

**RECYCLING PRACTICES IN THE CITY OF MBOMBELA,
SOUTH AFRICA**

**Dissertation submitted
by
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DECLARATION OF INDEPENDENT WORK

I, Philix Mnisi, student no. _____ hereby declare that this research document submitted to the Central University of Technology, Free State, is my own independent work and has not been submitted before to any institution by myself or any other person in fulfilment of any requirement for the attainment of any qualification.



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19 October 2020

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ABSTRACT

Introduction: The study focused on determining the factors influencing waste picking in the City of Mbombela municipality, Republic of South Africa. The study objectives were to assess determinants of waste picking, influence of convenience factors in recycling; and to determine the incentives as stimulants of recycling participation.

Methodology: The data were collected from February to March 2019. A participatory method of data collection was used to determine the factors that influence the engagement of participating waste pickers (WPs) in waste picking activities. Available WPs at three landfill sites, Hazyview, Barberton and Tekwane, and who operated in the streets of Hazyview town, Barberton town and Mbombela (Nelspruit) CBD were recruited. Only WPs willing to participate and sign a consent form were included in the study. The respondents were interviewed using a structured questionnaire and their responses were recorded by the principal researcher and a trained, knowledgeable assistant. A sample size of 149.4 (150) WPs was determined by using Yamane's (1967) formula. This ideal number was not achieved as 146 WPs participated.

Results and discussion: The study found that age and gender were not determinants of waste picking participation, while a high level of education determined sustainable waste picking practices. Poverty, income need and employment are determinants for waste picking. Aluminium recyclables were desirable by most (53.4%) WPs. Unavailability of recyclables, costs of waste picking, health and safety hazards are factors of inconvenience in recycling, while recyclable accessibility, available markets and good prices are factors of convenience. The distance between waste source and deposit point is a convenience or an inconvenience. Moreover, availability, accessibility of recycling facilities and reliable transportation are factors of convenience. Financial incentives motivated the majority of WPs (81.3% LWPs and 9 0.1% SWPs) to recycle.

Conclusion: As waste picking contributes to poverty alleviation and offers alternative employment to WPs, the industry should be formalized or compensated. The study recommends intervention by authorities to eliminate inconveniences while enhancing convenience factors for growing waste picking in the City of Mbombela. Since the majority WPs rely on financial incentives, it is recommended that maintaining and improving financial incentives, public awareness on other recycling incentives is important.

Key words: Convenience, recycling, waste pickers, waste picking

LIST OF ACRONYMS

DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
EDD	Economic Development Department
EIs	Economic Instruments
EPR	Extended Producer Responsibility
HDPE	High-density polyethylene
K4	Card box
LWPs	Landfill waste pickers
MBO	Membership-based organization
MDGs	Millennium Development Goals
MEC	Member of the Executive Committee
n	Sample size
N	Population size
NWMS	National Waste Management Strategy
PET	Polyethylene terephthalate
PPE	Personal protective equipment
RSA	Republic of South Africa
SA	South Africa
SDGs	Sustainable Development Goals
SHEQ	Safety, Health, Environment and Quality
SPSS	Software Package for Social Statistics
Stats SA	Statistics South Africa
SWPs	Street waste pickers
TPB	Theory of planned behaviour
USA	United States of America
VBN	Value-Belief-Norm
WPs	Waste pickers

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CHAPTER 1

GENERAL BACKGROUND

1.1 Introduction

Global population growth, massive economic developments and the extent of natural resources consumption have led to the challenge of high waste generation in many countries. In South Africa, a growing population and the concomitant expansion of the economy have resulted in the generation of increasing volumes of waste which, in turn, has put pressure on waste management facilities that are already in short supply (DEA, 2011a). The first goal of South Africa's National Waste Management Strategy (NWMS) "focuses on implementing the waste management hierarchy" through the promotion of solid waste minimization, re-use, recycling and recovery of waste "with the ultimate aim of diverting waste from landfill" (Department of Environmental Affairs [DEA], 2011b). Thus, diverting waste away from landfill sites remains a focal point in the implementation of the waste hierarchy in South Africa.

Suttibak and Nitivattananon (2008:45) state that "the success of recycling depends on understanding the factors that influence recycling performance". The absence – or a limited understanding – of the push and pull factors that impact recycling is highlighted by this study as one of the constraints that inhibit recycling performance. No record of studies that were conducted in South Africa to understand these factors on both national and local scale could be traced. Moreover, the different roles of government and society to address these factors are vague. This study thus sought to close this gap in the literature by providing all stakeholders (i.e., both relevant authorities and waste and environmental health practitioners) in the waste recycling field with information that will assist them in their efforts to improve waste management policies and enhance the implementation of waste management strategies.

The literature identifies a myriad of factors that influence the recycling of solid waste. In this context, Crociata et al. (2015) refer to different disciplines that are associated with recycling performance and the factors that enhance expertise in this field. For example, economists attribute recycling performance to economic variables, environmentalists attribute it to biophysical values, psychologists refer to social

motivation, sociologists highlight social pressure and environmental constraints, while legal practitioners and engineers attribute it to recycling regulations and the impact of alternative technologies, or the lack thereof (Crocata et al., 2015). It thus seems that the factors that influence recycling are multi-disciplinary and therefore multi-disciplinary interventions are needed to attain optimal and sustainable recycling practices. However, it remains unclear whether the factors identified in international literature pertain to South African communities and, if so, to what extent these factors are inhibiting or encouraging waste recycling participation in this country. It is also critical to establish whether other factors regarding waste recycling and picking that have not been mentioned in international literature may be identified within the South African context.

Hornik et al. (1995) classify such factors as extrinsic incentives, intrinsic incentives, internal facilitators, external facilitators, and demographics, while Miafodzyeva and Brandt (2013) classify them as socio-psychological, technical-organizational, individual socio-demographic and study-specific factors. Suttibak and Nitivattananon (2008) group these factors into technical, financial, economic and institutional categories. Collectively, Hornik et al. (1995), Folz (2004), Barr (2007), Omran et al. (2009), Miafodzyeva and Brandt (2013) and Alessandro et al. (2015) identify demographic, socio-cultural, convenience and incentive factors as major drivers of recycling performance. Demographic, socio-cultural, convenience and incentive factors are briefly discussed.

1.1.1 Demographics

A positive correlation exists between demographics and recycling performance which is confirmed by Belton (1994), Hornik et al. (1995), Lee and Yip (2006), Gifford (2007), Yau (2010), Sidique et al. (2010), Siu and Xiao (2015), Crociata et al. (2015) and Grazhdani (2016). These studies identify the common demographic variables that are associated with recycling and general waste management practices as age, gender, income level, level of education, family size, country of birth, race, ethnicity, marital status, home ownership, type of residence, and acculturation. The current study endeavoured to determine the relationship of these factors with recycling practices in South Africa. More particularly, the role of waste pickers is highlighted as Belton (1994) and Hornik et al. (1995) argue that the demographics of waste pickers

and the communities where they function have a significant influence on recycling performance. The latter authors also suggest that internal facilitators such as knowledge, awareness and recycling education are the strongest predictors of household recycling, which is a view that is corroborated by Izagirre-Olaizola et al. (2015). In addition, Omran et al. (2009) and Izagirre-Olaizola et al. (2015) confirm that gender, education, age, race, family size and living area are demographic variables that impact recycling. According to Siu and Xiao (2015), demographics represent households' quality of life (their ability to afford goods and services), priorities, and their socio-cultural status that may all strongly influence recycling participation. They thus argue that the efficacy of the private recycling sector may be predicted by the types of housing prevalent in an area.

1.1.2 Socio-cultural factors

Aguilar-Luzon et al. (2012) examined the theory of planned behaviour (TPB) and the value-belief-norm (VBN) as two social behavioural models that influence household recycling participation, and they argue that the TPB has a more significant influence on recycling behaviour than the VBN. Under the TPB they examined variables such as attitude towards recycling, subjective norms, and perceived behavioural control, whereas under the VBN they tested environmental, social and egocentric values, the ecological paradigm, awareness of consequences, ascription of responsibility, and personal norms and behaviour. They state that the importance of these behavioural theories is primarily to understand social and psychological aspects within society that lead to certain behaviours. They also posit that influence on behaviour is only manifested through daily life-style behaviours such as recycling, and they thus support the notion that cultural orientation and social values, beliefs and norms are determinants of environmental behaviour.

According to Hornik et al. (1995:110), "the effects of social variables endure longer than that [sic] of utilitarian variables", but they state that both social and utilitarian factors influence recycling performance. Hornik et al. (1995) also point out that social variables influence people's participation in recycling because it feels good, while utilitarian variables make one do good because one is coerced or forced to do so (e.g., when separation at source is made a legal requirement). Furthermore, both social and utilitarian variables are sub-classified into internal and external factors

(Hornik et al., 1995). Internal factors are the direct responsibility of individuals while external factors are under the control of relevant authorities. It is for these reasons that the roles and responsibilities of both government and society should be taken under the loop when recycling issues are considered.

1.1.3 Convenience factors

Hornik et al. (1995) state that, when recycling is considered, convenience is associated with demands for time, space, affordability, and effort. Terms that are often used synonymously with convenience include accessibility of recycling facilities, logistical factors, convenient locations, external and internal factors impacting recycling, technical-organisational factors, study specific factors, situational variables, time, space, money, effort, frequency of collection, materials-co-mingling, collection schedules, collection days, and recycling facilitators (Omran et al., 2009; Miafodzyeva & Brandt, 2013; Barr, 2007; Allessandro et al., 2015; Folz, 2004; Hornik et al., 1995). In the current study, convenience refers to the creation of a favourable environment in which recycling becomes the most preferred and easiest way of waste handling and disposal and is selected over all other existing alternatives. But before that can happen, there is a range of aspects that need to be improved in order to make recycling convenient to people, for example improving access to recyclables and recycling facilities, reliable and efficient recycling collection schemes, the appropriate location of recycling facilities, and well established collection dates and frequencies, just to mention a few.

Miafodzyeva and Brandt (2013) indicate that convenience, moral norms, information and environmental concerns are strong predictors of households' willingness to participate in recycling. Barr (2007) argues that situational variables are the main factors that influence household recycling behaviour, while Hornik et al. (1995) state that a lack of convenience is one of the most common barriers that impede recycling participation. Hornik et al. (1995) also highlight that the frequency of the collection of recyclables is one of the strongest predictors of poor or good recycling behaviour. A study that was conducted by Omran et al. (2009) in Malaysia found that 59.9% of households did not recycle and that 25.7% of these non-recyclers did not participate in recycling because it was inconvenient and time consuming. Furthermore, 32.6% of the respondents in Malaysia indicated that recycling facilities were too far and

inadequate (Omran et al., 2009). McDonald and Oates (2003) found that insufficient quantities of recyclables, having to share disposal bins, and lack of space to keep bins were common inconveniences that inhibited separation of waste at source by households. Barr (2007), Hornik et al. (1995), Miafodzyeva and Brandt (2013), Mohee et al. (2015) and Folz (2004) agrees with McDonald and Oates (2003) that convenient strategies such as recycling schemes influence recycling and that the quality index of recycling consists of: (1) recycling convenience and (2) scope of the materials targeted.

1.1.4 Recycling convenience

Recycling convenience refers to the frequency of collecting different types of recyclables that are placed together in one container coupled with a same-day collection schedule at the same point. Folz (2004) found that daily collection of recyclables, same-day collection as other waste and the use of kerbsides as collection points were deemed highly convenient by households and these factors thus positively influenced recycling participation. Wagner and Broaddus (2016) also state that kerbside collection of recyclables increases municipal recycling rates. An added convenience of kerbside collection is the increase in residents' participation as well as an increase in the volume of collected recyclables. For this purpose, Wagner and Broaddus (2016) argue that appropriate recycling bins should be used as open-top bins contribute to litter and are thus not recommended.

1.1.5 Incentives

A study that was conducted in Taiwan observed that households separated waste at source to avoid paying the disposal fee and this resulted in significant savings for them (Tan et al., 2015). Thus, the introduction of incentives to employ waste management strategies at household level (such as a discount in the removal fee per weight or volume of recycled waste materials per household) could encourage more households to recycle and separate waste at source. Conversely, the levying of an additional tax for unsorted recyclables from household bins can serve as a deterrent to do so among non-participating and unwilling residents. Moreover, Hornik et al. (1995) warn that, where incentives have been used as drivers for high recycling performance and where these incentives were then removed, the recycling system often collapsed. Yau (2010) cautions that both the use of and a lack of economic

incentives may influence their cycling choices, behaviour and participation of residents in high-rise buildings.

Recycling can legislatively be incentivised by targeting economic instruments for specific waste streams (Republic of South Africa [RSA], 2016). Thus, legislative interventions may be used effectively to change citizens' behaviour in terms of waste generation and management. For instance, economic instruments that are in line with the 'polluter pays' principle will extend waste producers' responsibilities. The extent to which municipalities incorporate economic instruments in their by-laws, integrated waste management plans and waste policies to advance the objectives of the national pricing of solid waste management is a subject of interest in current debates on waste management and was thus also a focus of this study. The adoption of economic instruments in municipal solid waste policies forms part of the basket of policy instruments. This can mainstream the 'polluter pays' principle, reduce waste generation, and increase diversion of waste from landfills while supporting the growth of a secondary resource economy from waste while also reducing environmental impacts (RSA, 2016). This highlights the importance of incentive and policy influences to divert waste from landfills, such as recycling at source or pick-up points. Against this background, key focus areas of this study were the extent to which the government can directly incentivise recycling through solid waste resource allocations, the advancement of infrastructural recycling developments, the utilisation of other systems to support recycling, the issue of prioritising recycling rather than landfilling in budget allocations, and the procurement of services and goods from local recycling industries.

When these issues were explored, cognisance was taken of the fact that factors that influence the recycling practices of communities within the City of Mbombela (the study site) were largely unknown as it was not clear whether the factors identified in international literature would be prevalent in the communities under study. It was also unknown to what extent these factors inhibited or encouraged recycling participation. It was therefore critical to establish whether factors that had been unidentified by international studies might be identified by a study that would focus particularly on communities within the selected study area, namely the City of Mbombela and towns in its vicinity.

1.2 Problem Statement

Suttibak and Nitivattananon (2008:45) point out that the success of recycling depends on “understanding the factors that influence recycling performance”. Various factors that influence recycling performance have been highlighted in both local and international literature, but no record of studies that had been conducted locally to expose the factors that influence recycling or waste picking participation activities within the City of Mbombela and surrounding area could be traced. The researcher thus takes the stance that the absence of knowledge about these factors inhibits the potential of local authorities to explore the full socio-economic and environmental potential associated with recycling (Suttibak and Nitivattananon, 2008). Among its other contributions, this study thus sought to close this knowledge gap. Secondly, the literature highlights that demographic, socio-cultural, convenience and community incentives are major factors that influence recycling or waste picking behaviour and participation (Omran et al., 2009; Miafodzyeva & Brandt, 2013; Barr, 2007; Allessandro et al., 2015; Folz, 2004; Hornik et al., 1995). However, it was unknown whether these factors –that are highlighted in international literature – were also prevalent in the study area as their influence in the City of Mbombela had been unexplored. It was therefore important to determine whether the factors identified in the literature also impacted the current study area and, most importantly, whether additional and previously unknown factors pertinent to the City of Mbombela could contribute to a better understanding of the drivers of waste picking and recycling practices.

1.3 Hypotheses

In terms of the City of Mbombela and its surrounding area, it was hypothesized that:

- ✓ Recycling participation and waste picking would be influenced by certain determining factors such as policy or regulations, unemployment, and poverty (to mention few);
- ✓ Recycling participation would be influenced by both convenience (availability and accessibility of recyclables) and inconvenience factors (unsafe work environment and community intolerance to waste pickers);
- ✓ Waste picking activities would be influenced by both economic and social incentives as drivers of recycling and

- ✓ Recycling and waste picking incentives that drive these practices internationally could be absent in the study area.

1.4 The Aim and Objectives of the Study

The aim of the study was to determine the factors that influence waste picking and recycling practices in the City of Mbombela and towns in its vicinity in the Republic of South Africa, with emphasis on the role of waste pickers. To achieve this aim, waste pickers from two strata were recruited.

The objectives of the study were to:

- Assess convenience as a factor that drives recycling practices; and
- Determine the impact of incentives as a driver of recycling practices.

1.5 Methodology

The methodology of the study covered the following areas:

- Description of the study area;
- Population and sampling;
- The sample size;
- Sampling frame; and
- Research design.

1.6 Description of the Study Area

The City of Mbombela is one of four municipalities that fall under the Ehlanzeni District Municipality in the Mpumalanga Province, Republic of South Africa (City of Mbombela, 2018). The City of Mbombela was established in terms of Section 12 of the Municipal Systems Act (2000) by the MEC for Cooperative Governance and Traditional Affairs in Mpumalanga subsequent to the dismantlement of two municipalities, namely Mbombela Local Municipality and uMjindi Local Municipality (City of Mbombela, 2018). The City of Mbombela is situated in the north-eastern part of South Africa in the Lowveld sub-region of the Mpumalanga Province (City of Mbombela, 2018). The municipality's area of jurisdiction and geographic coordinates are 25.4753°S, 30.9694°E (City of Mbombela, 2018).

Mbombela is the capital city of the Mpumalanga Province and accommodates the head office of the provincial government (thus the provincial legislature) (City of Mbombela, 2018). The location of this city with its status as a capital provides the municipality with a competitive advantage as a corridor for growth and development. The City of Mbombela comprises four regions which were amalgamated to form the City of Mbombela. It is situated in the Ehlanzeni District Municipality according to post-apartheid municipal demarcation as authorised by section 12 of the notice by the Member of the Executive Council for Cooperative Governance and Traditional Affairs (City of Mbombela, 2017).

The study area has landfill sites in the City of Mbombela (Tekwane West Landfill site), and near the towns of Hazyview and Barberton. These areas fall under the control of the City of Mbombela Municipality. The selected landfill sites are situated in three of the four different regions of the municipality (Figure 1.1), namely, Hazyview (northern region), Tekwane West (central region) and Barberton (southern region). They are indicated with a blue star on the map.

Hazyview: The landfill site is an operational site which is located 8.5 km south-east of Hazyview. The size is 6.5 hectares in size. The landfill site was provisionally classified as G:C:B area – i.e., general waste-communal-water deficit – in terms of the minimum requirements for waste disposal by landfill. The landfill site has not been granted permission in terms of the Environmental Conservation Act, yet it is operational.

Tekwane West landfill: The size of the site is 25 hectares in total (currently a 2-hectare cell is being used). The landfill site is permitted to operate as a G:L:B site –i.e. general waste-large-water surplus area in terms of the Environment Conservation Act. The operation of the landfill site commenced on 1 June 2011 and it has an estimated life span of 35 years. The landfill site is situated on the remaining extent of portion 5 of the farm known as Tekwane 573 (Erf 1347 Tekwane West) (entrance coordinates: S250 27' 43" E310 07' 29"). It is located approximately 18km east of Mbombela CBD (previously Nelspruit) north of Kanyamazane road.

Barberton landfill: The total area of this landfill is 99,116 m². The Barberton landfill is situated on the remainder of Portion 14 Farm Barberton Townland 369 JU, approximately 3 km north-west of Barberton. The operating license is valid for a period of 10 years. The landfill site is operational.

