	2.3 ±1.5
My friends and family encourage me to recycle	2.5 ±1.6
I would recycle more if there were incentives provided	4.4 ±1.1
Recycling is easy, and everyone can do it	3.7 ±1.3
Recycling has had a positive impact on my life	3.2 ±1.0
Recycling creates employment opportunities	4.3±0.1
People should sort their waste before the municipality collects it	4.2 ±1.1
Everyone should recycle	4.6 ±1.1
I am worried about the level of recycling in the town	3.8 ±1.1
I am worried that when people throw away materials, they can recycle	4.3±0.1
I am worried when people dispose their waste incorrectly	4.4 ±0.8

Recycling is vital in reducing illegal dumpsites	4.5 ±0.7
Recycling is vital in reducing pollution	4.5 ±0.8

Despite the sample population indicating having a limited or generic understanding of recycling, about 83% of the sample population agreed that everyone should recycle, and about 80% agreed that everyone should sort their waste before it is collected by the municipal trucks on collection days. This primarily refers to separating non-recyclables from recyclable materials to prevent a single waste stream. The results further indicate that people are aware of recycling low participation levels in their towns, as 72% of the respondents expressed that they were concerned about the level of recycling in the town. They indicated that they believe more can be done to improve recycling participation levels and that the town recycling initiatives could yield significant results if implemented effectively. Interestingly, while most of respondents indicated recycling to be a priority, over half of them (58%) indicated that recycling has a limited impact on their purchasing decisions. This means that when purchasing products, they do not consider if that product is recyclable or not. When asked about the reason for not considering the recyclability of products, a wide range of factors were mentioned, including lack of information, convenience, and lack of interest.

Interestingly, when the sample population was asked about various factors that the municipality can consider increasing the willingness to recycle, about 86% of respondents indicated that they would recycle more if incentives were provided to households that are actively recycling their waste. They cited financial incentives as the most preferred, indicating they would increase participation and assist in the overall development of the community. Furthermore, the results suggested that friends and family had a limited influence on promoting recycling behavior. More than half of the respondents (56%) revealed that their friends and family did not actively promote recycling. They pointed out that neither their family nor friends engaged in discussions about recycling or demonstrated any interest in waste management or environmental issues.

3.7 Discussion

This study aimed to assess the perceived recycling barriers among households in two medium-sized towns of Makhanda and Port Alfred.

3.7.1 Infrastructural factors and recycling participation

The findings suggest that municipal waste systems are operational and somewhat functional, but they are generally more tailored towards general waste disposal rather than separation at source recycling initiatives. Waste collection services were consistent across both towns, while there was a significant lack of crucial recycling resources, namely waste sorting bins and recycling buy-back centers. A study by Nhundu et al. (2017) on recycling determinants in the small town of Alice in the Eastern Cape suggests a similar trend of smaller municipalities prioritizing essential waste collection over recycling. Studies by Atkinson (2003) and Kosoe (2024) conducted in South Africa and Ghana, respectively, suggest that because of limited budgets and infrastructure, small towns' waste management authorities focus more on essential waste collection services to prevent public health risks, thus making recycling a secondary or optional service. This lack of prioritization of recycling thus leads to limited infrastructural support tailored towards supporting separation at source and recycling initiatives.

Additionally, the lack of prioritization of waste sorting mechanisms in the two study sites could be further attributed to the broader service delivery challenges facing South African municipalities, particularly in the Eastern Cape Province (Ngumbela & Juta, 2025; Rulashe & Ijeoma, 2022). Studies conducted in South Africa and other regions (Makhitha, 2025 Strydom, 2018; Xia et al., 2021) highlight that the absence of refuse bins, bags, and waste sorting bins is more likely to encourage residents to dispose of their materials in a single stream, further encouraging non-recycling habits and activities. The lack of infrastructure tailored towards separation at source, and, in a broader context, recycling, is more likely to act as an indirect barrier.