(<https://www.mbombela.gov.za/210-2018%20provision%20for%20the%20rehabilitation%20of%20the%20landfill%20site.pdf>)

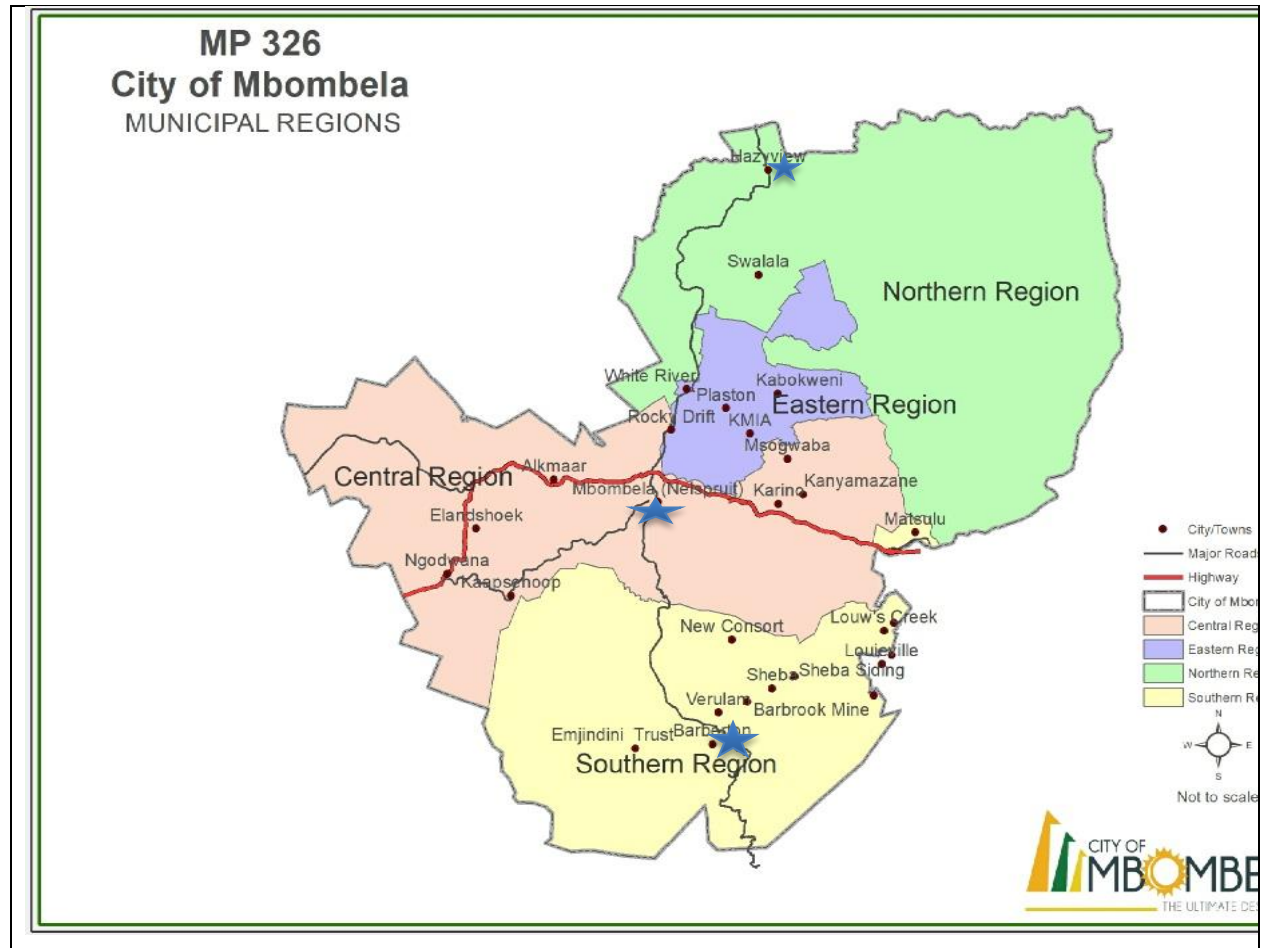


Figure 1.1 The City of Mbombela Municipal Map

Source: Google Maps (Accessed 2020/04/02)

1.7 Population and Sample Selection

Waste picking and the recycling of solid waste are prevalent in most municipalities and predominantly at waste management facilities (Hilsden & Verhoef, 2004; Polit & Beck, 2006; Parahoo, 2006). Waste recyclers (pickers) at the selected landfill sites as well as street waste pickers (often called pickers or informal recyclers) constituted the population of the current study. However, as the number of such people is large and they are often inaccessible, the study focused on recyclers referred to as pickers because they are primary waste collectors. In studies of this nature, Keller (2014) advises that a reasonable proportion of a population should be selected as representative of the entire population. It was impossible to determine the total

population of recyclers because of the informal nature of waste picking activities (Machete, 2017). However, the DEA (2011) estimates that there is an average of 128 trolley pushers (or street pickers) in every category B1 municipality of South Africa and 37 landfill pickers per municipal landfill site. The three landfill sites and their nearest towns that were purposively selected are situated in three different regions in the City of Mbombela Municipality (Machete, 2017), and the estimated average population of landfill pickers was 111. It was thus estimated that the total population of the current study was $N = 239$ comprising two types of recyclers, namely street and landfill waste pickers.

1.7.1 The sample size

Based on Yamane's (1967) formula, sample size may be calculated as follows:

$$n = \frac{N}{1 + N(e)^2}$$

The formula allows for the entire population to be sampled. The current study sample size was determined at a population confidence level of 95% with an error margin of $\pm 5\%$, where **N** indicates the population size, **n** indicates the sample size, and **e** indicates the level of precision (sampling error) that is equal to 0.05 (Yamane, 1967). Yamane's formula was applied to determine the sample size as indicated below:

$$\begin{aligned} n &= \frac{N}{1} + N(0.05)^2 \\ n &= \frac{239}{1} + 239(0.05)^2 \\ n &= 239 \div 1.6 = 149.4 \end{aligned}$$

1.7.2 Sampling frame

Because of the composition of the population size, a stratified random sampling frame was used to select the sample, as proposed by Leedy and Ormond (2010). Half (75) of each stratum was drawn by using the convenience sampling technique to make up the total required sample size (150). Convenience sampling was thus used to sample 25 landfill waste pickers (LWPs) and 25 street waste pickers (SWPs) from each of the three landfills and areas within a 20km radius of the landfill sites. A clear breakdown of how the sample was determined to represent the two strata of the study population is detailed in Figure 1.2.

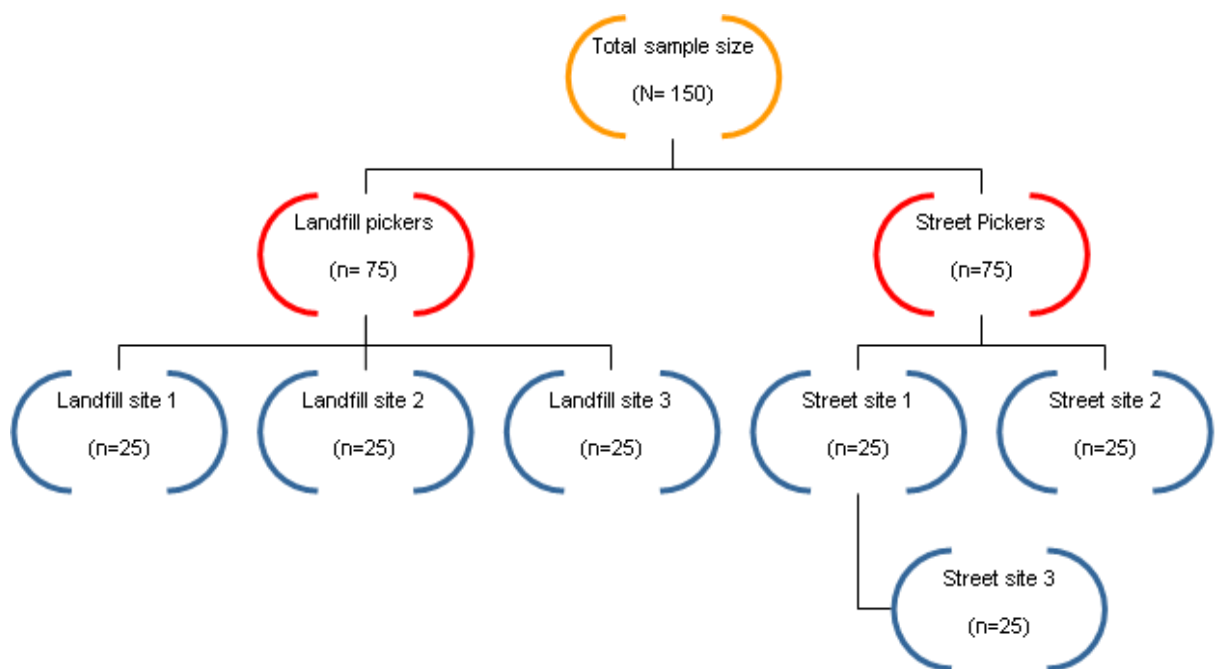


Figure 1.2: Calculation of sample size

Source: Adapted from Machete, 2015

The ideal total sample size of 150 as required by the stratified random sampling frame (Figure 1.2) was not achieved as only 146 (97.33%) participants were recruited. This was because some waste pickers who had been approached declined to participate in the survey, specifically at Hazyview landfill, Barbeton landfill, and in the streets of Barbeton. Thus, because no alternative waste pickers could be recruited, the target of 25 per site was not reached. However, Tekwane West landfill site had a large number of waste pickers and more than 25 waste pickers were willing to participate in the survey, thus the number for this site exceeded 25 for a total of 27.

1.7.3 Research design and methodology

1.7.3.1 Data collection

The City of Mbombela is characterised by four main regions (Figure 1.1). One is situated to the north about 8.5 km outside Hazyview town, another is in the central region 18 km from Mbombela CBD (Nelspruit), and the third landfills located in the southern region, about 3 km from Barberton town. Data collection started in February 2019 and lasted until March 2019. The process involved travelling by car to each landfill site at least twice or until the projected sample number (Figure 1.2) had been obtained and all WPs willing to participate had been interviewed. Nzeadibe (2008) also interviewed WPs who were available during the period of the survey and who were willing to participate. The process of interviewing was repeated until saturation had been reached or until there were no more WPs who had not been previously interviewed, as proposed by Kasinja and Tilley (2018).

Convenience sampling was used to select the respondents as every waste picker at the landfill sites and in the streets who was available at the time of data collection was approached. If a WP was willing to participate, he/she was informed of the purpose of the study and requested to sign a consent form. A questionnaire for each WP was completed in writing by the chief researcher and an assistant as not all WPs could read and write. Kasinja and Tilley (2018) state that structured questionnaires may be administered to waste pickers for data collection. In some instances, snowball sampling was used to recruit street waste pickers as originally recruited waste pickers provided the names of other street waste pickers who were visited at their homes, on the streets and at buy-back centres where they were recruited for data collection (Kasinja and Tilley, 2018).

The process entailed approaching the WPs one by one, recruiting them, posing the questions verbally, and the investigators then completed the questionnaires. Szolnoki and Hoffmann (2013) support the use of face-to-face structured interviews because they help to avoid spoilage or incomplete questionnaires. The LWPs were better organized than the SWPs as they had representatives on site to whom the purpose of the visit was first explained before the WPs were called for recruitment. Time for questions and answers was allowed. The WPs then went back to their waste sorting stations and they were then approached one by one for the interview and the completion of the questionnaire. Kasinja and Tilley (2018) also approached and

interviewed WPs having observed them recovering materials from streets, households and open dumps. The advantage of a structured questionnaire was that it assisted the investigators to stick to the objectives and not to deviate in any way from the objectives of the study (Subbo and Moindi, 2008).

To maintain objectivity, the study questionnaires were formulated to guide the interviewing process involving the WPs. The questionnaire was duplicated (a total of 160 copies with an extra 10 copies in case some were spoiled). The questions focused on the following: Section A: demographic information; Section B: convenient factors of waste picking; Section C: incentive factors for communities; and Section D: economic and other factors unique to the local communities. The questionnaire was designed to include both open- and closed-ended responses. Subbo and Moindi's (2008) questionnaire also had both closed- and open-ended questions. The open-ended questions elicited responses that allowed other options and supporting reasons.

The data collection interviews, observations (photographs) and completion of questionnaires were administered by the chief investigator and an assistant (Mr L. Mokoena) who was the Environmental Health practitioner from a neighbouring local municipality. Kasinja and Tilley's (2018) data were also collected using a structured questionnaire administered to the WPs by the investigators. The WPs gave their informed written consent for inclusion in the study before participating in the interviews (Kasinja and Tilley, 2018). In the current study, the one-page consent form was made available in three languages (English, Xitsonga and SiSwati). The WPs willing and able to read gave their consent in their preferred languages and signed or made their mark if they could not write. If the WPs could not read or write, the content was explained by the investigators as they could engage in all three languages, and then the WPs were given the form to sign or make their mark (Annexure B). The WPs from the two neighbouring countries (Mozambique and eSwatini) could also engage in any of the three languages as they are spoken in their countries of origin.

The sample size of 149.4 landfill and street waste pickers was determined by using Yamane's (1967) formula, as was explained above. The ideal was thus to recruit 150 waste pickers from the landfills at the two towns and in the City of Mbombela. The sample was eventually drawn from three selected areas within the City of Mbombela: Hazyview (landfill and street waste pickers), Tekwane (landfill and street waste

pickers) and Barberton (landfill and street waste pickers). Although the ideal sample of WPs was 150, only 146 (97.3%) WPs participated in the study as six WPs declined to participate in the study, citing the reason that the study would not benefit them directly. Kasinja and Tilley (2018) also found that some WPs declined to be interviewed.

The data collection methods included both interviews and observations during which photographs were taken (Figures 3.5 and 3.6). Observations of visible recycling practices at the landfill sites and in the streets were thus recorded by means of photographs, as proposed by Leedy and Ormond (2010). The interviews were combined with participant observation methods to obtain data for the study as proposed by Subbo and Moindi (2008), Machete (2017), and Nzeadibe (2008). Although the total population could not be accurately determined, there was confidence that, at the point of saturation, every WP working in the area had been approached (Kasinja and Tilley, 2018).

1.7.3.2 Questionnaire formulation and administration

The questionnaire (Annexure A) was used to collect data in order to address the following objectives:

- Assess convenience as a factor that drives recycling practices; and
- Determine the impact of incentives as a driver of recycling practices.

To obtain the study objectives, independent (predicted) and dependent variables were included. Dependent variables may be viewed in terms of their effect. Changed independent variables (predictors) will affect the dependent variables as it will only change in response to the independent variables (Statistics Solutions, 2018).

Independent variables

These values can be controlled and do not depend on any other variable, as they are stable variables. The following independent variables were included in the study to determine the socio-demographic information of the participating respondents:

- Age
- Gender
- Educational level
- Family income/poverty level

- Employment status.

Dependent variables

Dependent variables depend on factors that can be measured and are expected to change. Thus, the respondents' views were determined in terms of:

- Recyclability of waste
- Availability and accessibility of recyclables
- Market prices
- Operational costs
- Storage facilities
- Collection and transportation issues
- Distance from recycling to selling point
- Availability and accessibility of recycling facilities
- Work environment that impacts health and safety
- Community and municipal intolerance.

The data that were obtained by recording the responses in the questionnaires contributed to the determination of the factors that supported or discouraged the recycling of waste by waste pickers in the study area.

Breakdown of questions

Responses recorded and results recorded in the questionnaire were analysed (Chapters 2, 3 and 4). The questions were presented according to the following categories in the questionnaire:

- Section A: Demographic information
- Section B: Convenient factors for recycling
- Section C: Incentive factors for recycling
- Section D: Economic and other local factors.

1.7.3.3 Questionnaire validation by means of a pilot study

The questionnaire was initially designed to elicit responses that would address the aim and objectives of the study. A pilot study was conducted using another group of waste pickers in the Komatipoort area. The pilot study involved similar conditions as the envisaged study sample. The feedback from the pilot study participants assisted

the researcher to refine the questionnaire. Thus, unnecessary questions were discarded and some questions were re-phrased to avoid ambiguity and misinterpretation.

1.7.3.4 Language of the questionnaires

The questions were presented to the WPs in English or the language of their choice and then translated for the purpose of evaluation. The chief investigator and the assistant were proficient in the indigenous languages used by the residents and in English and, when language barriers were experienced, they could help in translations to ensure that clear and unambiguous responses were elicited. Nzeadibe's (2008) interviews were also conducted or translated into the language of the WPs to accommodate respondents with low literacy and those who could not speak English.

1.8 Data Analysis and Presentation of the Results

The study collected nominal, ordinal and interval data by means of structured interviews with two strata of waste pickers. These data that pertained to recycling practices were augmented by photographs. The survey data were captured using the Software Package for Social Statistics (SPSS) from a coded structured interview questionnaire for statistical analysis and presentation using figures, tables and graphs. Both descriptive and correlational statistical analyses were performed on different variables based on the type of data that highlighted method preferences and relationships. The collected data were mixed as they presented both qualitative and quantitative data and they were aligned with the expected relationships that were tested among variables (Keller, 2014). The kinds of relationships included documenting and prioritising recycling practices and factors that influenced recycling in the study area. Explanatory analyses in the form of inductive and deductive inferences were used during the synthesis of the study results (Gibbs, 2007; Creswell, 2009).

Most of the data pertaining to the factors that were found to influence recycling in the study area are presented in the form of frequency tables using figures (bar graphs and pie charts) and calculations of central and variable measures of tendencies (descriptive statistical measures). Correlational statistical calculations were also conducted to determine the correlation between drivers of recycling and recycling

performance (e.g., frequency of recycling, quantity of recyclables collected within a defined period and associated income, and different types of targeted recyclable materials).

1.9 Ethical Considerations

The ethical code of standards as required by the Central University of Technology was strictly adhered to and the following aspects are emphasised:

- The confidentiality and privacy of the participants were ensured.
- Consent was obtained in writing from all the participants.
- Each participant is referred to by pseudonym (e.g., Person A or Person B).
- No participants below the age of 18 were recruited for the study.

A standardised consent form was used and ethical clearance was obtained from the university's ethics committee (Annexure E) and the City of Mbombela (Annexure C) before the data collection process commenced.

1.10 Support Staff and Questionnaire Administration

The interviews, observations (photographs) and questionnaires were administered by the chief investigator who was assisted by Mr L. Mokoena, the waste manager (Environmental Health practitioner) from a neighbouring local municipality. The data were captured by the chief investigator through the guidance of a statistician, Maryna Viljoen of Statistics Consulting Services (Annexure D). Data analysis was conducted by Maryna Viljoen of the same company from April 2019 to June 2019.

1.11 Records

During the study, all records (completed interview surveys, statistical data and photographs) were securely stored at the Central University of Technology, Bloemfontein campus.

1.12 Delimitations of the Study

Limitations of this study included the following:

- Data were collected in only three of the four regions of the City of Mbombela Municipality.

- The ideal sample (150 respondents) was not achieved.

The study covered the following:

- Recycling participation included determinants such as socio-economic and demographic factors (age, gender, education and poverty levels, urbanisation, employment, and income).
- Convenience factors as drivers of recycling in the City of Mbombela are discussed under the following: recyclability, availability, accessibility, market and price, operational costs, storage, collection and transportation, distance, availability and accessibility of recycling facilities, unsafe work environment, unhealthy conditions, and intolerance of WPs.
- Incentives as drivers of recycling in the City of Mbombela were discussed under the following sub-topics: (a) Indirect incentives such as legislation or policy, knowledge and awareness, social pressure, and the infrastructure of available recycling facilities. (b) Direct incentives for recycling participation are discussed under the following: socio-economic and financial incentives, recycling incentives offered by the local municipalities, environmental incentives, recycling incentives offered by manufacturing industries, and recycling incentives associated with energy or power generation.

1.13 Structure of the study

The format followed in this document includes a general background and literature review. However, Chapters 2, 3 and 4 are written in article format which leads to duplication of some sections of the introduction and abstracts. Conclusions, discussions, recommendations and references are included in each chapter. The methodology used in the study is described extensively in Chapter 1 as it was only summarised in the articles for the purpose of publication.

This dissertation is organised in the following format:

Chapter 1: General background

The chapter presents a brief background of global and local issues linked with waste management problems associated with population growth, economic development, and the exploitation of natural resources. All these result in the challenge of high volumes of waste generation. High waste generation, particularly in urban areas, puts

pressure on waste management facilities, thus waste picking or recycling activities have become a viable and sustainable solution for this problem.

Chapter 2: Article 1–Determinants of recycling participation in the City of Mbombela municipal regions

This chapter seek to establish those factors that determine participation in waste picking activities in the area of the City of Mbombela.

Chapter 3: Second Article–Convenience and inconvenience factors: Waste picking in the City of Mbombela municipal regions

The chapter investigates a number of convenience and inconvenience factors in waste picking or recycling activities.

Chapter 4: Third Article – Recycling incentives in the City of Mbombela

The study determined the influence of incentives on waste picking participation in the City of Mbombela. Various incentives and stimulants that motivated WPs to participate in recycling are highlighted: legislation and policy, knowledge or awareness, social pressure, good (or poor) infrastructure, socio-economic and financial incentives, incentives offered by local municipalities, environmental incentives, incentives offered by manufacturing industries, and incentives associated with energy or power generation.

Chapter 5: General discussion, conclusion and recommendations

The key findings of this study are summarised in this chapter as related to the research questions (see Chapter 1). The applicability and relevance of the study findings are discussed with reference to the research questions and objectives. Finally, conclusions are drawn and recommendations are offered in combination to provide an overall view of the study findings and to propose the way forward regarding intervention improvements in waste picking activities and suggestions for future research.

1.14 Conclusion

Increasingly high volumes of waste are generated globally due to population growth, economic development, and the ongoing depletion of natural resources. These factors have led to challenges in managing the exponentially growing waste generation rate in cities and towns where waste picking, as an informal waste recycling activity, has become a solution that, if well managed, may be a sustainable alternative to formal waste management in conjunction with landfilling. The literature suggests that the management of successful waste picking practices depends on an understanding of the factors that influence recycling performance (Suttibak and Nitivattananon, 2008). As this practice had already been explored in various parts of South, it was important to determine whether the factors that impacted waste picking that had been identified in the literature also impacted waste picking in the Mbombela area, as this is one of the largest urban areas in this country. Moreover, the study attempted to determine whether any additional or previously unknown factors that were pertinent to waste picking in the City of Mbombela area might contribute to a better understanding of the drivers of waste picking and informal recycling practices. In essence, the study assessed 'convenience' as a factor that drives informal recycling practices and 'inconvenience' as a factor that causes a barrier to waste picking. An attempt was thus made to determine the impact of incentives as a driver of informal recycling activities.

As a general overview of the study, this chapter detailed the study area and the methodology that was employed. Subheadings were used to demarcate the relevant areas of discussion, for example: Description of the study area, Population and sampling, and Research design. The data collection tools and methods were described in detail while the data collection and analysis procedures were also outlined. The discussion clarified the manner in which the respondents were recruited and it was stated that both the principal researcher and a suitably qualified assistant were responsible for the administration of the questionnaire to ethically procure the required data from both landfill and street waste pickers ($n = 146$). The statistical analyses of the data were facilitated by a suitably trained and experienced statistician. Other ethical considerations that were adhered to were also discussed. The delimitations of the study were acknowledged and the chapter was concluded with an outline of the chapters of this thesis and a brief conclusion.

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CHAPTER 2

DETERMINANTS OF RECYCLING PARTICIPATION IN THE CITY OF MBOMBELA AND SURROUNDING AREAS

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ABSTRACT

Introduction: Recycling has become increasingly important to minimise waste challenges that occur worldwide due to population increase and limited resources. Willingness to recycle waste is driven by a wide range of factors that are classified as intrinsic or extrinsic and as being of internal or external origin. Policies, regulations, socio-economics, demographics, unemployment, education, poverty, and the desire to earn a living have been found to be determinants of recycling participation.

Methodology: The study investigated the determinants of recycling participation in the City of Mbombela and surrounding areas. During February to March 2019, the study used the participatory method for data collection. Available waste pickers (WPs) at three landfill sites – Hazyview, Barberton and Tekwane – and those operating in the streets of Hazyview, Barberton and Mbombela (Nelspruit) CBD were recruited. The willing recyclers who signed consent forms were included in the study. Recyclers were interviewed using structured questionnaires, responses recorded by the principal researcher and a trained assistant. A sample size of 149.4 WPs was determined using Yamane's (1967) formula. However, only 146 WPs effectively participated in the study.

Results and discussion: The study found that gender and age were not determinant factors for recycling participation as both genders participated equally. It was also found that the participants' ages ranged from 18 to 84 years and these age groups were represented almost equally in the waste picker groups. The waste pickers in the study area generally had a low level of education, which contributed to unsustainable waste recycling practices. Poverty, unemployment and the need to acquire an income were identified as the predominant determinant factors for waste picking activities in the study area. In general, urban areas and towns attract

immigrants and migrants in search of jobs and thus generate more waste. This in turn results in the high prevalence of WPs in these areas.

Conclusion: The notion that waste picking knows no gender or age was affirmed as both genders of all ages participated equally in waste picking activities at landfills and in the streets of Hazyview, Barberton, and Mbombela (Nelspruit) CBD. Empowering educational and awareness programs are recommended for WPs in the City of Mbombela to assist them in health and safety matters and to ensure waste management sustainability and progressive recycling small businesses. Clearly, waste picking activities have the potential to achieve Sustainable Development Goals (SDGs) 1, 2 and 6 that aim to end poverty and hunger and promote waste recycling, therefore government and local municipality policies should find ways to support or incorporate waste picking initiatives in their waste management plans.

Key words: determinants; participation; recycling; waste pickers; waste picking.

2.1 Introduction

Waste picking has become increasingly important to minimise waste challenges worldwide due to population increase and limited resources. Proper waste management should also address multi-dimensional challenges that are social, economic and environmental in nature. Waste picking may achieve certain objectives such as economic growth and it may reduce raw material costs for local enterprises (Navarrete-Hernandez and Navarrete-Hernandez, 2017). Sandhu et al. (2016) indicate that the informal sector contributes positively to the sustainability of environmental, economic, social and institutional dimensions. In this context, waste picking is a multi-dimensional process that is associated with service provision (waste pickers collect and recycle waste), economic advancement (it provides financial benefits for the disadvantaged) and the reduction of waste volumes (waste picking reduces volumes of waste ending up at landfills which increases the life span of landfills) (Dias, 2016; Rutkowski and Rutkowski, 2015). It has been suggested that waste pickers contribute significantly to waste collection in the city of Johannesburg as about 53% of recyclable glass bottles and 64% of scrap metals are harvested by them and sold to recycling plants (Simatele et al., 2017). Although there is a high drive in many societies to recycle waste and there are large numbers of WPs, the actual determinants of their participation are not clear. The study thus investigated the determinants of recycling participation in the City of Mbombela.

In the context of this study, the term 'recycling' refers to the primary stage of reclaiming waste from waste streams by waste pickers. It is difficult to rate the actions and motives of individuals due to a variety of determinants that usually are not related to waste or environmental protection (Butkus et al., 2018). The willingness of individuals to recycle waste is determined by a wide range of factors that may be distinguished as intrinsic (e.g. a perceived importance of recycling) and extrinsic (e.g., financial incentives such as landfill taxes, deposits, charges and fees) (Remr, 2019). The study thus explored the factors that influence participation in recycling that may be due to internal or external factors.

Machete (2019) identifies and ranks 32 factors that seem to influence recycling. These factors are based on 47 internationally public shed articles. Among the factors identified by Machete (2019) are public policy and legislation, which he ranks highest

as a factor that influences recycling performance. This ranking is supported by Remr (2019), who confirms the need for the introduction of specific policy measures to increase recycling participation. Butkus et al. (2018) also argue that the establishment of environmental regulations is important in the quest to improve municipal waste management and recycling practices. Da Cruz et al. (2013) state that countries such as Germany are forerunners in producer responsibility schemes for the recycling of packaging waste in Europe. Some countries already have national legislation on recycling or recovery of packaging waste. Evidently, policy formulation and environmental regulations can be considered as factors that determine recycling participation.

Theoretical analyses have indicated that the main factors that affect waste sorting habits are infrastructure at municipal level, economic instruments, socio-demographic characteristics, and individual motivation (Butkus et al., 2018). Crociata et al. (2015) observe that the social and economic profiles of communities have become a common priority in predicting recycling participation. This view is supported by Schenck et al. (2016), who iterate that a number of international and South African studies have assessed the social and economic circumstances of waste pickers operating in cities and towns. Thus, research has confirmed that social, economic and demographic factors play an important role in determining participation in recycling.

2.2 Socio-economic and demographic determinants of recycling participation

The socio-demographic variables that are generally related to recycling participation include gender, age, education, and family income (Izagirre-Olaizola et al., 2015). Schultz et al. (1995) observe that the four most reported demographic variables impacting recycling behaviour are age, gender, income and education. However, in this study these variables are clustered as socio-economic and demographic determinants of recycling participation and they are discussed as the four most reported variables associated with waste picking. Seven socio-economic and demographic variables were explored to determine their influence on recycling participation in the area of the City of Mbombela. These variables are age, gender,

level of education, poverty, urbanisation, employment status, and family income. An important finding was that the ages of waste pickers varied extensively.

2.2.1 Age categories of waste pickers

Awopetu et al. (2014) and Yigit (2015) state that people of all ages, including children and the elderly, participate in waste picking. Sasaki et al. (2014) found that 427 waste pickers on site were children aged 15 or younger. They found that even pre-school children were waste picking. According to the DEA (2014), the average age of waste is difficult to determine as WPs' ages range widely from as low as 16 to as high as 83 years. It is thus evident that age does not play a significant role in determining participation in waste picking as children below 16 years have also been found to take part in waste picking activities. Census findings in South Africa (Stats SA, 2011) have indicated that an increased proportion of households is headed by children aged 10 to 14 years. This increased from 0, 27% to 0, 29% and from 0, 18% to 0, 21% for males and females respectively between 2001 and 2011 in the province of Mpumalanga. The finding that children engage increasingly in waste picking may arguably be considered a symptom of the collapse of the socio-economic status of the wider community.

This wide range age phenomenon is not peculiar to South Africa. For instance, Nguyen et al. (2015) established that, in Vietnam, the age of waste picker respondents ranged from 18 to 73 years, with the middle group (25 to 50 years old) accounting for 61.7%. Back in South Africa, a study that was conducted in Pretoria on street waste pickers by Schenck and Blaauw (2011) found that 6% was between the ages of 20 to 30 years old, 22% was in the 31 to 40 years category, 49% was 41 to 50 years old, and 23% was 51 to 60 years old. What emerged clearly from these studies is that youths, middle aged and older people all participate in waste picking. It is notable is that it is predominantly people in the middle age group who participate in waste picking activities. The elderly has a lower participation rate, followed by the youth group which has the lowest participation rate. Conversely, a study on recycling programs that was conducted in Sweden and Bulgaria showed that most of the Bulgarian respondents were young (18 to 24 years old) while the Swedish respondents were generally older (Stoeva and Alriksson, 2017). Butkus et al. (2018) assessed the factors that encouraged sorting of waste at household level and found

that the age of participants ranged as follows: 18 to 30 years (50%) from the population representation of 35%; 31 to 40 years (15%) from the population representation of 20%; 41 to 50 years (14%) from the population representation of 18%; 51 to 60 years (13%) from the population representation of 15%; and over 60 years (8%) from the population representation of 12%. The latter study thus found that, in Sweden, more young people participated in recycling activities than middle aged and elderly people even though the majority of the Swedish population comprises older people (Stoeva and Alriksson, 2017). Based on the inconclusive findings of the above studies regarding the age of waste pickers, it cannot be concluded that a relationship exists between recycling and a particular age group. Rather, the results suggest that certain factors occur at a certain place and at a particular time that influence age groups to take part in waste picking.

2.2.2 The association between gender and waste picking

Both men and women and boys and girls engage in waste picking (Awopetu et al., 2014; McLean, 2000; Schultz et al., 1995; DEA, 2014; Dias, 2016; Chu and Chiu, 2003; Nguyen et al., 2015; Yigit, 2015). A study was conducted by Jafari et al. (2017) to understand the incentives that encourage citizens to participate in e-waste recycling programs. Data collection for the latter study was conducted through direct interviews of 148 Iranian respondents in the Teheran metropolitan area, of which 43 (29.1%) were females and 105 (70.9%) were males. This study proposes that more males than females tend to engage in waste picking activities. Conversely, Butkus et al. (2018) examined the factors that encouraged households to sort waste and recruited 409 heads of households to participate in the survey. These participants consisted of 42% males and 58% females, and the authors suggest that fewer males than females tend to participate in waste picking activities.

However, waste pickers interviewed in the city of Enugu in Nigeria were all male because no female waste pickers were visible during the survey period (Nzeadibe, 2009). Schenck and Blaauw (2011) also found that the majority of street waste pickers in Pretoria was male (97.2%) and that only a limited number (3%) was female, which was similar to the findings of a study that was conducted in Istanbul (Turkey) where the majority of the 24 interviewed waste pickers was men (22) while only a few women worked in the field (Yigit, 2015). Thus three studies conducted in three

different locations found that male waste pickers were more prevalent than females, but the possibility cannot be ruled out that female waste pickers were just not visible at the time and location when the studies were conducted.

In contrast with the three studies (Enugu in Nigeria, Pretoria in South Africa and Istanbul in Turkey), a study on recycling programs conducted in Sweden and Bulgaria found that it was mainly women who participated in waste picking (Stoeva and Alriksson, 2017). Subbo and Moindi (2008) also observed that women waste pickers in Kisumu (Kenya) played a vital role in conserving the environment. The results of a cross-country comparative analysis study on internal determinants of the recycling behaviour of university students revealed that male students were less likely to recycle than female students (Izagirre-Olaizola et al., 2015). The authors cited above argued that the gender difference could have resulted from the specific study area and the sampled groups, and their findings pertaining to the association between gender and waste picking or recycling activities were thus inconclusive. It was suggested that representatives of a particular gender might have been less willing to participate in the study or that other factors such as the educational levels of the waste pickers could have been contributing factors to participation or abstinence.

It is thus evident that gender does not seem to be a determining factor in recycling participation, as males and females of varying frequencies were found to be taking part in waste picking activities. This view is supported by research by Izagirre-Olaizola et al. (2015) on the socio-demographic determinants of recycling participation. These latter authors suggest that a weak relationship exists between gender and recycling behaviour.

2.2.3 Education levels of waste pickers

The literature suggests that a relationship exists between low education level and recycling participation. According to Yigit (2015), 50% of the waste pickers who participated in a study in Istanbul (Turkey) had a primary education, while 20.8% had reached middle school level, 20.8% had reached high school level, 4.2% had attained university level, and only 4.2% had no formal education at all. The DEA (2014) also found that almost two-fifths (39%) of waste pickers had attended but not completed secondary school, a similar proportion (40%) had attended primary school, and 15% had no formal education. Only a small proportion (7%) had graduated at Grade 12 or

higher level. These findings are similar to those of Sasaki et al. (2014), who found that over 60% of the waste pickers participating in their study was elementary school dropouts. It was evident that about 50% of the waste pickers had attained lower school education levels while 40% had reached high school, and the remaining 10% had either college or university degrees or no education at all.

In contrast with the findings of various authors such as the DEA (2014), Yigit (2015) and Sasaki et al. (2014), Butkus et al. (2018) observed that the educational levels of 409 respondents who responded to questions on household waste sorting were as follows: 10% had a secondary school education, 21% had a vocational school diploma, and 69% had higher education qualifications. Another study that focused on factors influencing household waste recycling behaviour that was conducted in Taiwan found that the respondents who were surveyed regarding waste management practices were better educated than adults in Kaohsiung generally were, with 31.6% of the respondents having completed college or higher degrees (Chu and Chiu, 2003). Stoeva and Alriksson (2017) report that an assessment of recycling programs that was conducted in Sweden and Bulgaria showed that the respondents in both groups were studying towards their first tertiary qualification (Bachelor programs) in the natural sciences field. The latter study found that the lowest percentage of participants had a secondary school education while the majority of the participants who engaged in recycling practices was highly educated and, probably due to their studies, highly sensitised to the need for recycling. Nguyen et al. (2015) also found that the highest percentage (53.9%) of their sample (participants who supported recycling) held degrees.

Mwanza and Mbohwa (2017) argue that education is amongst the twelve factors that influence sustainable recycling of MSW in developing countries. Izagirre-Olaizola et al. (2015) propose that students who have a higher level of knowledge about current environmental problems are more likely to participate in recycling programs, while Sidique et al. (2009) argue that educating the public increases the recycling rate. Schenck et al. (2016) compared the educational levels of two waste picker groups (street and landfill) and found that landfill waste pickers (LWPs) generally had a better schooling track record than street waste pickers (SWPs). The latter study proposes that landfill waste pickers (LWPs) have more opportunities to be involved in recycling than their street waste picker (SWPs) counterparts.

However, Nzeadibe (2009) states that, although informal sector waste workers are often uneducated, they possess skills that are directly related to waste recycling as well as to the location of markets and potential customers for waste buy-back. The importance of education in the recycling phenomenon is underscored by the South African government's commitment, through the Department of Higher Education and Training, to expand training programs that meet the need for skills development and that contribute to the ideal of a 'green economy' by ensuring that the requirements for a green economy are met (EDD, 2011).

Based on information from the literature, Figure 2.1 illustrates the association between education and waste picking/recycling.

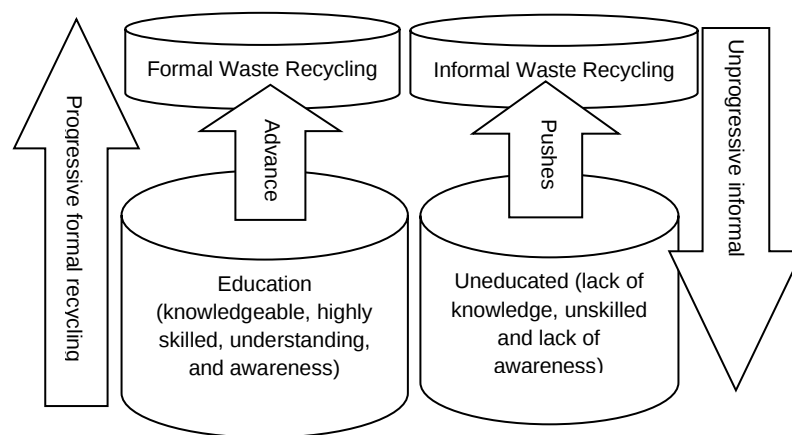


Figure 2.1: Conceptual framework of the influence of education on waste picking

Source: Author

Figure 2.1 illustrates the conceptual framework that indicates how high education levels can influence progressive formal and sustainable recycling, versus how low education levels can influence non-progressive and unsustainable waste recycling. Viljoen et al. (2016) argue that low levels of schooling and limited language proficiency, amongst others, make it difficult for waste pickers to move upwards in the hierarchy of the informal economy.

2.2.4 Poverty alleviation

In 2002, an estimated 13.5 million South Africans experienced hunger. This figure dropped to 6.8 million in 2017 and, in 2019, it dropped to approximately 1.7 million households across the country (Stats SA, 2019). In Nigeria, Awopetu et al. (2014)

found that 60% of Nigeria's population was below the poverty line at the time of their study and that people were driven by poverty and the desire to earn a living to become waste pickers. Schenck and Blaauw (2011) argue that poverty and hardship result in unemployment and that this forces many to venture into the informal economy in urban settings in order to survive. Clearly, a high unemployment rate causes people to live in poverty and many people, often regardless of a high education level, then resort to informal waste picking to alleviate poverty and hunger.

Informal recycling activities contribute towards poverty alleviation (Nzeadibe, 2009). For instance, Subbo and Moindi (2008) found that discarded polythene bags were used by groups of women in Kisumu (Kenya) to make ropes to sell and in this way, they earned an income that reduced their poverty. In Colombia, in the Bogota municipality where irregular waste collection services were the norm, waste pickers took advantage to provide this service and they then harvested waste which they reused and sold to earn an income (Dias, 2016). Rutkowski and Rutkowski (2015) and Nzeadibe (2008) also found that WPs were service providers who collected and recycled urban waste as source of income for the disadvantaged. Nguyen et al. (2015) also found that in Hanoi (Vietnam), 23% of their sampled participants voluntarily saved recyclable waste which they gave to the poor or to waste collectors as a commodity and a source of livelihood. Evidence from the literature has thus demonstrated that waste picking contributes to livelihood and poverty alleviation.

2.2.5 Urbanisation and waste picking and recycling practices

A study that was conducted in Rangpur in Bangladesh found that urbanisation led to population growth and a concomitant increase in solid waste (Rakib et al., 2014). Yigit (2015) argues that urbanisation causes the population to generate more waste which adds to the inability of municipalities to deal with the management of expanding volumes of waste. Mwanza and Mbohwa (2017) also state that urban populations continue to increase which results in higher resource consumption with increased waste generation. While Rakib et al. (2014) and Yigit (2015) link urbanisation with population growth that results in increased waste generation, Mwanza and Mbohwa (2017) argue that there is another step between population growth and waste generation which is the high consumption of resources. The latter authors argue that there is a strong association between urbanisation, population growth and high

resource consumption rates by an economically active population. However, the literature collectively suggests that this association is negative when the consumption rates of resources are exacerbated by a large population that is economically inactive and thus paralyzed by poverty.

Most economically active populations are found in urban areas (DEA, 2014). For instance, Rakib et al. (2014) state that income levels and consumption rates in Rangpur city coincide with people's lifestyles which are linked to waste generation rates. The two studies referred to above have revealed that urban populations are mostly economically active and have high levels of income. As a result, there is often a higher waste generation rate per person in urban areas than in rural areas due to the availability and affordability of consumables. Thus the association between urbanisation and waste generation may be expressed as:

Urbanization → high population → high income/economically active → high resource consumption → high rate of waste generation → high pollution.

Because urban areas and cities generate high volumes of waste that are deposited at landfill sites, waste pickers migrate from their rural villages to cities to look for recycling opportunities. Awopetu et al. (2014) and the DEA (2014) found waste picking taking place in many cities of developing countries due to the abundance of recyclable waste at dump sites. For instance, prior to 2014, waste generation rates in Rampur had increased by around 40% for plastic, 30% for paper, 10% for glass and 20% for iron and these increases resulted in rural people migrating to this city in large numbers (Rakib et al., 2014). Mclean (2000) argues that if waste collectors remain in a city, it may be assumed that they are generating a higher income than what they did in their home villages. According to Muzenda (2013), the City of Tshwane had an influx of waste pickers in 2000 when the city fathers initiated a project to train over 1000 waste pickers at landfill sites. This attracted numerous waste pickers who hoped to make a better living for themselves and their families.

It is undeniable that urbanisation and industrialisation lead to a straight-line approach in human consumption where unwanted items are disposed at landfills (Stoeva and Alriksson, 2017). The urban solid waste generation rate has thus become an issue of concern in developed and developing countries (Rakib et al., 2014). As people in urban areas consume high volumes of resources and generate high volumes of waste that end up on landfill sites, this has resulted in the evolution of waste pickers who view waste as a commodity and dump sites as their mining areas. According to

the DEA (2014), the high rate of uncollected waste in cities has led to the emergence of 'the waste picker generation'. Yigit (2015) concurs with this view and argues that, because of the high waste generation rate in urban areas, waste pickers take advantage of inadequate formal waste management programs by collecting useable and renewable materials from the streets.

It is evident that waste pickers have become a solution for the growing problem of high rates of waste generation in rural areas and cities, especially in those areas with inadequate waste removal and disposal services. As a result of this phenomenon and the legislative demands to reduce waste generation and landfilling, PIKITUP initiated drop-off facilities around the City of Johannesburg for residents to dispose of unwanted equipment or gadgets like electronic appliances in order to reduce high volumes of waste at landfill sites (Muzenda, 2013). Also, in response to the potential health threats posed by the waste generated by the municipal market, the Tonney Red Women's Group in Kisumu, Kenya, diversified its activities to include waste management by placing bins at strategic market points. These bins are clearly marked for sorting various waste types for reuse and recycling (Subbo and Moindi, 2008). Clearly, as waste sorting initiatives provide solutions for high waste volumes, they also address social, economic and other environmental problems while creating employment opportunities.

2.2.6 Employment opportunities

Economic pressure due to demographic and economic challenges result in the reduction of much needed work opportunities which, in turn, lead to unemployment and poverty for many people (DEA, 2014). The June 2019 quarterly employment survey reported that an estimated 2000 of the 10 174 000 people employed in the formal non-agricultural sector of the South African economy lost their jobs. Full time employment decreased by 26 000 to 9 103 000 while part time employment increased by 24 000 (Stats SA, 2019). Thus, waste picking or recycling by waste pickers occurs mainly for employment reasons as there is a continuous decline in employment opportunities for the growing population in the country. McLean (2000) predicted twenty years ago that, due to the high levels of unemployment in South Africa, the number of people working in waste recycling as an alternative income generating activity would increase. Evidently, high unemployment rates in the formal economy

increase self-employment opportunities such as waste picking in the informal economy.