The findings suggest the need for a comprehensive approach to encouraging recycling participation, including initiatives that extend beyond providing infrastructure and also focus on educational and behavioral challenges. If the province of the Eastern Cape is looking to implement

measures to improve recycling uptake levels, the policies and the initiatives that are drafted should combine both infrastructural enhancements (specifically the provisions of recycling bins and the development of designated collection points) and behavioral interventions which include awareness campaigns, incentive programs, and engaged community development initiatives. An example of such an intervention is demonstrated through the Delterra rethinking recycling program in Olavarna, Argentina, which aimed to increase recycling participation through a combination of infrastructural, knowledge, and behavioral interventions (Delterra, 2021). Infrastructural advancements included the provision of general waste disposal bins, waste sorting bins, and waste collection trucks (Delterra, 2021). Knowledge and behavioral advancements were through intense recycling outreach programs that included behavioral nudging strategies, such as using social media applications to remind people to sort and dispose of their waste responsibly. As a result of these interventions, Delterra (2021) reports that almost all of Olavarna 's residents separate and sort their waste before it is collected. Overall, the organization highlights that due to the simultaneous implementation of the various initiatives in the city, recycling participation has increased by over 50%.

3.7.2 Knowledge and attitudinal factors on recycling participation

Knowledge and recycling participation

The findings indicated that recycling knowledge had a statistically significant relationship with recycling participation, meaning that one's lack of understanding of recycling procedures and concepts have an impact on the reduced likelihood and ability to participate in recycling activities. This aligns with studies by De Kock (2020), Strydom (2018), Oluwadipe et al. (2022) and Wright (2011) that suggest lack of knowledge to be a key barrier to recycling participation. These studies suggest that the most significant difference between people who recycle and those who do not is their knowledge about recycling, including theoretical and practical recycling knowledge. Given this, the finding of low recycling participation levels in this study is not surprising, considering that many respondents cited a basic understanding of recycling.

Many respondents cited to only understand recycling in theory but lacked practical knowledge on how to recycle waste. This primarily refers to the lack of knowledge of how to sort, clean, and store their recyclables. Studies conducted in South Africa in big cities like Johannesburg and Cape Town show a similar trend. A study by Schoeman and Rampedi (2022) conducted in Johannesburg reported that over 60% of the respondents did not recycle their waste, citing a lack of understanding of the technical specifics of categorized waste collection and sorting. Similarly, in a study by Anyasi and Atagana (2021) in Upper Clermont, Cape Town, knowledge was the most mentioned barrier behind limited recycling facilities, with some respondents indicating that even if facilities would been made available, the lack of understanding and information on waste separation, collection times, and disposal techniques would have still hindered their ability to adhere to their recycling commitments.

Elsewhere, a study by Babazedeh et al. (2018) conducted in Tabriz, Northwest Iran, also identified insufficient awareness among citizens as one of the leading barriers, particularly awareness of waste separation initiatives. Sudin et al. (2023) in Malaysia reported that only 15% of respondents were frequent recyclers, with the majority citing not being active recyclers because they found recycling difficult and time consuming, suggesting difficulties in the comprehension of various recycling concepts. Altogether, the findings are consistent with studies elsewhere, showing that recycling knowledge gaps constrain recycling rates and call for waste management authorities to prioritize knowledge development, possibly through well-thought-out recycling awareness public initiatives. Overall, the findings of this study indicate that the lack of recycling knowledge is not a localized issue but a broader issue in waste management systems across the globe, affecting places of varying sizes.

Findings indicated that interventions to address the limited recycling knowledge across both towns have been limited. This was reflected in less than 10% of the respondents, indicating that they have participated in a recycling awareness initiative in their lifetimes. The literature highlights awareness campaigns as vital drivers to positive recycling participation (Lakhan, 2016; Lit & Shanel et al., 2022). Interestingly, however, the study found the relationship between attendance at recycling awareness initiatives and recycling participation statistically insignificant. This

relationship noted in this study could be influenced by two factors. Firstly, the low engagement in awareness initiatives across both towns can naturally limit their potential to bring about sufficient education and behavioral changes as intended. If people do not engage in awareness initiatives or if such initiatives are unavailable, then their impact will not be as significant. Secondly, despite non-engagement in awareness initiatives, many respondents indicated a willingness to participate in them in the future should they be available. The increased willingness indicates that people are not engaging because they lack interest but rather signals an issue of limited availability and accessibility.