The commodity known as waste materials has significant business and entrepreneurial potential that may result in economic growth as it creates employment opportunities for unemployed people through recycling initiatives. Waste management – and especially recycling – provides significant opportunities for small enterprises aimed at beneficial re-usable waste resources (Economic Development Department, 2011). Machete (2019) argues that the role of municipal supply chain management systems is a potential instrument for municipal use to grow the local economy and to create sustainable local recycling industries. Schenck (2016) proposes that South Africa's informal economy based on waste picking has become a place where a significant number of people are trying to make a living in urban areas. Nzeadibe (2009) also argues that recovered waste materials contribute towards job creation and that this solves many of cities' solid waste disposal problems. Awopetu et al. (2014) discovered that solid waste picking was the main occupation for Nigerian communities at the time of their study. The Nigerian government and businesses are thus committed to the employment of young people through green economic activities such as recycling (Economic Development Department, 2011). It is evident that waste recycling does not only address waste problems but has the potential to reduce the unemployment rate through job creation and informal economic activity.

2.2.7 Income generation

Waste picking as a form of waste recycling occurs mainly for the purpose of generating income by unemployed people and for complementing low salaries earned by employed members of a family as well as pensioners who receive a limited grant by the government. It was found that more than 60% of waste pickers sorted waste for the purpose of income generation (Nguyen et al., 2015). Awopetu et al. (2014) concur that dumpsite workers, truck drivers and other people pick up usable waste and sell it to complement their salaries. Sasaki et al. (2014) state that some learners help their parents after school to collect recyclables at least once or twice a week to make extra money. This supports the notion that income generation is a

factor that drives recycling participation by different categories of people in the community.

Based on the findings of their studies, Nzeadibe (2009), Subbo and Moindi (2008) and Schultz et al. (1995) argue that income is derived from selling recovered waste materials and products made from recyclables. In Colombia, the Bogota municipality launched a payment scheme to remunerate waste pickers for their waste picking services in addition to what they can earn by selling materials at market prices (Dias, 2016). In Plovdiv in Bulgaria there are 22 buyback centres that are operated by private entrepreneurs who pay people for various recyclable items (Stoeva and Alriksson, 2017).

Clearly, opportunities exist in different countries for waste pickers to trade waste as a commodity and generate income. It is also clear that in some countries, the municipalities acknowledge the work done by waste pickers who contribute towards cleaning the streets. Moreover, even though waste pickers earn an income from selling the recyclables they pick up, some municipalities provide additional income for them through a waste recycling remuneration scheme.

2.3 Research Methodology

The study was conducted in the City of Mbombela which is situated in the north-eastern part of South Africa. The City of Mbombela Local Municipality is a Category B municipality in Mpumalanga Province and is located in the Ehlanzeni District (City of Mbombela, 2020). The municipality is one of the four municipalities in the district, making up nearly a third of the district's geographical area (City of Mbombela, 2020). The City of Mbombela was established by the amalgamation of the Mbombela local municipality and Umjindi local municipality in August 2016 (City of Mbombela, 2020). In 2020 the estimated population was approximately 711 776 people. Mbombela (previously Nelspruit) is the capital of the Mpumalanga Province. Mbombela is a SiSwati word meaning 'a lot of people together in a small space' (City of Mbombela, 2019).

The City of Mbombela covers an area of 7 141km² and accommodates the following cities/towns: Barberton, Emoyeni, Entokozweni, Hazyview, Kaapschehoop, Kabokweni, Kanyamazane, Luphisi, Matsulu, Mbombela, Mpakeni, Msogwaba, Ngodwana, Skukuza, Tekwane, and White River (City of Mbombela, 2020). These

study purposefully selected towns or areas where landfill sites are located namely the one outside Mbombela (Nelspruit) known as Tekwane West Landfill site, Hazyview landfill site outside Hazyview town, and Barberton landfill site outside Barberton town. The selected landfill sites are situated in three of the four regions of the municipality (Figure 1.1): Hazyview landfill (northern region), Tekwane West landfill (central region) and Barberton landfill (southern region) as indicated with a blue star on the map.

Waste recyclers at landfill sites as well as street waste pickers (often called pickers or informal recyclers) constituted the population of the current study. However, as the number of such people is large and they are often inaccessible, the current study focused on recyclers called pickers because they are primary waste collectors. In studies of this nature, Keller (2014) advises that a reasonable proportion of a population should be selected as representative of the entire population. It was impossible to determine the total population of recyclers because of the informal nature of waste picking activities (Machete, 2017). However, the DEA (2011) estimates that there is an average of 128 trolley pushers (or street pickers) in every category B1 municipality of South Africa and 37 landfill pickers per municipal landfill site. The estimated average population of landfill pickers was 111. It was thus estimated that the total population of the current study was $N = 239$, and that this figure was comprised of two types of recyclers, namely street and landfill waste pickers.

Data were collected from February to March 2019. A participatory method of data collection was used to understand the challenges that the waste pickers faced (Simatele et al., 2017). Convenience sampling was used to select the respondents as every waste picker at the landfill sites and in the streets who was available at the time of data collection was approached and, if willing to participate, they were informed of the purpose of the study and requested to sign a consent form. The questionnaires were completed in writing by the chief investigating officer and the assistant as not all WPs could read and write. Kasinja and Tilley (2018) state that such structured questionnaires may be administered to waste pickers for data collection. In some instances, snowball sampling was used to recruit street waste pickers as originally recruited waste pickers provided the names of other street waste

pickers who were visited in their homes, on the streets and at buy-back centres where they were recruited for data collection (Kasinja and Tilley, 2018).

The process was to approach the WPs one by one for interviews and, when they complied, the investigators completed the questionnaires. Szolnoki and Hoffmann (2013) support the use of face-to-face structured interviews because they help to avoid spoilage or incomplete questionnaires. The LWPs were better organised than the SWPs as they had representatives on site to whom the purpose of visit was first explained. After each presentation, time for questions and answers was allowed. The WPs went back to their waste sorting stations and were approached one by one for interviewing and the completion of the questionnaires. Kasinja and Tilley (2018) also approached and interviewed WP upon observing them recovering materials from streets, households and open dumps. The advantage of the structured questionnaire was that it assisted the investigators to stick to the objectives and not to deviate in any way (Subbo and Moindi, 2008).

The sample size of 149.4 landfill and street waste pickers was determined by using Yamane's (1967) formula. The ideal was to recruit 150 waste pickers in the selected study area (Hazyview landfill and streets, Tekwane landfill and streets in its vicinity, and Barberton landfill and streets). Although the ideal sample of waste pickers was 150, only 146 waste pickers effectively participated in the study.

2.4 Results and Discussion

The results showed that the ages of the 146 waste pickers who participated varied from 18 years to older than 50 years. The gender representation was 50% male and 50% female. School education levels were: 14% with no schooling background, 30% primary school level, 54% secondary school level, 1% diploma/degree level, and 1% unclassified level of education. Eighty-six percent (86%) of the waste pickers engaged in waste picking for income generation, as a job opportunity, and for the eradication of poverty and hunger. The results showed that 96% of the waste pickers resided in the three towns in the City of Mbombela region while the remaining 4% resided either in the Bushbuck Ridge local municipality or the Nkomazi local municipality areas. In terms of nationality, 85% of the respondents was South African, 14% was Mozambican, and 1% came from the Kingdom of eSwatini. The results showed that 88% was unemployed, 2% was students, 5% was pensioners, and 5%

was otherwise employed. A relatively high rate of the waste pickers (30%) received a grant from the government.

2.4.1 The age profile of the respondents

Figure 2.2 presents the WPs' age profile. The response rate to the question of age was not 100% (145 or 99.32%) because one respondent did not respond. According to the results, the WPs were categorised into four age groups: 29 years and younger (25.5%), 30 to 39 years (23.5%), 40 to 49 years (24.1%), and 50 years plus (26.9%). The ratios among the four age groups of WPs showed no clear difference. This means that nearly all age groups participated in the study equally and that almost an equal number of WPs from each age group picked waste. It was also noted that the age group of 50 years and older had the highest representation, as shown in Figure 2.2. This may have been due to the wider scope of this age group as it included WPs of 50 up to 84 years of age. It is thus noteworthy that the study found that people of various age groups, from 18 to 84 years, participated in waste picking activities.

These findings are similar to the findings of the DEA (2014), which found that the ages of waste pickers ranged very widely from as low as 16 to as high as 83 years old. In Rangpur City (Bangladesh), Rakib et al. (2014) observed that the respondents' ages ranged from 20 to 45 years for males, 18 to 35 years for females, and 8 to 14 years for children, while Schenck et al. (2016) found that waste picking in Free State Province (South Africa) had no age limit as it arose from the need to find a source of income where other jobs were scarce. The relatively low average age of waste pickers in Bangladesh was a result of the participation of 2% children, who are amongst the marginalised groups engaging in labour and recycling activities (Rakib et al., 2014).

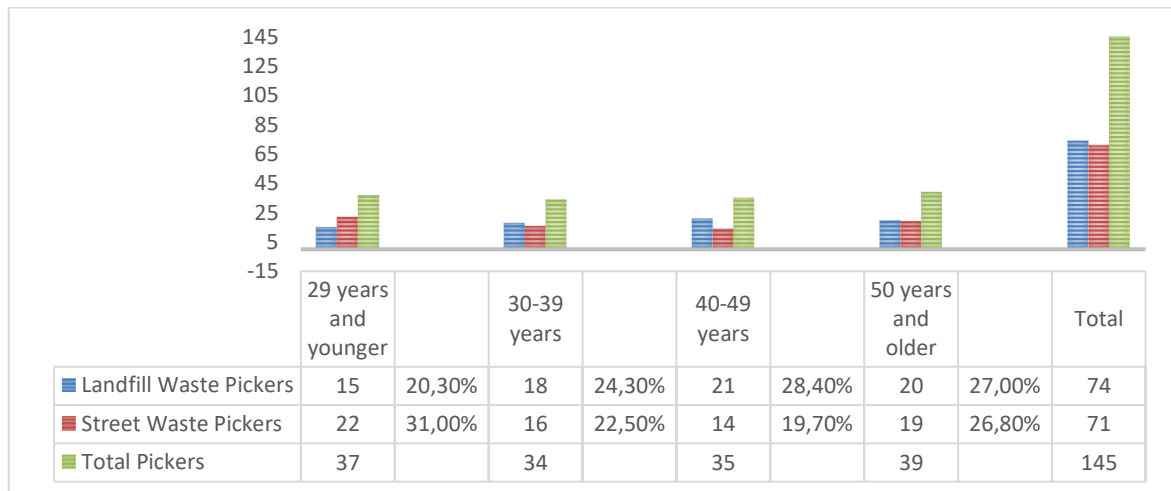


Figure 2.2: The age profile of the respondents

Table 2.1: Statistical analysis on age groups

Statistic	DF	Value	Prob
Chi-Square	3	2.8067	0.4224
Likelihood Ratio Chi-Square	3	2.8231	0.4197
Mantel-Haenszel Chi-Square	1	1.0991	0.2945
Phi Coefficient		0.1391	
Contingency Coefficient		0.1378	
Cramer's V		0.1391	

2.4.2 Gender

The data presented in Figure 2.3 indicate a total balanced gender distribution ratio of 73 (50%) male WPs and 73 (50%) female WPs from the total sampled participants of 146 (100%). A similar 50:50 gender split was also observed by the DEA (2014). However, the results showed that there were more females (57.3%) working at the landfill sites than on the streets (42.3%), while there were more males (57.8%) on the streets than at the landfill sites (42.7%). These observations support the findings by Schenck et al. (2016) who reported that women preferred to collect waste at landfill sites where they felt safer than on the streets. An almost equal gender split of 48.3% female and 51.7 % male from a sample of 410 LWPs was reported by Schenck et al. (2016). However, Moleko (2019) reported that in six towns in the Matjhabeng

Municipal area in South Africa (300), the majority of the respondents who were involved in waste picking was female. This finding may be attributed to the fact that, in most societies, women are responsible for domestic work and taking care of their husbands and children (South African Civil Society Information Service [SACSIS], 2010). A 2012 Matjhabeng population census indicated that there were more female than male residents (Matjhabeng Local Municipality, 2012) and this trend may have persisted and contributed to the study findings by Moleko in 2019. Matjhabeng is one of the six municipal areas in the Free State Province of South Africa.

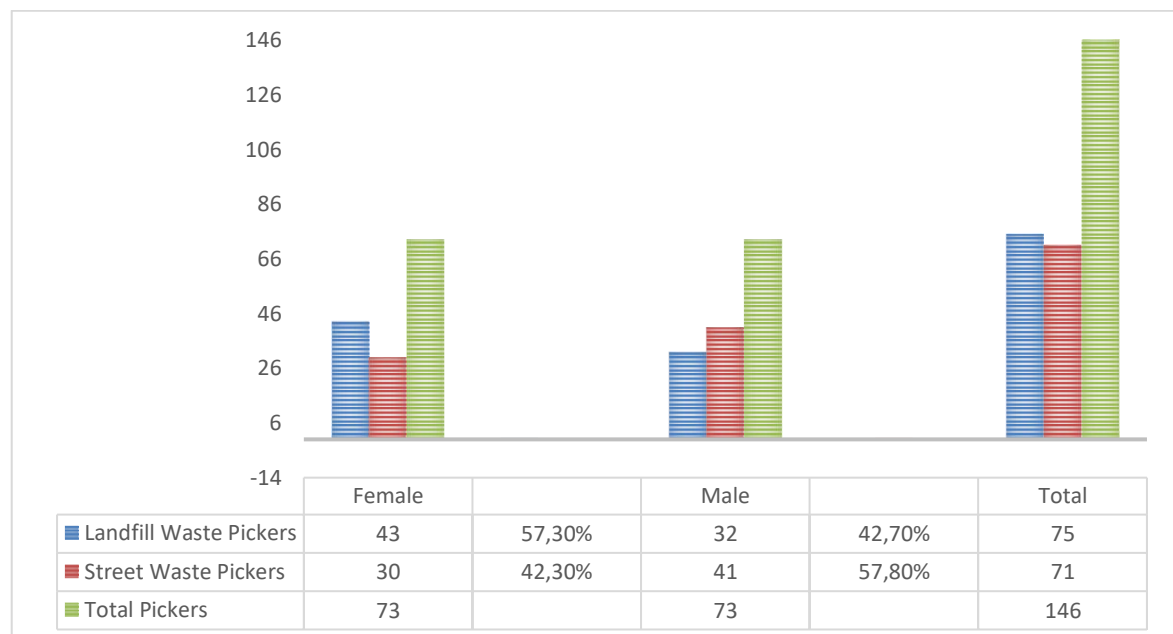


Figure 2.3: Gender distribution of waste pickers

2.4.3 Level of education

Table 2.1 shows that 10 (13%) of the LWPs versus 11 (15%) of the SWPs – and thus a total of 21 (14%) waste pickers – had received no schooling. One (1%) of the LWPs and 1 (1%) of the SWPs for a total of 2 (1.4%) waste pickers held a diploma or a degree. Combined, the waste pickers' educational levels are summarised as follows: 21 (14.4%) had no schooling background, 44 (30.1%) had a primary school education, 78 (53.4%) had a secondary school education, and 2 (1.4%) had a high level of education (diploma/degree), while 1 (0.7%) was unclassified. The results are presented in Table 2.2.

Table 2.2: Educational levels of LWPs and SWPs

	LWPs	SWPs	Total
Unclassified	1(1.3%)	0 (0%)	1
No schooling	10(13.3%)	11 (15.5%)	21
Grade 0-4	13 (17.3%)	6 (8.5%)	19
Grades 5-7	17 (22.7%)	8 (11.3%)	25
Grades 8-10	20 (26.7%)	25 (35.2%)	45
Grades 11-12	13 (17.3%)	20 (28.2%)	33
Diploma	1 (1.33%)	0 (0%)	1
Degree	0 (0%)	1 (1.4%)	1
Total	75	71	146

The data pertaining to the education levels of the respondents in this study relate closely to the finding of the DEA (2014) that almost 39% WPs had not completed secondary school, that 40% had a primary school education, and that 15% had no formal education. A survey conducted at the Jos Plateau State in Nigeria found that, although the awareness of e-waste among the respondents was relatively high (67.5%), many (73%) did not have detailed knowledge and proper education on waste handling (Miner et al., 2020). Moleko (2019) reported the educational demographics into three categories: primary (grades 1-7), secondary (grades 9 – 12), and tertiary (post grade 12). The primary, secondary and tertiary education levels of the respondents were 56, 191 and 48 respectively (Moleko, 2019). Sound knowledge and awareness of waste disposal and recycling strategies are essential to ensure safe disposal, re-use and recycling (Miner et al., 2020).

Table 2.3 shows a P-value of 0.1473. The P-value is therefore greater than 0.05, indicating that there is no statistical significance between the education levels of the LWPs and SWPs.

Table 2.3: Statistics for education levels of waste pickers

Statistic	DF	Value	Prob
Chi-Square	7	10.8055	0.1473
Likelihood Ratio Chi-Square	7	12.1044	0.0972

2.4.4 Poverty alleviation

Figure 2.4 shows that the response rate by WPs regarding their reasons for engaging in waste picking was good, as the data from all the questionnaires (146 or 100%) could be processed. The majority of the WPs (85.6%) indicated that they picked waste to generate income, as a job opportunity, and to eradicate poverty and hunger. Only (8.2%) WPs stated that they wanted to clean the environment, help clean the community, and protect animals (fauna). Some waste pickers just enjoyed waste picking. The third highest response rate (4.1%) was for those doing waste picking to support or provide for their families. This response relates very closely to the main reasons that many WPs provided such as generating an income, seeing it as a job opportunity, and eradicating poverty and hunger. Therefore, people engaged in waste picking activities for poverty alleviation, which is a finding that relates to achieving Sustainable Development Goals (SDGs) 1 and 2 (United Nations, 2015).

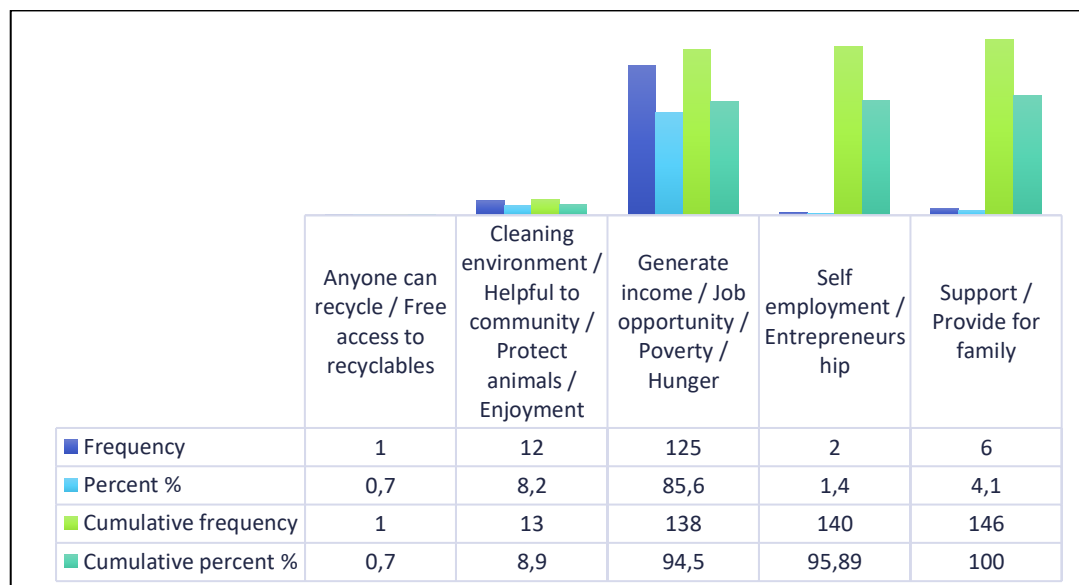


Figure 2.4: Reasons for engaging in waste recycling

2.4.5 Urbanisation

2.4.5.1 The distribution of WPs across the study site

The availability of waste in urban areas causes waste pickers to migrate to these areas as here they have access to recyclable waste materials that may earn them an income. Figure 2.5 indicates the operational distribution of waste pickers in the three selected towns (Hazyview, Mbombela and Barberton) that are all administered under the City of Mbombela municipality. Each town has a landfill site. Figure 2.5 shows that the sample of LWPs that was recruited at each landfill site was relatively equally distributed among the three sites: 18% at the Tekwane landfill site outside Mbombela CBD, 16% at Hazyview landfill site, and 16% at the Barberton landfill site. It is noteworthy that a slightly higher number of people could be sampled at Tekwane landfill site, which was not surprising as this is the main landfill site servicing the City of Mbombela. Although it was originally envisaged that the samples for each landfill site would be the same, more waste pickers could be recruited at Tekwane landfill site than at the Hazyview and Barberton landfill sites.

A relatively similar recruitment trend resulted for the street waste pickers (SWPs): 17% for Mbombela (Nelspruit) CBD, 17% for Hazyview, but only 14% for Barberton. It was originally envisaged that 25 (17%) respondents would be recruited for each group in each region, but only 21 (14%) SWP respondents could be recruited in the streets of Barberton. This resulted in a total of 146 instead of 150 respondents. It was evident that the bigger towns had higher waste generation that resulted in a higher number of waste pickers. It was evident that the bigger towns had higher waste generation that resulted in a higher number of waste pickers.

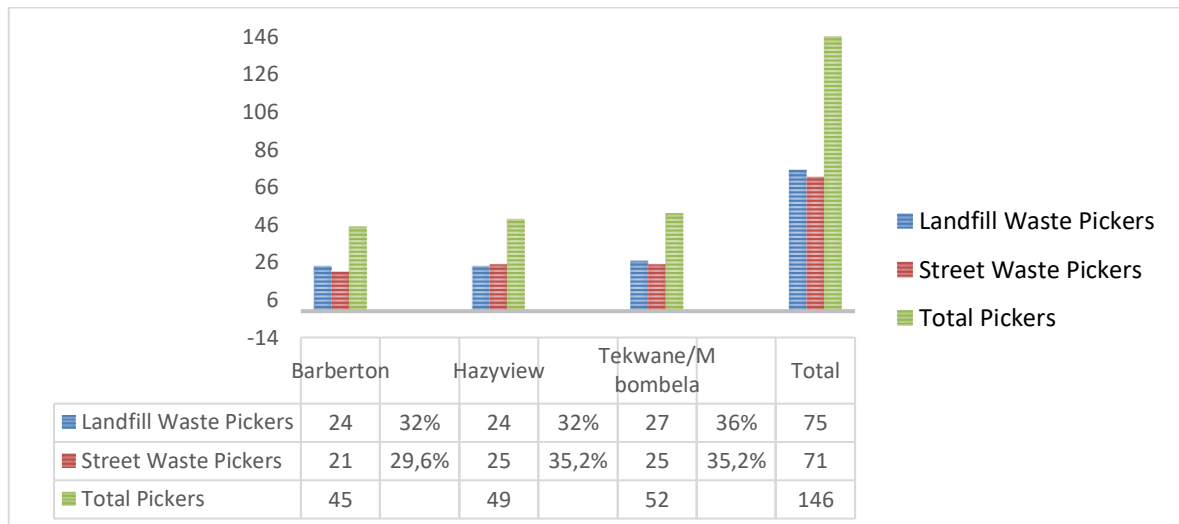


Figure 2.5: Sample of percentage of waste pickers per city/town under study

2.4.5.2 Residential distribution of waste pickers

Figure 2.6 indicates that 34.7% of LWPs and 31% of SWPs resided in residential areas surrounding Mbombela CBD and its landfill site, while 30.7% of the LWPs lived in villages surrounding Hazyview town and its landfill site. A bit more than 30% (30.7%) of the WPs resided in areas surrounding Barberton town and its landfill site while the remaining 4.2% resided in neighbouring municipal areas such as Bushbuck Ridge and Nkomazi from where they commuted to pick waste at the landfill sites in the Mbombela area. Some WPs thus migrated from one local municipality to another where there would be an abundance of waste and access to waste picking.

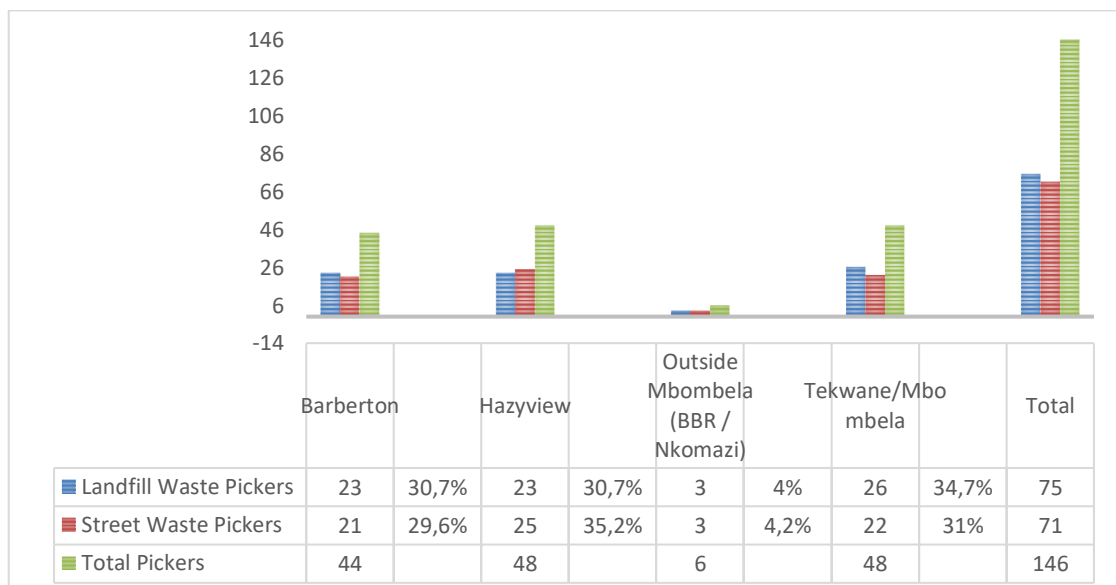


Figure 2.6: Residential distribution of waste pickers

2.4.5.3 Nationality

Figure 2.7 shows that 78.7% of the LWPs versus 93% of the SWPs was South African, 20% of the LWPs versus 7% of the SWPs was Mozambicans, and 1.3% of the LWPs versus 0% of the SWPs were from the Kingdom of eSwatini. About 14% (14.4%) of the WPs had migrated from neighbouring countries to the City of Mbombela in search of work, but they ended up doing waste picking as it was the only available income generating opportunity. Some WPs indicated that they were doing this work because it did not require any documentation and they had free access to an income generating opportunity (Figure 2.4). It is surmised that migration may have been more prevalent than the recorded 14.4% as not all the WPs felt comfortable to disclose their nationalities and no identity documents were verified.

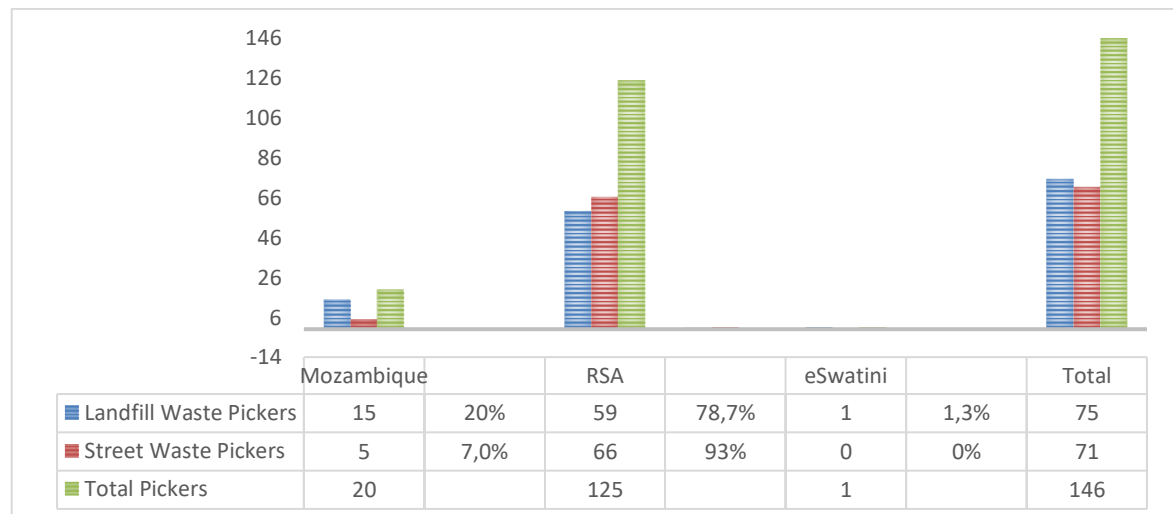


Figure 2.7: Citizenship of the waste pickers

2.4.6 Employment status

Figure 2.8 indicates that 94.7% of the LWPs versus 81.7% of the SWPs were unemployed, while 1.3% of the LWPs versus 2.8% of the SWPs were students. Also, 2.7% of the LWPs and 7% of the SWPs were pensioners, and only 1.3% of the LWPs and 8.5% of the SWPs were employed. Of the unemployed WPs, 94.7% of the LWPs and 81.7% of the SWPs resorted to waste picking as a source of income as they could not find jobs, while the students (1.3% LWPs and 2.8% SWPs) engaged in waste picking to make extra pocket money. Figure 2.4 also indicated that “generating income/job opportunity/eradicating poverty or hunger” were the major reasons for waste picking activities of 85.6% of the WPs. Evidently, not only the unemployed and

students engaged in waste picking, but pensioners also participated in this activity to complement their monthly income. Almost 2% (1.3%) of the LWPs and 8.5% of the SWPs were employed but chose to augment their income by means of waste picking, which may suggest that waste picking or recycling was either lucrative, or that their income was below the breadline and they needed to augment it to feed their families. Rakib et al. (2014) also established that recycling and waste collection created job opportunities for people migrating to Rangpur city from rural areas, while Dias (2016) also found that WPs generated income for themselves and others.

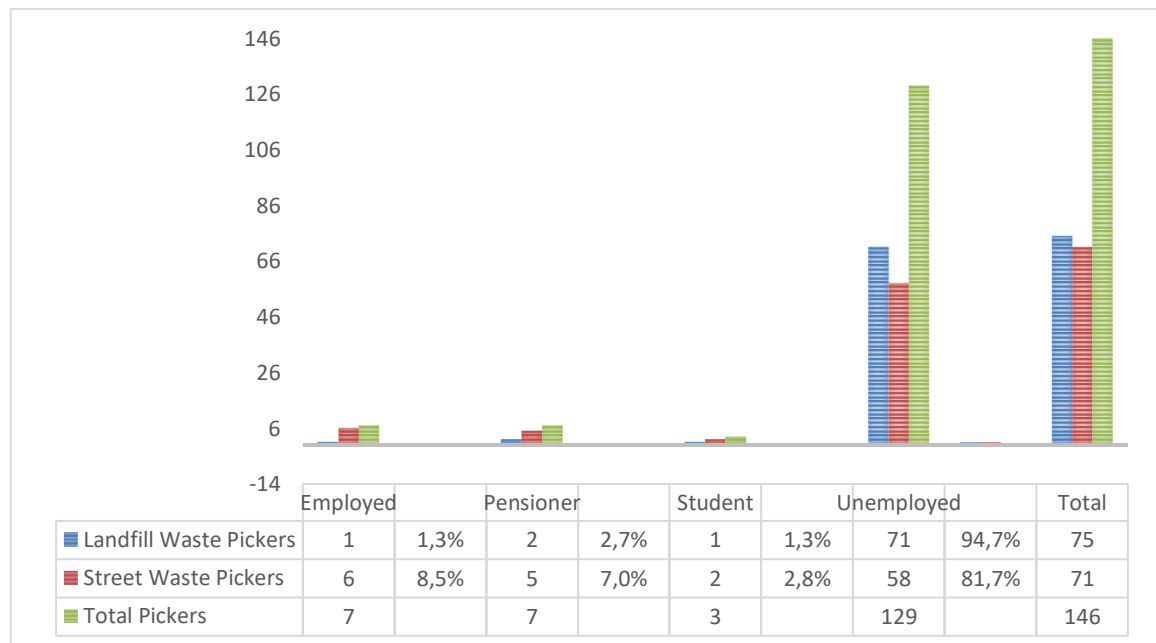


Figure 2.8: Employment status of the respondents

2.4.7 Waste pickers' sources of income

The WPs were asked to respond either 'yes' or 'no' to determine whether they were receiving any form of government grant or not. Figure 2.9 indicates that, of a total of 146 WPs, only 33.8% of the SWPs and 26.7% of the LWPs received some form of a grant, while 66.2% of the SWPs and 73.3% of the LWPs received no grant at all. It is clear from Figure 2.9 that most of the WPs (66.2% SWPs and 73.3% LWPs) were not getting any grant. This could be a key reason why these people engage in waste picking as it was their primary source of income. The results are consistent with those of Dias (2016), who also found that waste picking in Pune was the main source of household income for 85% of WPs. In Nakuru, waste picking was the sole source of income for 80% of WPs while it was the sole source of household income for 66% of

WPs in Belo Horizonte, 59% of WPs in Durban, and 34% of WPs in Bogota (Dias, 2016).

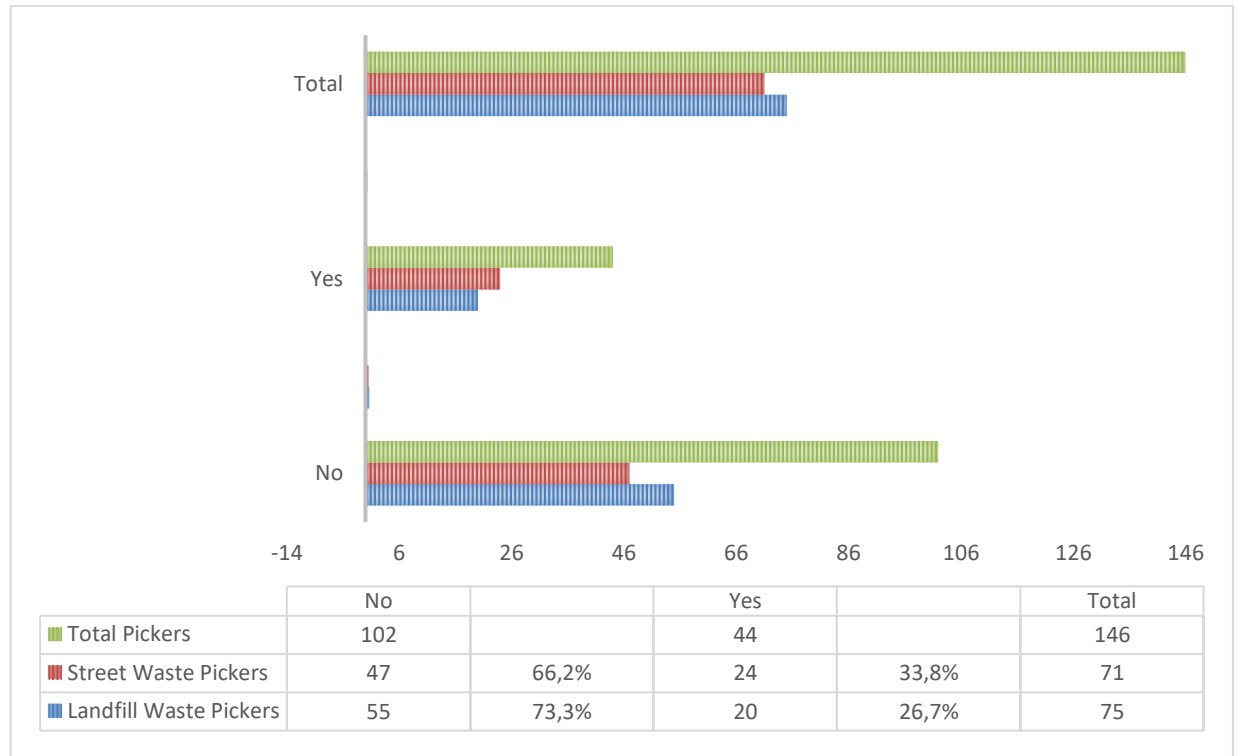


Figure 2.9: Waste pickers receiving government grants

The WPs who received grants were also asked to specify the type of grant they received. Figure 2.10 shows that among the WPs who received grants, 85% of the LWPs and 62.5% of the SWPs received a child support grant, which might have been inadequate to support families if it was the only source of income. This could have been a reason why these individuals resorted to waste picking as they needed to generate a supplementary income. Old age grants were received by 10% of the LWPs and 25% of the SWPs, whereas a disability grant was received by 5% of the LWPs and 8.3% of the SWPs. In the last category, only 4.2% of the SWPs received a grant in aid. All these grants may have been too little to support families as all these categories of WPs engaged in waste picking mainly for income generation to support their families.

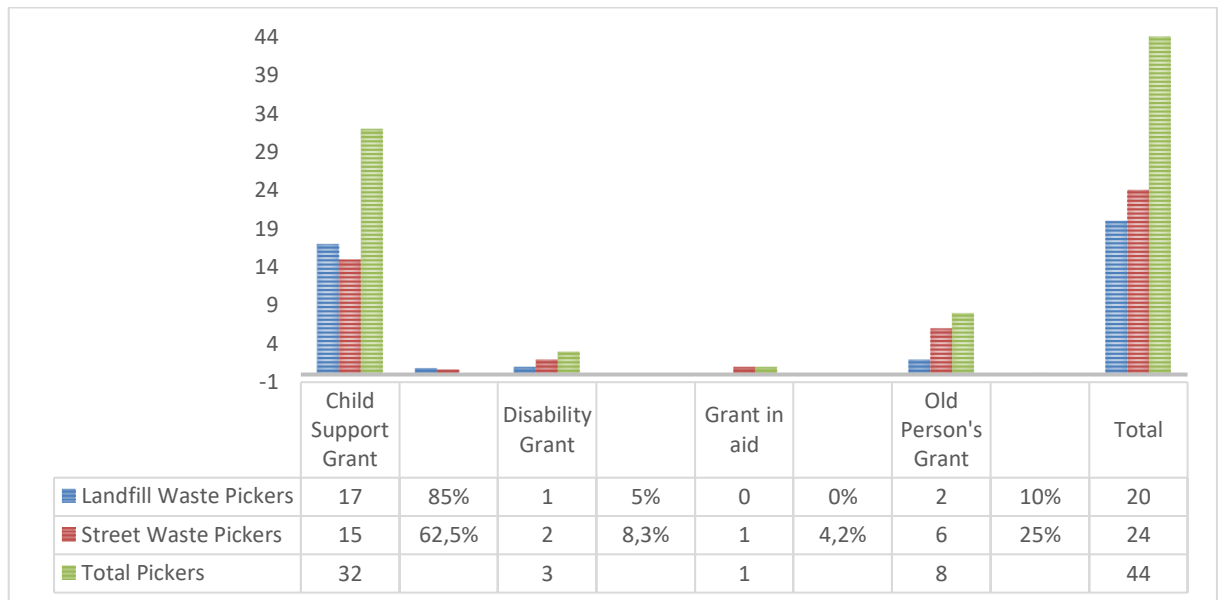


Figure 2.10: Types of grants received by the waste pickers

The WPs were also asked to provide information on their average income from waste picking. Table 2.4 shows that 136 (93.2%) of the WPs earned a minimum of R10 per day, the middle-income group received R1175 per week, and the maximum income was as much as R11500 per month. Thus, the lower quartile was R380 per week and the upper quartile was in the region of R2119 per week. Although in no way a sign of affluence, these earnings were relatively adequate and a determinant factor for waste packing and recycling activities. An important factor, however, was that these earnings seemed to depend on the extent to which waste picking was done. Rakib et al. (2014) found that their respondents' income capacity varied according to working hours and job availability, which ranged from R38.43 to R53.17 per day for males, R25.51 to R44.72 per day for females, and R17.06 to R21.20 per day for children.

Table 2.4: Earnings of waste pickers through waste recycling

Table: Analysis Variable					
n %	Median	Lower Quartile	Upper Quartile	Minimum	Maximum
136 (93.2%)	R1175.00	R380.00	R2119.00	R10.00	R11500.00

2.5 Conclusion

The current study found no relationship between waste picking and any specific age group. The results also showed that there was no statistically significant difference among the four categories of age in terms of waste picking as a preferred occupation. The age groups were almost equally distributed and it was determined that waste picking was done by children below the age of 18 as well as the elderly up to 84 years of age. The DEA (2014) also found that the ages of WPs ranged from as low as 16 years to as high as 83 years.

The current study established that gender was not a determinant of recycling participation, as both males and females engaged in waste picking. Even though various authors have found variances in gender ratio participation, generally one gender is not favoured over the other as far as waste picking is concerned. Some factors may determine that one gender may be either more or less represented in a particular group of recyclers at a particular location or time, as some studies have found that either male or female participants were more dominant than the other. However, the probability may not be ruled out that this was due to a particular time or the location of the study. The current study revealed a balanced gender representation of 50% males and 50% females from a sample of 146 WPs, and this 50:50 gender split was on a par with findings by the DEA (2014).

This study found that most of the recycling participants in the study area had received some level of education. Only 14.4% of the WPs had no schooling while 30.1% had a primary school education. At a higher level, 53.4% of the WPs had a secondary school education, a small percentage (1.4%) had a diploma or degree, while 0.7% was unclassified. In general, the WPs had low education levels which meant that their waste picking activities might be unsustainable. However, the study proposes that a lack of education was not a determinant of waste picking practices as the majority of the participants in this study was literate and had received some schooling. Conversely, Nguyen et al. (2015) found that in Hanoi (Vietnam), 53.9% of their respondents held a degree. A study in the Free State Province (South Africa) by Schenck et al. (2016) compared the education levels of LWPs and SWPs and found that LWPs generally had a better schooling track record than SWPs.

The literature has confirmed that a high unemployment rate causes many people to live in poverty, and therefore many of these people have resorted to informal waste picking to alleviate poverty and hunger. Studies by Nguyen et al. (2015), Rutkowski and Rutkowski (2015), Nzeadibe (2008), Awopetu et al. (2014) and Schenck and Blaauw (2011) have also revealed that waste picking activities contribute effectively towards poverty alleviation in many developing and underdeveloped countries. This notion was corroborated by the current study considering that the highest earnings from waste picking reached in excess of R11 000 per month, although such high earnings seemed to occur only at the top end of the scale. The study results showed that the main reason for waste picking in the City of Mbombela by the majority (85.6%) of the WPs was to alleviate poverty.