Interestingly, respondents across both towns indicated the provision of financial incentives and the use of local and indigenous languages in the awareness initiatives as vital factors to be incorporated in future initiatives. Some studies (Nahman, 2021; Oelofse & Strydom, 2010; Sanz et al., 2017, Wang et al., 2021) suggest that financial incentives are a significant and successful mechanism to increase participation in recycling public awareness initiatives. Li et al. (2020) emphasize that in disadvantaged communities engulfed by various socio-economic challenges, recycling financial incentives have been shown to increase recycling participation and motivation. The findings of this study align with the findings by Li et al. (2020) with both towns of Makhanda and Port Alfred located in the Eastern Cape, a province with one of the highest unemployment and poverty levels in the country (Eastern Cape Government, 2025). Financial incentives for household recycling participation could alleviate economic pressure and provide much-needed financial relief. Oelofse and Strydom (2018) highlight that financial incentives could be monetary rewards such as vouchers and deposit refund schemes. This finding calls for waste management authorities to consider financial incentives when conducting public awareness initiatives for small to medium-sized municipalities to increase engagement and participation.

Programs like "Find your reason to recycle" implemented in Cape Town are one way the local municipalities can incentivize recycling awareness initiatives. Scholtz (2024) highlights that this program involved engagement between the recycling sector representatives and the broader community through interactive games. Participation by the community was incentivized, and some of the prices included subscriptions to private recycling collection services, shopping vouchers,

and eco-friendly accessories, e.g., bags made from recycled PET bottles. In small to medium-sized towns like Makhanda and Port Alfred, with limited economic growth, initiatives like these could be instrumental in building motivation for people to participate in awareness initiatives.

On the use of local languages, mainly IsiXhosa, in awareness initiatives, it is vital to consider that, unlike big cities and towns where people are generally exposed to different languages and cultures, small towns are generally closely knit (Gardiner, 2017; Sikhakhane & Lubbe, 2005). They are mostly dominated by a single language directly speaking to their culture and heritage. Oliwa (2024) highlights that the use of indigenous languages in environmental awareness initiatives has been proven to increase cultural relevance and further remove possible language and learning barriers that could be encountered in the initiative. IsiXhosa native speakers mostly occupy both Makhanda and Port Alfred; therefore, awareness initiatives conducted or communicated in their mother tongue are more likely to sound familiar, which can be instrumental in improving participation and engagement. In a nutshell, this finding calls for waste management structures in small to medium-sized towns to consider the cultural attributes of target communities when planning and implementing awareness initiatives. This includes written or verbal translations and the inclusion of local people in the initiatives' drafting and implementation process.

Attitudinal and behavioral factors in recycling participation

Findings indicated that recycling is not considered a norm across both towns, as reflected by the low scores on statements indicating that friends, family, and the general community encourage or expect others to recycle. Delmas (2019) highlights that positive social norms are important because people are more likely to recycle if they perceive recycling as an everyday activity and appreciated by people close to them. Similarly, Sorkun (2018) and Strydom (2018) allude that individuals who see those close to them recycling are likely to follow suit because the activity appears normal and socially acceptable. Additionally, Berglund et al. (2022) suggest that family and friends' encouragement is vital because it significantly strengthens social expectations, which forces non-participation and negative recycling behaviors to be less acceptable. This is mainly because encouragement from close friends and family tends to influence more than the general public or institutional messaging (Berglund et al., 2022). The finding that respondents did not consider

recycling a social norm across both towns is, however, unsurprising. As noted, recycling awareness levels across both towns were low, meaning people have a generic or basic understanding of recycling. Naturally, if people are not informed about something, they are less likely to have conversations about it, let alone encourage each other to partake in it (Abrams, 2023). Overall, a significant body of literature (Bergland et al, 2022; Delmas, 2019; DuToit et al., 2015; Sorkun, 2018; Strydom, 2018) suggest negative attitudes as a significant recycling barrier.

The findings further indicate that people do not consider the recyclability of a product in their purchasing decision, suggesting that recycling is not a priority in consumer decision-making. There are many reasons why this could be the case. Studies by Roy et al. (2022) and Sudin et al. (2023) suggest that consumers sometimes do not engage in recycling activities because they perceive recycling as less of a personal priority in their daily lives. Instead, they mostly believe that the government and municipalities should take full responsibility for recycling activities and issues. Northen et al. (2024) suggest that in their study, the recyclability of a product was not an important factor in consumers' purchasing decisions; instead, the item's convenience and social perception were considered vital. The Recycling Partnership organization (2022) suggests confusion about recycling labels as a crucial limiting factor. If people do not understand the different recycling labels on various products, they are less likely to factor recycling into their purchasing decisions. Patreau et al. (2023) bring it down to additional costs, suggesting that if recyclable products are more expensive or have additional costs, then people are more likely to avoid them, especially people in disadvantaged communities who are focused on increasing the food basket with a limited budget.

As noted in this study and other studies (Makhitha, 2025) recycling knowledge tend to be limited in places outside of big cities and towns. Therefore, the low priority of recycling among the respondents of this study is logical. If people lack an understanding of recycling, they are less likely to incorporate it into their daily decisions. Furthermore, as noted by the Human Sciences Research Council (HSRC) (2024) and Kanbur and Christiaensen (2016), small to medium-sized towns are mostly engulfed by poverty and high unemployment numbers, which means people have a limited income at their disposal and are less likely to prioritize eco-friendly or recyclable goods.

Instead, their purchasing decisions are significantly influenced by affordability and necessity. Additionally, it is also vital to note that small towns tend to have few retail options compared to larger urban areas (McGuirt et al., 2015); this means that the variety of eco-friendly/recyclable goods could be limited, which can have an impact on their prices and further contribute to the declining prioritization by residents. Overall, this finding once again calls for more recycling education initiatives in small to medium-sized towns and the prioritization of affordable and sustainable alternative products. This could involve subsidies or tax incentives for businesses that adopt eco-friendly practices, particularly those aimed at mainly expanding the range of recyclable materials.

Overall, despite a significant body of literature (Bergland et al, 2022; Delmas, 2019; DuToit et al., 2015; Sorkun, 2018; Strydom, 2018) suggesting positive attitudes as a significant factor in encouraging recycling participation, findings indicate that positive recycling attitudes do not always translate to positive recycling behavior, signaling a significant intention-action gap. This gap, noted in this study, has been noted in various other studies conducted globally (Elhaffer et al., 2020; Konstantinidou et al., 2024; Martin et al., 2006; Wang & Mangmeechai, 2021). Martin et al. (2006) note that this gap lies in people expressing an intention or willingness to recycle yet failing to put their intention or willingness into action. This could be influenced by several barriers including but not limited to infrastructural challenges, lack of knowledge, and attitudinal challenges, many of which have been discussed throughout the study.

3.8 Conclusion

The findings of this study identified three main constraints to recycling activities in Makhanda and Port Alfred : (i) recycling infrastructural challenges, (ii) knowledge gaps, and (iii) attitudinal and behavioral factors. These constraints are similar to studies conducted elsewhere in South Africa (Schoeman & Rampedi, 2022; Strydom, 2018), including in bigger towns and cities. To improve recycling, both towns require substantial infrastructural developments and awareness to support separation at source initiatives. There is a need for locally tailored and culturally sensitive recycling awareness initiatives to provide technical and theoretical recycling concepts and further include recycling initiatives in the broader community goals. Additionally, when implementing

initiatives to address these challenges, it is important to note that recycling barriers are interlinked and require a multidisciplinary approach. This requires local municipalities and other vital waste management stakeholders to consider various interconnected factors impacting recycling behaviour and participation dynamics. In light of the municipal governance challenges affecting service delivery in South African municipalities in general, and Eastern Cape Province municipalities in particular, addressing barriers to recycling would require more than statements of intent. Instead, concerted effort and political will to address municipal governance issues such as corruption, incompetence, and maladministration are needed as the first steps towards encouraging participation in recycling, among other pro-environmental actions.

CHAPTER 4: SYNTHESIS OF FINDINGS AND POLICY IMPLICATIONS

4.1 Introduction

What is the extent and state of waste-picking practices in Makhanda and Port Alfred? How does waste picking contribute to the livelihoods and poverty alleviation of waste pickers in Makhanda and Port Alfred? What challenges constrain the operations of waste pickers in Makhanda and Port Alfred? What are the perceived barriers to household recycling in Makhanda and Port Alfred? These are the questions that were addressed in the study. Chapter 2 focused on the contribution of waste picking to the livelihoods of waste pickers across the two medium-sized towns of Makhanda and Port Alfred. Chapter 3 focused on the perceived barriers to recycling among households in both towns.