The literature (Rakib et al., 2014; Yigit, 2015; Mwanza and Mbohwa, 2017) confirmed an association between urbanisation, population growth, high consumption of resources, and high waste generation. It was also found that waste generation rates per person in urban areas were higher than in rural areas due to population density and the affordability of consumables (DEA, 2014; Yigit, 2015). It is noteworthy that affordability extends the association of urbanisation with waste generation according to the following model:

Urbanisation → high population → high income/economically active → high resource consumption → high rate of waste generation and high pollution.

Another noteworthy phenomenon is that the high rates of waste generation in urban areas due to high population density attract large numbers of people from rural areas as WPs to cities, which exacerbates population density. However, these WPs become a solution to a growing waste problem in urban areas as they perform an important waste recycling function, especially in areas with inadequate waste removal services. The current study found that 95.9% of the WPs resided in areas surrounding the landfills in the towns and the city under study, whereas the remaining 4.1% of the WPs originated from neighbouring local municipalities such as Bushbuck Ridge and Nkomazi. Evidence was also found that 14.4% of the WPs had migrated from neighbouring countries such as Mozambique and eSwatini to areas surrounding the City of Mbombela in search of work.

High unemployment rates in the formal economy increase self-employment rates in the informal economy such as waste picking. Waste material as a bartering commodity has significant business potential for economic growth and the creation of employment for the unemployed through recycling initiatives. It is thus evident that waste recycling does not only address waste problems, but has the potential to reduce the unemployment rate. This was confirmed by the finding that not only unemployed people and students engaged in waste picking, but that people who were employed, those who received government grants, as well as pensioners participated in waste picking to augment their monthly income. Evidence was thus found that unemployed people found employment by picking and selling waste.

This study established that income generation was a determinant for participation in waste picking by different groups of individuals residing in communities close to landfill sites. However, many living in outlying areas also migrated to the streets of Mbombela and the surrounding towns in search of an income. Opportunities exist in this city and surrounding towns for waste pickers to trade waste as a commodity and to generate income. The literature revealed that, in some countries, municipalities acknowledge the work done by WPs who are utilised to contribute towards cleaning towns and cities. Some municipalities pay WPs while they are still allowed to sell their recyclables to make money. This was not the case for the WPs in this study. It was found that some earned a minimum of R10 per day while the middle income group could earn as much as R1175 per week (roughly R167.85 per day) with a maximum income of R11500 per month (roughly R383.33 per day). These earnings are relatively high and may be the determinant actor that encourages WPs to participate in this form of recycling from which they can earn a living.

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CHAPTER 3

AVAILABILITY AND ACCESSIBILITY OF RECYCLABLES AND FACILITIES FOR CONVENIENT WASTE PICKING

ABSTRACT

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Introduction: Successful waste picking is not solely dependent on social, economic and environmental benefits but is also affected by convenience and inconvenience factors. In addition to economic incentives, waste recycling is influenced by factors that are either convenient (encouraging) or inconvenient (discouraging) for waste picking, and it is important to understand what factors encourage or discourage people from picking and recycling waste. The study thus investigated several convenience and inconvenience factors that impact waste picking. The key factors that were identified are the recyclability, availability and accessibility of recyclables; the availability and in/stability of the market; price; operational costs; storage facilities; collection; distance and transportation; availability of and accessibility to facilities; working conditions; health and safety protection; and community intolerance.

Methodology: The study investigated the determinants of recycling participation in areas surrounding the City of Mbombela. The data were collected from February to March 2019. A participatory method of data collection was used to understand the challenges that were faced by waste pickers, and to select WP respondents at three landfill sites, namely Hazyview landfill, Barberton landfill, and Tekwane West landfill. WPs who operated in the streets of Hazyview town, Barberton town and Mbombela (Nelspruit) CBD were also recruited. Only WPs who were willing to participate and sign a consent form were recruited for the study. The respondents were then interviewed using a questionnaire. The sample size of 149.4 (150) waste pickers was determined by using Yamane's (1967) formula. However, this ideal number was not achieved as 146 WPs effectively participated in the study.

Results and discussion: The study found that recyclables such as aluminium were more convenient to recycle than polyethylene terephthalate (PET) bottles and plastic. The study also confirmed various factors of convenience for waste picking which

included the availability and accessibility of recyclables, best markets and best prices, the availability and accessibility of recycling facilities, and infrastructure. Factors that hampered the activities of the waste pickers were: the unavailability of recyclables, operational costs, distance, intolerance, and health and safety hazards.

Conclusion: The responses confirmed that it would be more beneficial to society, the environment and the economy if all people are aware of the recyclability (i.e., the residual value) of each type of waste material. Moreover, it is crucial that reusable materials are made available and accessible for recycling, that competitive markets are developed to reduce recycling costs, that recycling facilities are made available and accessible for storage, that transportation is available, and that buy-back centres function at central locations to improve recycling convenience. The recommendations of the study are that efforts should be made by authorities to prevent waste pickers' exposure to health and safety hazards, and that there is a need to create public awareness of the important role of waste pickers in order to eradicate intolerance towards them.

Keywords: accessibility, availability, convenience or inconvenience factors, recyclability, waste pickers, waste recycling.

3.1 Introduction

Chapter 2 dealt with determinants of recycling participation and focused on the triggers of waste picking activities by communities in the Mbombela area. To achieve environmental sustainability, some level of convenience is highly desirable in waste picking activities. The success of waste picking as an activity from which an income can be derived does not necessarily depend only on the social, economic and environmental benefits derived from waste, but also on the convenience of waste recycling. Yau (2012) argues that, in addition to economic incentives, waste recycling is likely to be influenced by convenience and inconvenience factors. Suttibak and Nitivattananon (2008) suggest that convenience measures that encourage older people to participate in recycling are amongst the key recommendations to develop and improve recycling performance. For instance, when citizens who are concerned about their environment have bins near their homes, they appear more willing to recycle waste than when they have to walk a long distance to drop off the waste. The unavailability of bins is thus an inconvenience factor (Gonzalez-Torre and Adenso-Diaz, 2005). Therefore, convenient or inconvenient conditions can respectively elicit positive or negative responses to waste management and recycling participation.

Prior to the field work, an intensive literature review was conducted to explore the factors that previous authors have highlighted as either convenient or inconvenient drivers or deterrents of waste picking preferences. This review revealed that several convenience and inconvenience factors influence waste recycling activities. Yau (2012) suggests that, to stimulate community participation in waste recycling, it is important to understand the first steps that encourage or discourage people from recycling waste materials. It is for this reason that this study investigated and thus highlights several convenience and inconvenience factors that were found to either encourage or discourage recycling participation. The key factors that were highlighted by the literature and that will be discussed are:

- recyclability of recyclables
- availability of recyclables
- accessibility of recyclables
- market prices
- operational costs
- storage facilities

- collection and transportation
- distance from recycling to selling point
- availability and accessibility of recycling facilities
- the work environment that impacts health and safety
- intolerance of communities and municipal officials towards waste pickers.

3.2 Convenience and Inconvenience Factors that Impact Waste Picking

3.2.1 Recyclability of waste materials

The recyclability and the non-recyclability of waste materials appear to be factors of either convenience (positively supporting recycling) or inconvenience that influence recycling participation in either a positive or negative manner. Paper is the most frequently separated item. On average, paper is discarded and deposited in waste bins by households at least once every week (Gonzalez-Torre and Adenso-Diaz, 2005). In Rangpur city, most waste pickers reported that paper waste collection was profitable and more convenient than other types of waste (Rakib et al., 2014). Other materials recovered by waste pickers include various grades of plastic, scrap metals, bottles, aluminium cans and textiles (Nzeadibe, 2008). In addition, PET, steel and cardboard all offer high financial returns and have been the most commonly separated waste material (Suttibak and Nitivattananon, 2008). In a comparative study involving 18 selected countries, South Africa ranked amongst the top seven waste generators (Machete, 2019). Rubble and biomass were found to be the largest categories of recyclables that were readily available in high mass or volumes, followed by metals, paper, plastic, glass, and vehicle tyres (Machete, 2019).

Different aspects impact the recyclability of waste materials and each of these may lead to one recyclable material being more convenient than another. The fundamental precondition that impacts waste picking is the requirement that solid waste materials must have some residual monetary value (Velis, 2017). The fact that waste is considered a valuable resource is important and municipalities and those in charge of waste management should be cognisant of this fact (Mwanza and Mbohwa, 2017; Dos Muchangos et al., 2014). Sandhu et al. (2016) state that informal waste pickers play a significant role in recovering recyclable waste and recycling these materials for production or consumption processes. Clearly, amongst the elements

that determine the recyclability of waste materials is their residual value and thus their potential for generating income. The recyclability of waste materials thus plays a significant role in waste pickers' choice of which materials to pick and sell. Waste that cannot be recycled and that thus has no monetary value is ignored and will remain uncollected by waste pickers in the streets or at landfill sites.

3.2.2 *Availability of recyclables*

Although various waste materials may be classified as recyclable, if these materials are not available recycling cannot occur. Waste picker activity is therefore largely driven by the availability of recyclables in significant volumes (DEA, 2014). As was previously stated, South Africa ranks as atop waste generation country and rubble and biomass are the leading recyclable waste sources that are readily available in high volumes in this country. Metals, paper, plastic, glass, and vehicle tyres are also high on the recyclables list (Machete, 2019). Kasinja and Tilley (2018) found that in Zingwangwa, which is a township in Blantyre in Malawi, the collection of organic materials and their processing were difficult for waste pickers. They also found that plastic and metals were the two most available waste categories. Simatele et al. (2017) concur, and state that waste materials that are predominantly collected and recycled range from paper to carton boxes and scrap metals. In some countries the institutionalisation of waste pickers allows them to collaborate with residents who ensure that recyclable or reusable materials are available, and they collect these at a high rate (Navarrete-Hernandez and Navarrete-Hernandez, 2017). However, if citizens have a negative attitude towards waste pickers and drive them from their residential areas where they pick waste along streets and at waste collection sites, their activities become limited and less waste is recycled. It is thus evident that the availability of recyclables is a factor that influences recycling participation. Moreover, the availability factor of recyclables also depends on the accessibility of waste for recycling or picking purposes.

3.2.3 *Accessibility of recyclable materials*

Waste materials may be recyclable and available but, if they are not accessible to waste pickers, the recycling or picking of waste becomes difficult, if not impossible. According to Velis (2017), one of the fundamental preconditions that should be met for waste picking to occur is that waste should be physically accessible to waste

pickers as it is their aim to collect and sell sufficient volumes of recyclable waste to make a living (Schenck et al., 2016). In Brazil, waste picker cooperatives work together with waste pickers and encourage door-to-door collection of separated waste, the collection of recyclables from households, and large quantity waste generating enterprises (Rutkowski and Rutkowski, 2015). Dias (2016) argues that waste pickers should be granted access to waste as a common-pool resource. In Nigeria, waste pickers have unrestricted access to the Ugwuaji landfill facility (Nzeadibe, 2008). The above authors all agree that accessibility of recyclable waste materials is a factor that facilitates waste picking activities.

However, the accessibility of recyclables may either be convenient or inconvenient due to policies, procedures, processes, and regulations. Policies and legal provisions that allow the formalisation of the informal sector are key factors that will facilitate convenience (Aparcana, 2016). Privatised operations impact WPs' ability to collect waste at household level as households may prevent WPs from picking waste at disposal points for pick-up in favour of waste collection by private companies or municipal waste workers (Sandhu et al., 2016). This has been the experience of many. Dias (2016) for instance argues that the integration of WPs begins with a legal framework that promotes access to waste as a livelihood resource. Observations and anecdotal evidence have suggested that this intolerance may be because WPs do not collect all the waste but pick waste selectively from disposal containers and often leave the residue on pavements and at collection sites where it is unsightly and even hazardous. This is an inconvenience factor as it causes residents and municipality workers to bar WPs from streets and waste disposal sites. Conversely, in the greater Santiago area in Chile, WPs have access to collection schedules and arrive at sites to pick recyclable and reusable materials of a high quality and in large quantities in a short time period, which is an activity that increases their earnings per hour (Navarrete-Hernandez and Navarrete-Hernandez, 2017). This positive feedback about waste picking suggests that it is important that those responsible for the formulation of policies and regulations create waste collection opportunities for WPs that are convenient and that allow them ready access to recyclables. However, WPs should not abuse these opportunities and should ensure that the environment remains unpolluted after they have picked the waste they require.

3.2.4 Markets and price

The market for recyclables is another important factor of either convenience or inconvenience as it has an influence on the level of participation in waste picking activities. Waste recycling behaviour can sometimes be stimulated or discouraged by market-based instruments (Yau, 2012) and it has become important to create and develop sustainable markets for recyclable and recycled materials to ensure that fair prices are paid (Jimenez-Rivero and Garcia-Navarro, 2017; DEA, 2014). In Maputo, recycling enterprises are struggling because recycling is undertaken in a limited way by waste pickers and private initiatives due to an undeveloped local market for recyclable materials (Dos Muchangos et al., 2014).

The demand for markets for specific recyclables determines the types of waste streams sought by WPs, recyclers and buyers. Kasinja and Tilley (2018) found that there was a large market for plastic and metal recyclables despite a seasonal market for plastic. In Maputo, glass bottles were once purchased by a buy-back centre that was situated close to a waste disposal site as there was no glass manufactured in Mozambique because the glass factory had closed down (Dos Muchangos et al., 2014). Waste recycling is also seasonal. For instance, Nzeadibe (2008) found that waste paper, cardboard and polyethylene packaging materials were not recovered at one point in time because there was no market for these recyclables. Thus, markets for recyclables appear and then disappear due to economic indicators, and thus WPs will selectively focus on collecting recyclables that are in high demand by current markets. However, Li et al. (2019) state that recovered paper is one of the major raw materials for the recycled papermaking industry and that this resource is therefore constantly in demand. In concurrence, Gonzale-Torre and Adenso-Diaz (2005) also argue that paper is the most frequently separated item and that, on average, it is taken to recycling bins on a weekly basis. Moreover, in Rangpur city most WPs reported that paper waste collection was profitable and that collecting paper was more convenient than other types of waste (Rakib et al., 2014). Liu et al. (2019) hypothesise that, if waste paper could be recycled effectively in China, then the domestic volumes of recycled waste paper produced every year would satisfy the need of the waste pulp production.

The market is influenced by demand-and-supply chain processes that also influence the price of recyclables. The prices paid for recyclable materials are also either

convenience or inconvenience factors that impact recycling participation by waste pickers. Price is the most influential factor when it comes to informal waste pickers' preference for the materials they will recover. For instance, metals generally generate high prices while the low prices paid for dyed plastics prevent waste pickers from recovering them to a large degree (Kasinja and Tilley, 2018). Organics dominate municipal solid waste volumes at a level of about 70%, and thus good recycling rates are achieved when pickers focus on organic waste recovery. However, organic waste recovery was historically not a priority for waste pickers because of low prices and the threat it posed to health (Velis, 2017). Jimenez-Rivero and Garcia-Navarro (2017) found that the price of recycled gypsum rated it an extremely desirable commodity by 88% of respondents.

It is evident that a factor of inconvenience for waste pickers is the low prices of recyclable waste materials, whereas high prices are a convenience factor. Low prices also cause some potential recyclable materials (for example organic waste or biomass) to be discarded back into the waste stream due to the insignificance of their value. Navarrete-Hernandez and Navarrete-Hernandez (2017) argue that the institutionalisation of waste pickers is a convenience factor as it provides them with an opportunity to secure a stable place in street markets where they could sell reusable products, often at good prices. Moreover, in some countries waste picker cooperatives pay a better price for sorted materials than local scrap yards (Rutkowski and Rutkowski, 2015). A significant volume of recyclable waste is also usually delivered by informal solid waste pickers to recycling facilities that trade it at market related prices (Simatele et al., 2017). For instance, despite the demand for different types of plastics, most plastics are bought at a good price – although dyed or coloured plastics yield lower prices than clear plastic (Kasinja and Tilley, 2018). Therefore, a good price for recyclable materials is a convenience factor that encourages recycling participation.

3.2.5 Operational costs

Another factor of convenience or inconvenience that has an influence on waste picking participation is operational costs. Issues such as topography, pedestrian access and distance to waste sites influence waste pickers' transport mode and this influences the operational costs of waste picking (Rutkowski and Rutkowski, 2015).

Kasinja and Tilley (2018) observed that some waste pickers used public transport for their waste picking activities and that transportation costs included the fare to and from Zingwangwa as well as the cost for transporting the materials they had collected to the point of sale. An extreme form of collusion was visible when the waste pickers were allowed to continue their waste picking operations once they had paid an undisclosed amount to municipal sanitary workers (Sandhu et al., 2016). This of course amounted to bribery. Chokhandre et al. (2017) assessed the economic burden of morbidities in terms of expenditure incurred for health treatment, working days lost, and persisting illnesses among waste pickers, and found the mean expenditure to be higher among WPs than non-WPs. Some e-waste is sold to individuals for possible reuse and some is sold to recyclers or are donated to people who need it (Miner et al., 2020). It is evident that various factors influence the costs of recycling activities. Avoidance of burdensome cost factors is not always easy when engaging in waste picking, although it could be possible depending on the proactive management of other factors. Some of these factors, such as distance, storage facility, collection and transportation, are discussed in the next sections.

Operational costs for WPs are of course lowered by reducing transportation costs. Waste recycling systems could therefore be improved by addressing influential factors such as the reduction of transportation costs incurred by waste pickers (Suttibak and Nitivattananon, 2008). One suggestion is that waste pickers should be assisted by municipalities by sponsoring of their transportation costs for the collection of recyclables instead of expecting them to push the waste in trolleys to buy-back centres (Schenck et al., 2016). Thus, by reducing transportation costs, the level of recycling convenience for WPs will be increased.

3.2.6 *Storage, collection and transportation*

When storage facilities are available for use by WPs it becomes a convenient factor for waste picking participation. The policy on waste picker cooperatives in greater Santiago de Chile established a recycling centre consisting of land, parking, and undercover working space to sort and store recyclable materials (Navarrete-Hernandez and Navarrete-Hernandez, 2017). A survey showed that sorting waste into categories required space, time, and effort, and that a lower collection frequency of waste materials would require storage on the respondents' (buyers') properties for

a period of time (Czajkowski et al., 2015). After areas for waste pickers' use had been established, the waste picker cooperative determined the number of waste pickers for each service based on the estimated volume of recyclables they could produce. The services included collection, transportation, and storage facilities (Rutkowski and Rutkowski, 2015).

The Chile experience highlights the fact that one of the biggest challenges faced by WPs in the informal economy is the need for sorting and storage space for the recyclables they have collected (Dias, 2016). Clearly, the availability of storage facilities is amongst the convenience factors that influence waste picking activities because, when such facilities are available, waste pickers may extend their operations which will, in turn, provide job opportunities for more people, generate more income, and contribute more significantly towards waste recycling.

A lack of space and storage facilities is of course a factor of inconvenience for waste pickers as it puts their recyclables at risk. Theft occurs if waste pickers do not have a secure place where they can store their recyclables (Schenck et al., 2016). Miner et al. (2020) found that, in the Jos Metropolis in Nigeria, the storing of e-waste at home was prominent as people were inconvenienced by the lack of a door-to-door collection program.

Other inconvenience factors that influence recycling behaviour are the time and the effort needed to engage in recycling activities (Czajkowski et al., 2015). To help address these factors, waste-picker cooperatives in greater Santiago de Chile provide waste pickers with tricycles or motorised vehicles to collect recyclable and reusable materials (Navarrete-Hernandez and Navarrete-Hernandez, 2017). Recovered materials such as bottles and plastics are transported by pick-up vans and sometimes push-charts from landfill sites to bottling and plastic banks, scrap metal dealers, and small-scale manufacturers (Nzeadibe, 2008). In Bogota, Colombia, a court ruling in recognition of waste pickers' contribution to the city instructed the municipality to include waste pickers in the waste management system and to remunerate them for the services they provide in terms of the collection and transportation of recyclable waste (Dias, 2016). Many recyclables are collected and transported to waste disposal sites by private entrepreneurs (Stoeva and Alriksson, 2017) who are paid by municipalities for their services, but waste pickers appear to

transport their collected materials to recyclers at their own cost (DEA, 2014). The collection and transportation of recyclable waste materials are clearly crucial factors of inconvenience in the process of waste picking as these processes are costly and often labour intensive – but when these factors are not addressed, recycling is subject to failure.

3.2.7 Distance as a factor that impacts waste recycling by waste pickers

The distance to and from recycling facilities is either a convenience or inconvenience factors in the waste picking sphere. The distance that needs to be travelled to processing facilities has a direct influence on the economic viability of a collection and sorting business (DEA, 2014). The point where recyclable waste is stored should therefore be within a reasonable distance from where waste pickers collect the recyclables and from where they have to pull their carts for the delivery or sale of the waste (Rutkowski and Rutkowski, 2015). Kasinja and Tilley (2018) found that none of the informal WPs under study in Zingwangwa resided in the immediate area where they picked and delivered their recovered materials as they all lived in informal settlements situated more than five kilometres from the collection area. In Sweden and Bulgaria (Europe), packaging waste is collected and placed into recycling bins near the residences of the WPs and at drop-off stations while municipalities are responsible only for household waste streams (Stoeva and Alriksson, 2017). According to the South African DEA (2014), more transfer stations should be provided at municipal level to reduce the distances waste pickers have to travel. It is evident that distance is an important factor that influences waste picking activities and recycling, and this factor thus needs to be considered when planning the location of recycling drop-off and collection points and facilities.