4.2 Summary of key findings

- The informal waste economy across both towns was dominated by low-educated and youthful newcomers, indicating that the sector is expanding and is a considerable fallback for the unemployed and marginalized.
- Despite the reported incomes of waste pickers across both towns being lower than those in major cities, the sector still significantly reduced poverty incidence and depth, thus positioning waste picking as an important avenue for alleviating extreme poverty.
- Key challenges constraining waste picking activities across both towns include the lack of personal protection equipment, limited recycling buy-back centres, disruptive weather conditions, and gender disparities.
- There is limited infrastructure tailored towards recycling. Available services and resources were tailored towards general waste disposal and management rather than waste recovery.
- Limited recycling knowledge is a significant barrier across both towns and contributes significantly to the intention-action gap noted in both towns.

The findings of this study suggest that waste collection practices differ from place to place. The working hours, days, materials collected, and collection sites vary from place to place depending on many factors, including but not limited to local buy-back centers, the availability, accessibility, and market performances of the collected materials. The different factors affecting the industry in different locations underscore the importance of localized studies. To effectively understand the industry and address the various challenges it faces, it is vital that studies on waste collection practices are conducted across the country in varying locations and sizes. This will allow localized findings and allow waste management authorities to effectively identify patterns and trends within the sector, which can be instrumental in drafting policies to address key challenges that are holistically affecting the sector.

Concerning waste collection income, waste pickers in the two study sites reported lower incomes than those operating in big cities and towns. This disparity signals significantly broader inequalities in waste resources, market linkages, infrastructure, and other factors affecting waste collection income between areas of smaller and larger sizes. It also signals that waste pickers operating in smaller markets require additional assistance and investment to thoroughly maximize the economic potential of waste picking. The income disparity also suggests that the economic potential of the informal waste sector in small to medium-sized towns is still somewhat underdeveloped and underutilized.

Generally, based on the findings, it can be argued, as others have, that there is an urgent need to formalize the sector. Waste-picking activities are largely informal, meaning they are unregulated, typically unregistered, undocumented, and rarely have authority over their operations and practices. The formalization of this sector mainly includes municipalities recognizing waste pickers as integral stakeholders in local waste management initiatives and activities. A close examination of the findings of this study and other studies, even those in bigger cities and towns, clearly indicates that the root cause for many issues plaguing the sector stems from governance issues, and investment. The sector requires the drafting of policies and regulations that seek to professionalize the sector. The formalization of the sector would be instrumental in improving working conditions, infrastructural development, training initiatives, and fair-trading procedures

between waste pickers and buy-back centers. This could provide social and legal protection for waste pickers, which could be instrumental in developing and advancing the sector.

For example, findings showed that many waste pickers worked very long hours in landfills without proper protective equipment and basic amenities, and the main reason for this was that many of them did not have the financial power to afford these services for themselves. The inclusion of waste pickers into local municipal formal waste management systems could allow the sector to have a budget that can be used to contribute to the development and advancement of working conditions and the provision of the necessary protection materials. In addition, findings across both towns indicated that one of the many factors constraining the income potential of waste picking is the limited number of buy-back centers and unjust trading practices between buy-back centers and waste pickers.

The formalization would not only allow for financial investment to build more buy-back centers However, it would also assist in drafting legal and fair-trading policies and regulations to govern the relationship between waste pickers and buy-back centers. This would include setting minimal prices for materials per kg that waste pickers can collect and providing clear guidelines on health and safety standards for waste pickers when sorting, cleaning, and packing materials at buy-back centers. Furthermore, the gender income disparities noted in the study further call for the urgent need for the government and waste management authorities to intervene in drafting policies and invest resources to support female waste pickers through infrastructural advancements and training opportunities. The growing number of people entering the informal waste sector, paired with its economic potential in the country, is a clear indication that the sector requires the intervention of the government and other external actors to oversee the industry and prevent unjust practices and unfavorable conditions for waste pickers.

Overall, the findings of chapter one suggests that waste picking activities across both towns are motivated by financial needs. Thus, this informs us that recycling across both towns is just not an environmental tool but rather an economic tool that has the potential to address the key socio-

economic and environmental challenges. Findings on waste picking income and contribution to poverty incidence and depth reduction highlight the need for more studies to highlight the economic opportunities of recycling. The findings highlight the importance of incorporating and prioritizing the economic contribution of recycling in discussions centered on strengthening recycling participation and engagement. The contribution of recycling in creating employment and income opportunities presents the opportunity for waste management authorities and local municipalities to use it as a strategic tool to increase participation in recycling activities, especially in disadvantaged communities grappling with high unemployment and poverty figures. This study lays the groundwork for more studies in various areas nationwide about the economic potential and its role in driving recycling participation levels.

Findings indicated that recycling barriers are deeply interconnected. For example, the findings of this study demonstrated that the lack of recycling facilities not only affects people's ability to follow recycling procedures physically but also makes recycling a tedious activity, significantly contributing to the development of negative attitudes and perceptions. This interconnection informs waste management authorities, including local municipalities, that recycling barriers cannot be addressed in silos. This calls for them to develop multi-disciplinary recycling policies and draft waste strategies that deal with recycling barriers simultaneously; this means that when drafting initiatives to increase participation, these initiatives must not tackle these challenges from a single standpoint but instead include a range of infrastructural, educational, and behavioral tools. For example, suppose local municipalities plan to increase participation by improving the availability and accessibility of awareness campaigns. In that case, these initiatives must be accompanied by the necessary infrastructure and be tailored toward the targeted community's objectives.

The study further revealed that the existing infrastructure across both towns is tailored towards general waste disposal rather than recycling. This is demonstrated by a relatively consistent waste collection service with limited access to recycling resources, such as waste sorting bins and buy-back centers. This signals that waste management systems across both towns are tailored towards waste removal rather than recovery. This disparity between waste disposal and waste recovery

resources signals a prioritization issue. It shows that both local municipalities prioritize waste disposal initiatives over waste recovery. This becomes a significant limitation in improving recycling initiatives because recycling is a secondary priority, affecting its prioritization in financial investments and overall advancement initiatives. Overall, the findings call for waste management authorities across both towns to draft and implement policies centered on recycling activities. Specifically, policies that will encourage separation at source initiatives through behavioral and infrastructural interventions.

The finding that education, income, and age significantly influence recycling participation carries significant implications for recycling policymakers. It underscores that personal circumstances can heavily shape one's ability to participate in recycling activities. As such, it means that initiatives to promote recycling participation must be targeted and specifically designed in the context of the targeted community. For example, communities with low education levels require recycling initiatives to be simplified and provided through community-based informal education techniques. In contrast, low-income communities would require initiatives that promote incentivized recycling programs or significant financial investments of the informal waste-picking sector. Additionally, in communities where the objective is to increase youth participation in recycling activities, then the use of digital technologies could be highly effective, while if the older generation is the target, then traditional and indigenous engagement channels could be the most effective.

Overall, the findings on barriers across both towns suggest that despite low recycling participation levels being a country-wide issue, the solutions cannot be nationwide. The initiatives to encourage recycling need to be specifically designed for each community and be specifically tailored towards the local demographic profile of the targeted community. In a nutshell, one-size-fits-all approaches to waste management issues like low recycling participation levels will continue to misalign with the communities they are intended for and, thus, likely be ineffective in achieving long-term changes.

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Appendix A: Waste picking contributions to the livelihoods of waste pickers in Makhanda and Port Alfred, South Africa

Data collection

Questionnaire Survey

Section A – Socio-demographics

Please kindly indicate with a **cross (X)**

1. Gender: Male ☐ Female ☐ non-binary ☐ Prefer not to say ☐

2. Race: African ☐ White ☐ Coloured ☐ Other ☐

3. Employment: Employed ☐ Unemployed ☐ Student ☐ Retired ☐ Self Employed ☐

If employed, nature of employment: Permanently employed ☐ Temporary/contract ☐

4. Level of education: Tertiary ☐ Secondary school ☐ Primary school ☐ No education ☐

5. Marital status: Single ☐ Married ☐ Divorced ☐ Choose to not disclose ☐

6. Est. net monthly income: _____ (*Include all income sources)*

7. Age: _____

Section B – Economic contribution of recycling in Makhanda and Port Alfred; To be filled by ALL respondents.