3.2.8 Availability of recycling facilities

The availability of recycling facilities is another factor of convenience that influences the recyclability of waste materials. The demand for recyclables is higher in areas that have processing facilities than in areas where there are no processing facilities (DEA, 2014). Kasinja and Tilley (2018) state that metals such as lead, aluminium, copper and brass are not recycled in Malawi but are exported to South Africa or Tanzania where they are be recycled. However, in some grocery stores there are buy-back machines where people can deposit plastic bottles and aluminium cans

(Stoeva and Alriksson, 2017). It has been suggested that increased support of waste pickers is required, especially by providing access to recyclables through source separation programs and industry provided buy-back centres, as this will increase collection rates (Simatele et al., 2017). Evidently, the unavailability of recycling facilities may at worst result in people's non-participation in waste picking or in low recycling rates. Recycling facilities and buy-back centres should thus be easily accessible for waste pickers.

3.2.9 *Accessibility of recycling facilities*

The ease of accessibility to recycling facilities is an important factor of convenience in recycling participation. Bernstad (2014) supports the importance of accessibility, convenience and the existence of the necessary infrastructure to assist people in participating in waste recycling. For instance, Hispanic women living in areas where recycling facilities such as kerbside services and drop-off facilities were prevalent were more likely to recycle than those living in areas with no recycling facilities (Pearson et al., 2012). In Maputo, there is an informal market for buying and selling reclaimed materials and objects outside the municipal waste disposal site, although this market is under-developed (Dos Muchangos et al., 2014). In Sweden, municipalities' contract in packaging recovery organisations for the collection, transportation and processing of separated recyclable waste (Stoeva and Alriksson, 2017). In the latter country all such establishments on each street receive the service, and a pair of waste pickers moves the collected materials to a temporary transfer station with easy access for trucks (Rutkowski and Rutkowski, 2015). In South Africa (Gauteng), the strict regulations governing landfills have forced the province to consider waste recovery initiatives such as drop-off centres, collection banks, and buy-back centres (Muzenda, 2013). Based on their study that was conducted in Johannesburg, Simatele et al. (2017) argue that WPs' activities commonly contribute to high littering, which of course results in exacerbating environmental pollution. Thus, local municipalities may limit or even prohibit WPs from accessing landfills or any other waste storage areas. It is undeniable that accessibility to recycling facilities is a crucial convenience factor for effective waste picking activities.

3.2.10 Unsafe working environments and unhealthy working conditions

Unsafe working environments in which many waste pickers operate is a factor of inconvenience for these people. Some waste streams that pose health risks, the lack of personal protective equipment (PPE), the possibility of injuries, lack of security, exposure to safety hazards due to a lack of relevant equipment, and dangerous items are factors that exacerbate health risks for waste pickers (DEA, 2014; Schenck et al., 2016; Rakib et al., 2014). In a comparative study on the rate of injuries amongst waste pickers and non-waste pickers, the prevalence of injuries was high (75%) among waste pickers, whereas it was a mere 17% for the comparison group (Chokhandre et al., 2017). A lack of infrastructure such as secure road networks was also found to be a serious challenge as the waste pickers had to use the same roads as those used by motorists (Simatele et al., 2017). Waste pickers are evidently exposed to various safety hazards, which is a factor that inconveniences waste picking activities. Finding a solution to eliminate this factor is thus necessary.

Despite the safety hazards associated with waste picking, it is a necessary activity and multi-beneficial by nature. For instance, it saves waste management service costs for municipalities, and it is argued that a portion of this saving should be channelled to support waste pickers. Moreover, Simatele et al. (2017) state that, despite the contribution waste pickers make towards waste management, they are faced with extremely hazardous working and living conditions. Kasinja and Tilley (2018) found that 68% of informal waste pickers understood the need for PPE but did not use it because it was too expensive. This expenditure would of course reduce their profits. In Greater Santiago de Chile, waste picking cooperatives are by policy mandated to donate tools and machinery to waste-pickers to improve their safety and enhance waste collection. They thus provide equipment such as gloves, overalls, safety shoes, a can crusher, and cardboard baler machines (Navarrete-Hernandez and Navarrete-Hernandez, 2017). Therefore, by taking cognisance of the contribution WPs make towards waste management, municipalities do not stand to lose but will reap long-term benefits should they invest in eradicating safety hazards associated with waste picking.

The unhygienic conditions that WPs are exposed to is another factor of inconvenience in recycling participation. Most waste pickers operate without any

personal protective equipment (PPE) and hence handle waste directly, which exposes them to health risks (Simatele et al., 2017). A study determined that the prevalence of respiratory symptoms was higher among waste pickers (28%) than a comparison group (15%), while the prevalence of dyspnoea and chronic cough in particular was also found to be higher among waste pickers than non-waste pickers (Chokhandre et al., 2017). In Maputo, air, soil and groundwater are highly compromised at landfill sites and in adjacent areas, and this poses a real threat to environmental and public health (Dos Muchangos et al., 2014). Clearly, unhygienic conditions are an inconvenience factor that impacts waste picking participation.

3.2.11 Community members' and municipal officials' intolerant attitude towards waste pickers

The last factor of inconvenience is the intolerant attitude that communities and municipal officials have towards waste pickers, and this also has a negative influence on waste picking participation. Rather than support the activities of waste pickers, some municipal sanitation employees such as street sweepers, drivers and waste bin clearers harass and exploit waste pickers (Sandhu et al., 2016). Exploitation by formal waste recyclers, collectors and transporters is a factor of inconvenience for informal recycling participation (DEA, 2014). Many residents harbour a negative perception about waste pickers and communities have often viewed waste pickers as people who are a nuisance and obstruct public spaces. For these reasons it has been felt that they should be stopped from collecting waste (Simatele et al., 2017; Dias, 2016; Schenck et al., 2016; Kasinja and Tilley, 2018). Evidently, there are widespread negative perceptions about waste pickers that have often resulted in the harassment of waste pickers by various community stakeholders. Therefore, the inconvenience factor of intolerance towards waste pickers leads to potential repercussions due to waste picking activities, and consequently to the associated social rejection of the work waste pickers do.

3.3 Materials and Methods

The study was conducted in the City of Mbombela and two towns near it in the north-eastern part of South Africa. The City of Mbombela local municipality is a Category B municipality in Mpumalanga Province and is administered as part of the Ehlanzeni District (City of Mbombela, 2020). The municipality is one of the four municipalities in

the district and comprises nearly a third of the district's geographical area (City of Mbombela, 2020). The City of Mbombela was established by the amalgamation of the Mbombela local municipality and Umjindi local municipality in August 2016 (City of Mbombela, 2020). In 2020, the estimated population was 711 776 people. Mbombela (previously Nelspruit) is the capital of the Mpumalanga Province. Mbombela is a SiSwati word meaning 'a lot of people together in a small space' (City of Mbombela, 2019).

The City of Mbombela area of operations covers 7 141km² and includes Barberton, Emoyeni, Entokozweni, Hazyview, Kaapschehoop, Kabokweni, Kanyamazane, Luphisi, Matsulu, Mbombela, Mpakeni, Msogwaba, Ngodwana, Skukuza, Tekwane, and White River (City of Mbombela, 2020). The study purposefully selected two towns or areas where landfill sites are located, namely the landfill outside Mbombela known as Tekwane West Landfill site, Hazyview landfill site outside Hazyview town and Barberton landfill site outside Barberton town. These areas are under the control of the City of Mbombela Municipality. The selected landfill sites are situated in three of the four different regions of the municipality (Figure 1.1): Hazyview landfill is in the northern region, Tekwane West landfill is in the central region, and Barberton landfill is in the southern region (see the blue stars on the map).

Waste recyclers at landfill sites as well as street waste pickers (often called pickers or informal recyclers) constituted the population of the study. However, as the number of such people is large and they are often inaccessible, the study focused on recyclers called pickers because they are primary waste collectors. In studies of this nature, Keller (2014) advises that a reasonable proportion of a population should be selected as representative of the entire population. It was impossible to determine the total population of recyclers because of the informal nature of waste picking activities (Machete, 2017). However, the DEA (2011) estimates that there is an average of 128 trolley pushers (or street pickers) in every category B1 municipality of South Africa and 37 landfill pickers per municipal landfill site. The three different regions were purposefully selected (Machete, 2017) and the estimated average population of landfill pickers was determined at 111. It was thus estimated that the total population of the current study was 239. Two types of recyclers, namely street and landfill waste pickers, were recruited for the study.

The data were collected from February to March 2019. A participatory method of data collection was used to understand the challenges that waste pickers face (Simatele et al., 2017). Every waste picker at the landfill sites and in the streets who was available at the time of data collection was approached and, if he/she was willing to participate, they were informed of the purpose of the study and requested to sign a consent form. The questionnaires were completed in writing by the chief investigating officer and a trained assistant as not all the WPs could read and write. Kasinja and Tilley (2018) state that such structured questionnaires may be administered to waste pickers for data collection. In some instances, snowball sampling was used to recruit street waste pickers when originally recruited waste pickers provided the names of other street waste pickers who were visited in their homes, on the streets and at buy-back centres where they were recruited for data collection (Kasinja and Tilley, 2018).

The process was to approach the WPs one by one, obtain their consent, interview them, and record their responses in the questionnaire. Szolnoki and Hoffmann (2013) support the use of face-to-face structured interviews because they help to avoid spoilage or incomplete questionnaires. It was observed that the LWPs were better organised than the SWPs as they had representatives on site to whom the purpose of the visit was first explained. The waste pickers were then called, the purpose and the nature of the interviews were explained, and time for questions and answers was allowed. The LWPs then went back to their waste sorting stations and they were approached one by one and interviewed while the answers were recorded in the questionnaire. Kasinja and Tilley (2018) also approached and interviewed their respondents upon observing them recovering materials from streets, households and open dumps. The advantage of using the structured questionnaire was that it assisted the investigators to focus on the objectives and not to deviate, which is likely to happen when conducting interviews (Subbo and Moindi, 2008).

The sample size of 149.4 landfill and street waste pickers was determined by using Yamane's (1967) formula and the ideal was thus to recruit 150 waste pickers. The sample was drawn from three selected areas: Hazyview (landfill and street waste pickers), Tekwane (landfill and street waste pickers) and Barberton (landfill and street waste pickers). Although the ideal sample of waste pickers was 150, only 146 waste pickers effectively participated in the study.

3.4 Results and Discussion

The study established that some recyclables are preferred above others, and these preferred recyclables had high recyclability and monetary value. The unavailability of recyclables was an inconvenience factor for the waste pickers (WPs) while accessibility was an important convenience factor. However, only 44.5% of the LWPs compared to 22.6% of the SWPs found that appropriate waste was accessible for picking and earning an income. This significant difference is a reflection that LWPs have more access to waste at landfills than SWPs have on the streets where residents put their waste on kerbsides (pavements) at specific times for collection by municipality workers or service providers. This waste is then transported to the landfill sites. Here the waste is offloaded and then becomes accessible to the landfill WPs who search through and select the recyclables they prefer.

The results of the current study indicated that best markets (or buyers) and best prices were factors of convenience for the waste pickers, as 58.2% reported that an increase in price for recyclables stimulated increased participation in waste picking. However, 41.8% of the WPs expressed dissatisfaction with current unstable markets and prices. The results also showed that there were some operational costs involved in sustaining waste picking activities. The latter two findings highlight the fact that the waste pickers were impacted by factors of inconvenience that curbed their recycling endeavours.

The results also showed that the availability of storage facilities was both a factor of convenience and inconvenience. Moreover, a very high proportion (95%) of the WPs required transportation of their wares and they either hired private vehicles, used carts or trolleys, or depended on middlemen or buy-back centres to collect the recyclables they collected, particularly from landfills. It was also found that the distances that the WPs had to cover was a factor of convenience or inconvenience depending on the availability of transport and the location of the pick-up points relative to the buy-back or deposit points. The distances between waste sources and delivery points also impacted transportation costs, which was an inconvenience factor. The results concurred with the literature (Bernstad, 2014; Pearson et al., 2012; Simatele et al., 2017) in that the availability of waste recycling facilities was a factor of convenience as both street waste picking and landfill waste picking opportunities

existed and facilitated gainful participation in recycling. Thus, the accessibility of waste for recycling in areas around the City of Mbombela could be regarded as a convenience factor for waste picking. However, other factors such as threats to the health and safety of the waste pickers and the intolerance of community members and municipal waste workers were perceived as factors of inconvenience by the waste pickers. Each factor is discussed in the following sections. It should be noted that not all the waste pickers responded to all the questions. This could be attributed to the low level of education of some waste pickers.

3.4.1 Recyclability of waste materials

Table 3.1 provides a summary of the information about recyclable waste materials provided by the 146 respondents. Amongst the recyclables that were accorded high recycling frequencies were aluminium (78 or 53.4%), PET bottles (71 or 48.6%), and plastic (71 or 48.6%). Metal/steel/scrap (67 or 45.9%) and mixed paper waste (53 or 36.3%). Kasinja and Tilley (2018) found that 21% of informal WPs recovered only metals and plastic and that 26% recovered both plastic and metals. It may be surmised that the factors of convenience that influence the selectivity of the preferred recyclables could include residual monetary value, the availability and accessibility of markets or buy-back centres for these wastes, and acceptable buy-back prices, which all contribute to the recyclability of the preferred waste materials.

Table 3.1: Preference rates of recyclable waste materials (n = 146)

Waste Product	Frequency	Percentage %
Aluminium	78	53.4
Bottles -- PET	71	48.6
Plastic	71	48.6
Metal/steel/scrap	67	45.9
Paper (mixed)	53	36.3
Copper	43	29.5
High density plastic bottle (HD)	42	28.8
Paper (K4/cardboard/ bonce	41	28.1
Cans/tins	29	19.9
Iron/lead/cast iron/brass/bronze	25	17.2
Bottles (glass)	10	6.9

Glass	7	4.8
Batteries (vehicles)	1	0.7
Food for pigs	1	0.7

3.4.2 Availability of recyclables

Waste picking activities become convenient when recyclables are available, while the unavailability of recyclables is inconvenient. Figure 3.1 depicts that 50% of the LWPs and 46% of the SWPs indicated that “recyclables are not available anymore” or “recyclables are scarce”/“recyclables are not easy to find”, while 40% of the LWPs versus 43.2% of the SWPs reported that “competition for materials is very high” or “too many recyclers competing for recyclables”. Although stated by a limited number of the SWPs (2.7%), the fact that some WPs were barred from landfill sites by other WPs exposed a form of discrimination as some WPs deemed access to a particular landfill site their exclusive right. It may be argued that such behaviour in the waste picking industry violates the right of WPs to gainful employment, even if it is in the informal sector. Although this particular response rate was marginal, this finding may suggest that closer attention needs to be paid in legislative frameworks to the rights of informal waste workers. Moreover, although the age groups were not determined in these results, the fact that 10% of the LWPs versus 8.1% of the SWPs found waste picking physically demanding, might suggest that elderly and youthful participants were physically challenged by the demands of waste picking, yet they (or others who found it demanding) were compelled to persevere in order to earn an income. In total, 47 (32.2%) of the 146 participants referred to additional factors that made waste picking a challenging endeavour. In corroboration with the challenges that the participants mentioned regarding the unavailability and scarcity of recyclables, Sandhu et al. (2016) found that WPs spent about 10 to 12 hours per day looking for and sorting recyclable waste materials. Clearly, the unavailability of recyclables is a factor of inconvenience that impacts waste picking participation and makes it a challenging way of earning a living.

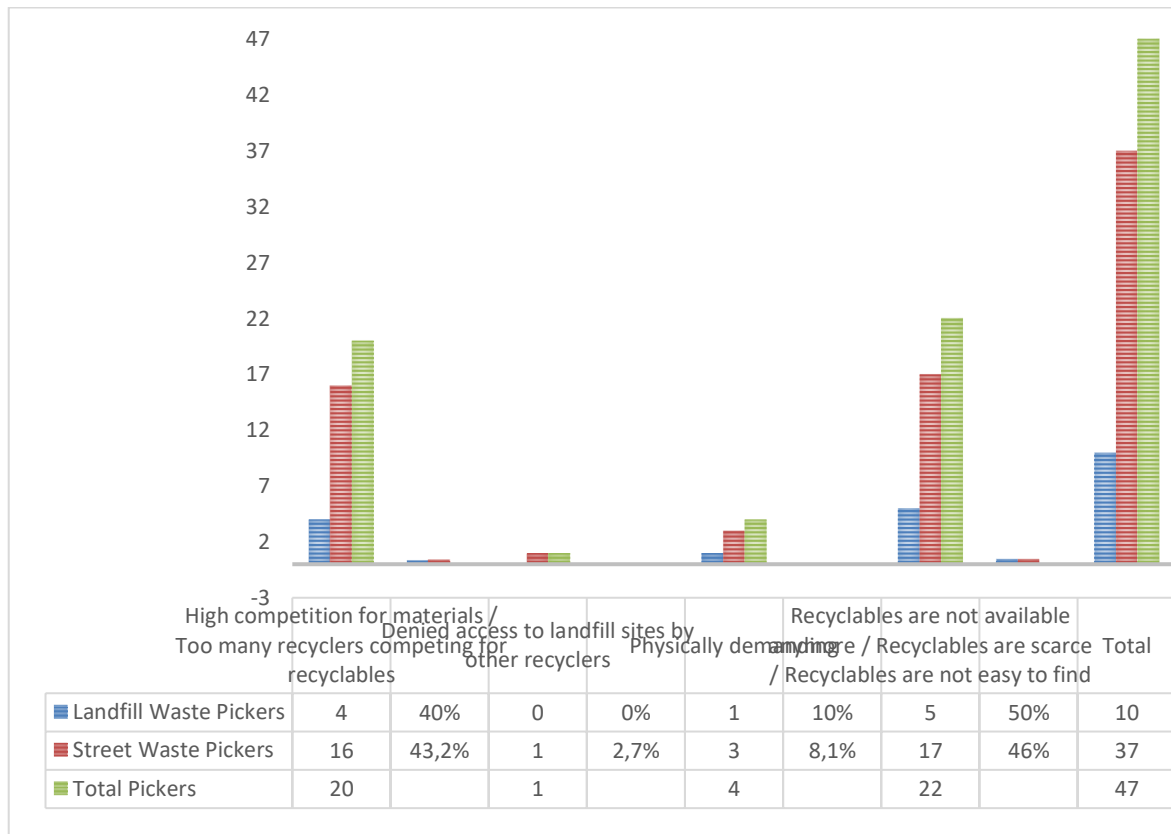


Figure 3.1: Challenges that impact on the availability of recyclables

3.4.3 Accessibility of recyclables

Gaining access to waste is an important factor of convenience in waste picking activities. The results presented in Figure 3.2 show that 86.7% of the LWPs compared to 46.5% of the SWPs indicated that recyclables were accessible, while 13.3% of the LWPs versus 53.5% of the SWPs reported that recyclables were inaccessible. The results thus suggest that WPs who work at landfills have more access to recyclables than SWPs. In South Africa, high volumes of recyclables still go to landfill sites rather than being separated at source. However, an overall 98 (67.1%) of the WPs agreed that recyclables were accessible in their areas of operation.

There have been urgent calls for waste minimisation and recycling to reduce the tonnage of waste reaching landfill sites (City of Mbombela, 2017). In greater Santiago de Chile, for instance, WPs are given access to the collection schedules of municipal waste trucks and, on collection days, WPs can collect items from the streets before the trucks arrive (Navarrete-Hernandez and Navarrete-Hernandez, 2017). This approach in greater Santiago de Chile contributes to the fact that much needed

recyclables and valuable waste materials are prevented from being deposited at landfill sites. This further assists in achieving Sustainable Development Goal 6 (SDG) 6 that requires the substantial increase of recycling and safe recyclable waste reuse globally (United Nations, 2015).

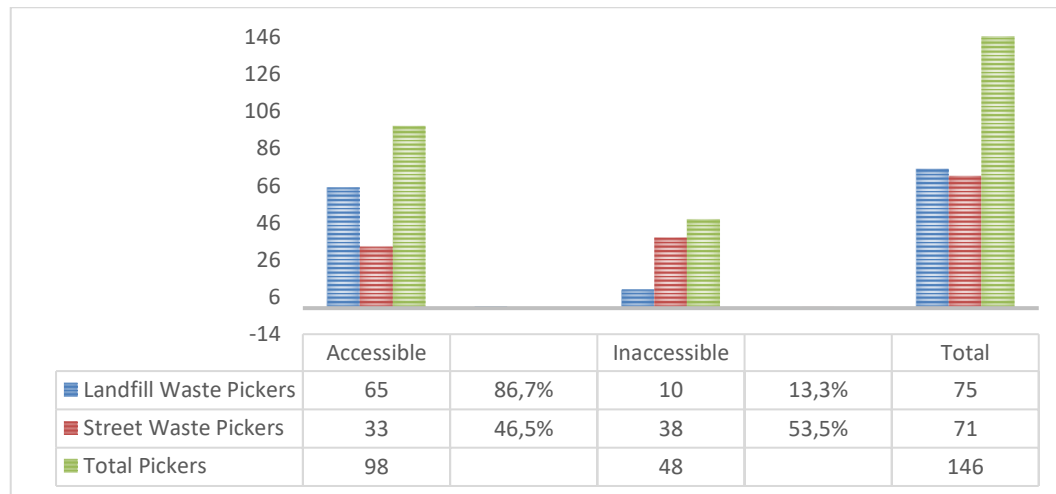


Figure 3.2: WPs' views on the accessibility or inaccessibility of recyclables

3.4.4 Market and price

The accessibility of a buy-back market and the best price for a recyclable material are factors of convenience in the waste picking context. Table 3.2 shows that 33.3% of the LWPs versus 28.6% of the SWPs reported that the increase in price for recyclable materials made it more convenient for them to increase their participation in waste picking activities. They also agreed that better prices depended on market availability. Another 31.8% of the LWPs versus 19.1% of the SWPs indicated that “generating income from recycling” was convenient and encouraged their participation in waste picking. This means that markets or centres where WPs can sell their recyclables to generate income need to be available. While a small proportion (1.5%) of the LWPs mentioned the need for stable prices and agreement of the price between a buyer and a seller, 1.5% also mentioned the ability to sell directly to factories and not to middleman as a factor of convenience for waste picking. Table 3.2 indicates that about 58.9% of the WPs desired improved markets and better prices for recyclables as factors of convenience for waste picking participation, while the remaining 41.1% of the WPs pointed to other issues such as timely collection, recycling facilities, a clean environment, unemployment, and access to resources that are not necessarily market related. A study that was conducted in Blantyre, Malawi, found that there were three to four buyers for metals as well as two

industries and two middlemen, but 68% of the WPs sold their metal recyclables to one middleman because he offered better prices and bought a variety of metals (Kasinja and Tilley, 2018). In informal operations, the mobile waste buyer buys directly from a household by paying a small amount for the recyclable waste (Sandhu et al., 2016). In Chongqing, recycling is done by recycling companies buying recyclables directly from households or people obtaining materials directly from them, and it was found that this system provided extra motivation for citizens to engage in recycling activities (Dos Muchangos et al., 2014). Evidently, best markets and prices are factors of convenience that endanger high rates of participation in waste picking or recycling.