1. Duration in the recycling business _____

2. Total number of hours worked in a day (Approx.) _____

3. Total number of days worked in a week/month _____

3. Types of materials you collect/receive : Please kindly indicate with a cross (X)

Steel	
Paper	
Steel /scrap metal	
Plastic	
Glass	
Cans	

If you collect all, which one is the most frequent_____

4. How many times a week do you collect /receive recyclables? _____

5. Does the number of times you receive or collect recyclables in a month significantly affect your monthly earnings? Yes ☐ No ☐

6. On average, how much recyclables do you collect daily (kg)? _____

7. What is the remuneration exchange rates of the materials you collect at Buy-back centres?

_____, *e.g., 1 Rand for 1 kg*

8. Which material would you say makes the most profit? Steel ☐ Paper ☐ Steel/scrap metal ☐ Plastic ☐ Glass ☐

9. Which material would you say makes the least profit?

Steel ☐ Paper ☐ Steel/scrap metal ☐ Plastic ☐ Glass ☐

10. Based on your own experience, how much have you made from recycling the following materials **daily**:

Steel	R
Paper	R
Steel /scrap metal	R
Plastic	R
Glass	R

11. Do you think your income from recycling activities is enough to cover your necessities? Yes ☐ No ☐

On average per month, how much do you need to cover your basic needs? _____

12. On average, how much do you make **per month** from collecting waste materials? _____

13. Do you receive social grants from the government or have any other additional income source? Yes ☐ No ☐

If yes, kindly state the name and the amount you receive from this source. _____

14. How much do you spend on the following monthly expenses? Please fill in the one that applies to you.

Transport to work	R
Work lunch and food	R
Patrol for trucks and staff	R
Electricity (Work related electrical bill)	R
Work protective gear	R

If you have other expenses, please state them below and insert the amount you spend on them monthly.

	R
	R
	R

15. Are you the breadwinner at home? ☐ Yes, No ☐

If yes, how many people do you support? _____

16. Recycling is a financially lucrative opportunity ☐ Yes, No ☐

17. I would still be collecting/receiving recyclables in the next five years. ☐ Yes, No ☐

18. I would recommend this industry to someone to pursue. ☐ Yes, No ☐

19. Between the reasons listed below, which one greatly inspired you to get into the recycling business?

Environmental /sanitary reasons	
Financial reasons	

Experiences and challenges:

20. I have sufficient space to store/keep the recyclables I have collected ☐Yes, No ☐

21. I have sufficient bags for me to place the recyclables I have collected ☐Yes, No ☐

22. I have gloves and other protective materials to protect me from harm as I collect my recyclables. ☐Yes, No ☐

23. I collect my recyclables from the local landfill sites ☐Yes, No ☐

If yes, which landfill site, do you frequently collect from _____

24. I collect my recyclables from the street and local parks ☐Yes, No ☐

If yes, which streets and parks do you frequently collect from_____

25. The local buy-back centres provide me with sufficient support in my operations

Strongly Disagree ☐ Disagree ☐ Nor Agree nor Disagree ☐ Agree ☐ Strongly Agree ☐

If you agree, please mark the support provided.

Trolley	
Protective gear	
Financial support	
Food	
No support provided	
Other	

26. Are there any seasonal or weather-related challenges impacting your line of work? ☐ Yes, No ☐

If yes, please state those challenges and your mitigation plan (if you have any).

_____

27. Do you have problems finding markets or buyers in the industry? (Financial constraints) ☐ Yes, No ☐

If yes, kindly explain.

_____

_____

28. Have you ever received any training on the work you do ? ☐ Yes, No ☐

If yes, please indicate what kind of training and facilitated this training opportunity _____

_____

29. Have you had any difficulties in understanding some of your responsibilities and duties at work ☐ Yes, No ☐

if yes, what were some of those difficulties _____

30. Do you think people in society appreciate and understand the type of work that you do Yes ☐ No ☐ I don't know ☐

Please kindly explain your response _____

Appendix B: Perceived recycling barriers in Makhanda and Port Alfred, South Africa

Data collection

Questionnaire Survey

Section A – Socio-demographics

Please kindly indicate with a cross **(X)**

1. Gender: Male ☐ Female ☐ non-binary ☐ Prefer not to say ☐

2. Race: African ☐ White ☐ Coloured ☐ Other ☐

3. Employment: Employed ☐ Unemployed ☐ Student ☐ Retired ☐ Self Employed ☐

If employed, nature of employment: Permanently employed ☐ Temporary/contract ☐

4. Level of education: Tertiary ☐ Secondary school ☐ Primary school ☐ No education ☐

5. Marital status: Single ☐ Married ☐ Divorced ☐ Choose to not disclose ☐

6. Est net monthly income: _____

7. Age: _____

8. How long have you been you been a resident of the town _____

Section B: Recycling barriers questions: Makhanda and Port Alfred households

Questions

Recycling facilities and services questions

1. My household waste is collected weekly. Yes ☐ No ☐

   If yes, who collects your waste materials? Private service ☐ Municipality service ☐

2. I have access to sufficient refuse bags to store my waste Yes ☐ No ☐

   If yes, who provides the refuse bags? Privately bought ☐ Municipality provides it ☐

3. There is a functional recycling or buy-back center in town Yes ☐ No ☐ I don't know ☐

4. I have access to a waste disposal bin(s) Yes ☐ No ☐ I don't know ☐

   If yes, who provides the disposal bins? Privately bought ☐ Municipality provides it ☐

5. I have access to clearly labelled waste sorting bins to store my recyclables Yes ☐ No ☐ I don't know ☐

   If yes, who provides the waste sorting bins? Privately bought ☐ Municipality provides it ☐

6. I am satisfied with how the municipality manages waste in town Yes ☐ No ☐ I don't know ☐

7. Do you currently recycle Yes ☐ No ☐

If yes, how do you recycle? ☐ Drop of recyclables to a drop off location ☐ Use a private recycling service ☐ ☐ Other.

If other, please explain _____

If No, did you ever recycle your household waste at any point in your life Yes ☐ No ☐

Recycling knowledge questions

8. What do you understand about "improper" waste management?

_____

9. What do you understand about the term “recycling?

_____

10. What do you understand about “waste sorting”?

_____

11. Please tick (✓) the option that most describes your recycling knowledge level

Level of recycling awareness	**(✓)**
No knowledge	
Basic	
Moderate	
Advanced	

12. Drawing from personal experiences, please elaborate on the option you selected above **(Q.11)**?

_____

_____

13. Do you think recycling is an effective waste management tool? Yes ☐ No ☐ I don’t know ☐

14. Have you encountered any specific challenges in storing or sorting recyclables materials? Yes ☐ No ☐

If yes, please highlight some of the challenges you have encountered:

_____

15. Have you ever attended an awareness session on recycling in town? Yes ☐ No ☐

If yes, how many sessions have you attended, and who facilitated these sessions?

_____

16. Would you be interested in attending a recycling awareness session in the near future? Yes ☐ No ☐

17. What are some things that you think are discussed in recycling awareness sessions?

_____

18. What role do you think education and awareness campaigns play in promoting recycling?

_____

19. What critical things do you think should be included in recycling awareness campaigns to get more people to recycle and attend the sessions?

_____

Informal waste pickers questions

Informal waste pickers are an important part of recycling. In your experiences and view:

20. What do you think is the role played by informal waste pickers in waste management and recycling?

_____

21. Do you encounter any issues with waste pickers operating in the town? Yes ☐ No ☐ , If yes please, state some of the issues below:

_____

22. What do you think should be done to support informal waste pickers in doing their business?

_____

Behavioural and attitudinal questions

For each question below, circle the response that most characterizes how you feel about the statement. Where :**1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree**

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
23. Recycling plays a role in reducing pollution levels	1	2	3	4	5
24. Recycling is essential in reducing the amount of waste disposed of incorrectly and illegally	1	2	3	4	5
25. I am concerned when people throw away materials in illegal dumpsites and on the street	1	2	3	4	5
26. I am concerned when I see people throwing materials that could be recycled	1	2	3	4	5
27. I am worried about the level of recycling in town	1	2	3	4	5
28. It is important for every household in town to recycle their waste	1	2	3	4	5
29. It is essential for people to sort their waste before it is collected by the municipality trucks	1	2	3	4	5
30. Recycling activities are instrumental in creating employment opportunities in the town	1	2	3	4	5
31. Recycling has positively impacted my life	1	2	3	4	5

32. Recycling is an easy activity that everyone can do	1	2	3	4	5
33. People would recycle more if the government started to incentivize recycling	1	2	3	4	5
34. My friends and family play an essential role in maintaining waste collection and sorting activities in my household	1	2	3	4	5
35. I consider recycling when buying a product or a service	1	2	3	4	5