Table 3.2: Preferences that encourage waste picking activities (n=129)*

	Landfill Waste Pickers	Street Waste Pickers	Total
Access to more recyclables	6 9.10%	10 15.90%	16
Access to resources (bags/storage/trolleys/equipment/balling machines)	4 6.10%	11 17.50%	15
Agreement in prices (between buyer and seller)	1 1.50%	0 0%	1
Clean environment	1 1.50%	1 1.60%	2
Generate income from recycling	21 31.80%	12 19.10%	33
Increased prices for recyclable materials	22 33.30%	18 28.60%	40
Recycling facilities	0 0%	1 1.60%	1
Selling directly to factories and not the middleman	1 1.50%	0 0%	1
Stable prices	1 1.50%	0 0%	1
Timely collection by collectors	0 0%	1 1.60%	1
Transport	1 1.50%	9 14.30%	10
Unemployment / Lack of other job opportunities	5 7.60%	0 0%	5
Working harder means higher income	3 4.60%	0 0%	3
Total	66	63	129
Frequency Missing = 17			

The reason for 129 and not 146 responses is that only 129 participants responded to this particular question. This may have been due to participants' low levels of education and limited knowledge.

3.4.5 Operational costs

Waste picking activities may incur various operational costs and this becomes a factor of inconvenience. However, when waste picking ensures a relatively stable income, the latter is a convenience factor. Figure 3.3 shows that 58.3% of the LWPs versus 67.6% of the SWPs reported that it was financially cheap (thus affordable) to engage in waste picking, while 41.7% of the LWPs versus 32.4% of the SWPs indicated that it was financially burdensome to do waste picking. Overall, the majority (90 or 62.9%) of the WPs found waste picking activities affordable while a minority (53 or 37.1%) found waste picking expensive. When the operational costs of waste picking are low, it is a convenience factor for WPs and when it is high it becomes an inconvenience factor in the recycling process. As the majority (62.9%) of the WPs in this study found that waste picking was not financially burdensome, it may suggest that this form of employment is financially sustainable and viable in the study area and a convenient source of income for the poor.

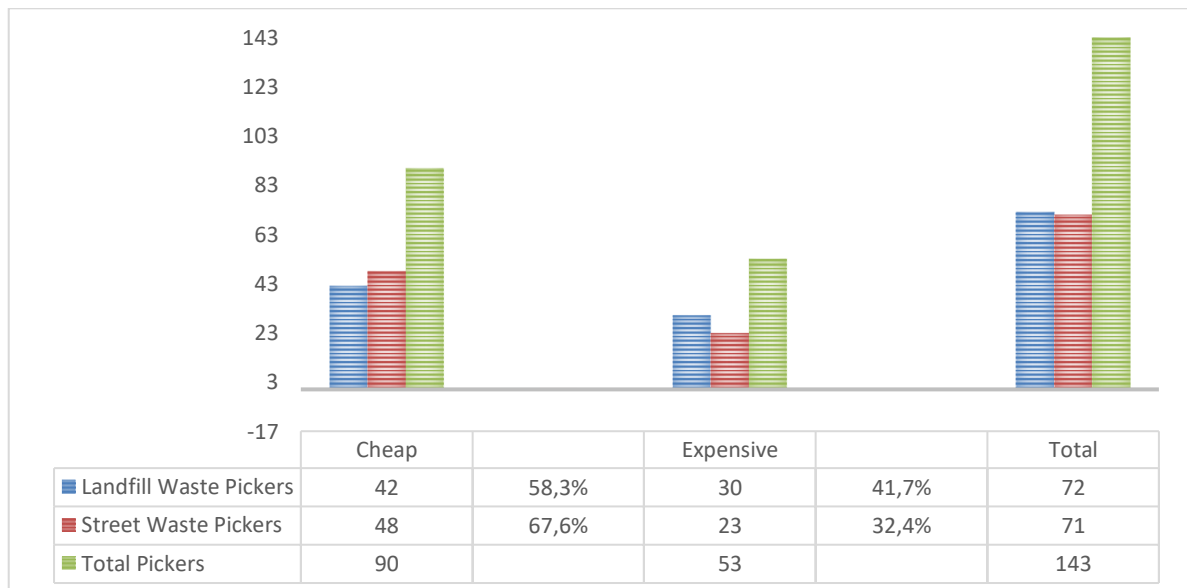


Figure 3.3: WPs' views on operational costs during waste picking process

3.4.5.1 Reasons for low operational costs of waste picking

Table 3.3 provides the reasons stated by WPs in support of the affordability of waste picking activities. It was found that 52.4% of the LWPs versus 64.6% of the SWPs indicated “I do not spend much on recycling”, while 30.9% of the LWPs versus 22.9% of the SWPs mentioned that “recyclables are accessible”. The remaining 16.7% of the LWPs versus 12.5% of the SWPs stated other reasons as outlined in Table 3.3.

It is clear that little expenditure in waste picking and the accessibility of recyclables lower the operational costs of recycling, and these become convenience factors that stimulate waste picking.

Table 3.3: Reasons for low operational costs of waste picking

	Landfill waste pickers	Street waste pickers	Total
Both parties must benefit (seller and buyer)	1 2.4%	0 0.0	1
I do not spend much for recycling	22 52.4%	31 64.6%	53
I do recycling at my own pace	1 2.4%	1 2.1%	2
I make some income through recycling	2 4.8%	1 2.2%	3
Recyclables are accessible	13 30.9%	11 22.9%	24
Recycling does not pay much	1 2.4%	1 2.08%	2
Recycling is a difficult work	0 0.0	2 4.2%	2
There is competition in recycling	1 2.4	1 2.1	2
Transport is expensive	1 2.4%	0 0.0	1
Total	42	48	90

3.4.5.2 Reasons for high operational costs of waste picking

Table 3.4 indicates the reasons why the minority (53 or 37.1%) of the WPs (see Figure 3.3) found waste picking expensive. Of these 58.6% of the LWPs versus 39.1% of the SWPs cited “transport costs or transportation of recyclables” as financially burdensome, while 10.3% of the LWPs versus 30.4% of the SWPs felt that waste picking was a “physically demanding work”. Only 10.3% of the LWPs and 8.7% of the SWPs were concerned with “insufficient pay-off/money being too little”, while other reasons were mentioned by 20.8% of the LWPs and 21.8% of the SWPs such as that recyclers were too many and that finding recyclables was difficult (Table 3.4). These findings corroborate those by Velis (2017), who argues that the financial

viability of recycling is unstable and that the sector remains vulnerable and subject to great price fluctuations.

Although expenses incurred by waste picking and the recycling process cannot be disputed, the costs can be reduced and some costs can be avoided without compromising safety, health, environment, and quality (SHEQ). By segregating clean recyclables, operational costs can be limited (Rutkowski and Rutkowski, 2015). Municipalities generally cover the administrative costs of solid waste collection and handling, purchase equipment such as carts, gloves and trucks, and support official waste workers' health insurance (Dias, 2016). These costs are far lower than if waste service providers had to pay for the collection and disposal of MSW by private companies (Dias, 2016). In Sweden and Bulgaria, waste collection fees are paid by citizens to the municipality where they live, and this fee contributes towards the costs of waste collection and processing of both general and recyclable waste (Stoeva and Alriksson, 2017). Most of the expensive collection systems in place in affluent regions, particularly in Europe and North America, are subsidised to adaptable levels and result in a substantial trade (particularly in terms of export) of recyclables (Velis, 2017). In South Africa, Gauteng municipalities were reluctant to pioneer waste minimisation activities because of the general low cost of landfilling, but recently the cost of landfilling has increased drastically (Muzenda, 2013).

Table 3.4: Reasons for the high operational costs of waste picking

	Landfill waste pickers	Street waste pickers	Total
Changes in prices	0 0.00	0 4.35	1
Difficult to get the recyclables	1 3.45	1 4.35	2
Distance to recyclables is far	0 0.0	1 4.35	1
Insufficient payoff / Money is too little	3 10.34	2 8.70	5
Multiple expenses	1 3.45	0 0.0	1
Not all people can do this kind of work	1 3.45	0 0.0	1
Not easy to get recyclables	0 0.0	1 4.35	1
Physically demanding	3 10.34	7 30.43	10
Recyclable material is free / Free access to waste	0 0.0	1 4.35	1
The prices have dropped so we are not encouraged to sell much	1 3.45	0 0.00	1
Too many recyclers on a site	2 6.90	0 0.00	2
Transport expenses / Transport of recyclable materials	17 58.62	9 39.13	26
Total	29	23	52
Frequency Missing = 1			

3.4.6 The storage, collection and transportation of recyclable waste

The study found a direct relationship between storage and collection and the transportation frequencies of recyclables.

3.4.6.1 Collection frequencies

The results in Figure 3.4 show that the response rate of WPs to collection frequencies was low at 68 (46.6%). It was not possible to account for this phenomenon. The only reason may be that the question was not understood, which is reasonable considering the relatively low academic level of some of the respondents. The total

response rate for the LWPs was 49 (72.1%) and a very low response rate was obtained for the SWPs at 19 (27.9%). More than half (53.4%) of the study respondents did not respond to the collection frequency question.

Figure 3.4 indicates that of those who responded, 42.9% of the LWPs versus 21.1% of the SWPs preferred monthly collection. In the second largest category, 22.5% of the LWPs versus 10.5% of the SWPs preferred a weekly collection, while 12.2% of the LWPs versus 31.6% of the SWPs preferred daily collections. Also, 10.2% of the LWPs versus 36.8% of the SWPs preferred an as-and-when collection frequency, while 12.2% of the LWPs and 0% of the SWPs preferred to collect waste every second week. Thus, various collection frequencies were used by the WPs, and their activities probably depended on the accessibility of recyclables and recycling facilities. Some WPs, especially SWPs, might have sold recyclables even more than twice a day depending on the availability of the recyclables they were able to collect, therefore availability is reiterated as a convenience factor in waste picking activities.

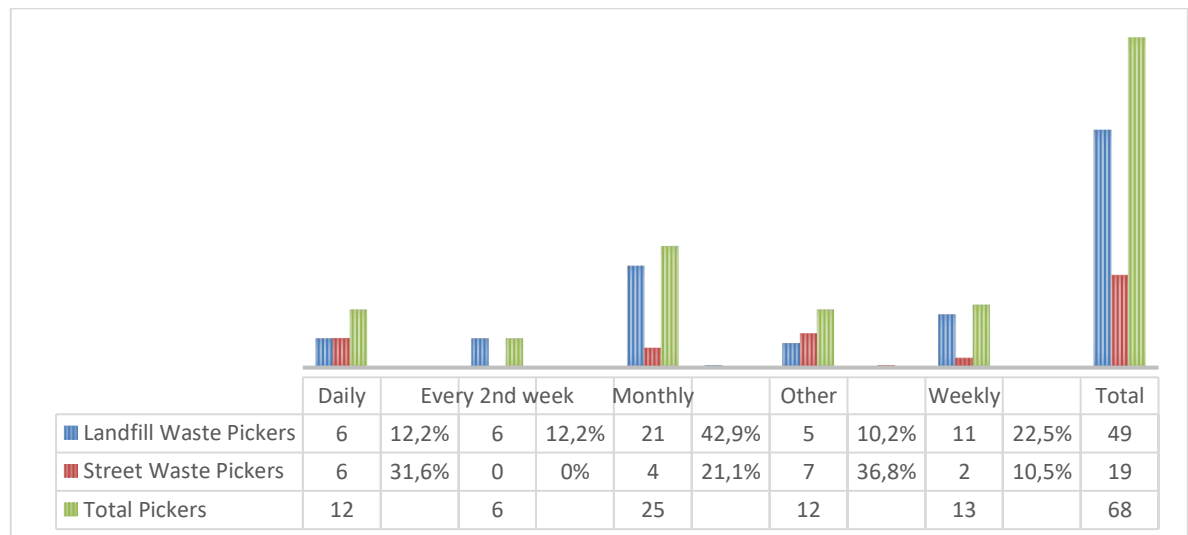


Figure 3.4: Collection frequencies of recyclable materials (n=68)

3.4.6.2 Storage of recyclables

Waste pickers who preferred daily collection of recyclables (Figure 3.4) may need storage space for only a few hours' –thus from the time of picking recyclables to the time of collection by the buyers such as middlemen or buy-back centres. The storage of recyclables normally takes place at landfill sites for LWPs (Figure 3.5; Photos 1 and 2). However, some SWPs also store recyclables at their homes, especially those who want to sell large volumes at a time (Figure 3.6; Photos 3 and 4). It is logical to

argue that, the higher the collection and resale frequencies, the lower the need for storage facilities of recyclable materials. Czajkowski et al. (2015) argue that a lower collection frequency of waste materials requires storage on the waste picker's property or elsewhere for a longer period. Figure 3.4 shows that 42.9% of the LWPs versus 21.1% of the SWPs collected and sold their recyclables on a monthly basis, while only 22.5% of the LWPs versus 10.5% of the SWPs collected and sold their recyclables every week. Respectively, these WPs would have required storage facilities for a month or at least a week before the recyclables could be sold. Prolonged storage of recyclables may pose some security risks, especially at landfills that operate without access control or security officials. However, this did not apply to the current study as the respective landfill sites all had access control and security officials. Evidently, the unavailability of storage facilities or space for recyclables is an inconvenience factor for recycling participation. Figure 3.5 and Figure 3.6 show that storage facilities for recyclables-in-process were available at landfill and private homes. However, the obvious exposure of the recyclables to the environment and elements may pose some problems such as theft and the impact of foraging animals. The photos indicate that wide open spaces were available at the landfill sites and at the homes of the WPs. Although undercover space was not available, this did not prevent the storage of waste.





Photo 3: Home storage by SWPs:
Cans and tins

Photo 4: Home storage by SWPs:
K4/HD/PET

Figure 3.6: Home storage of recyclables at the homes of SWPs

Source of photographs: Author

3.4.6.3 Transportation of recyclables

In total, 67 (45.9%) of the waste pickers responded to the question about the transportation of recyclables. This low response rate cannot be accounted for. Figure 3.7 shows that, of the WPs who responded to this question, 91.8% of the LWPs versus 94.4% of the SWPs used private service providers' transport, while 2.0% of

the LWPs versus 5.6% of the SWPs used their own transport such as carts or trolleys. The remaining 6.1% of the LWPs 0% of the SWPs did not need transportation as they were selling recyclables on site at the landfills. Although the response rate to this question was below 50%, it is clear from the responses that a large number (64 of 95.5%) of the WPs needed transportation for their recyclables. As a result, they either hired private vehicles or depended on middlemen who would buy and at the same time collect recyclables from landfill sites and from homes. Either method implies that costs were incurred. In Belo Horizonte, Brazil, WP collected waste door-to-door using vehicles or push-carts (Dias, 2016). The current study thus confirms that transportation is a factor of convenience or inconvenience in waste picking.

Figure 3.7 indicates an important alternative for WPs as they could sell their recyclables on site at Hazyview and Tekwane landfill sites. However, Figure 3.7 indicates that, although the option to “sell on site” was available, 95.5% of the WPs still preferred to pay transportation costs for their recyclables to be taken to the markets in Mbombela (Nelspruit) or even as far as Johannesburg to get better prices for their products. The SWPs informed the researcher that they were allowed by those LWPs already operating at a landfill site to only sell recyclables that they collected from the streets, as they were not allowed to collect recyclables from the landfill site. Similarly, Dos Muchangos et al. (2014) found the existence of local schemes such as informal purchasing of ferrous scrap metal at waste disposal sites by a Chinese company based in Maputo. The DEA (2014) also found that the majority of WPs lacked infrastructure such as transport and storage facilities to sustain their businesses. In terms of storage space, this study found that adequate space was available both at the landfill sites and some homes of WPs for the storage of recyclables for a week or month at least (section 3.4.6.2 photographs). However, these spaces were uncovered and thus exposed to the elements and theft.

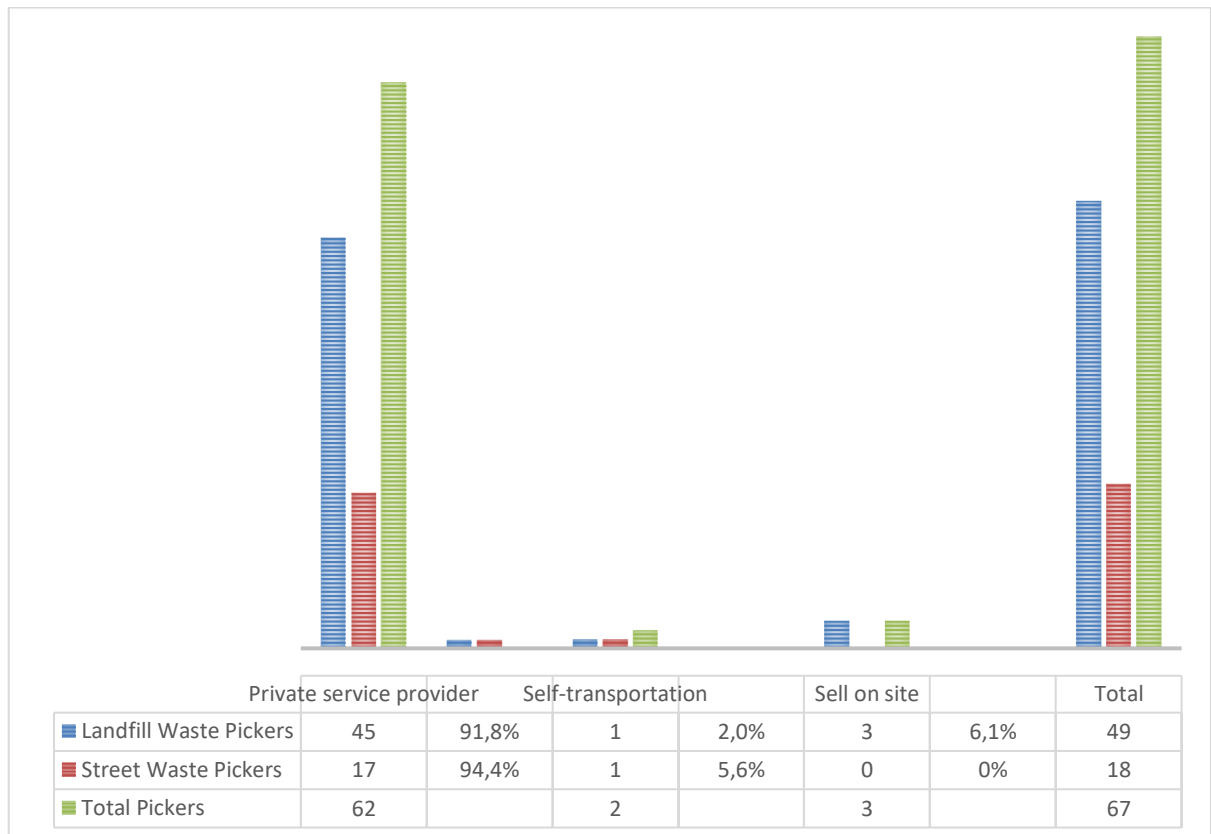


Figure 3.7: Transportation of recyclables

Table 3.5: Statistics for transportation of recyclables

Statistic	DF	Value	Prob
Chi-Square	2	1.6565	0.4368
Likelihood Ratio Chi-Square	2	2.3687	0.3060
Mantel-Haenszel Chi-Square	1	0.5076	0.4762
Phi Coefficient		0.1572	
Contingency Coefficient		0.1553	
Cramer's V		0.1572	
WARNING: 67% of the cells have expected counts less than 5. Chi-Square may not be a valid test.			

Table 3.5 shows a P-value of 0.4368. The P-value is therefore greater than 0.05, indicating that there is no statistically significance difference in the results shown in Figure 3.7 between the LWPs and SWPs.

3.4.7 Availability, accessibility and the distance to and from recycling facilities

3.4.7.1 Availability of recycling facilities

The current study concurs that the availability of waste recycling facilities is a factor of convenience that contributes to successful participation in recycling. A total response rate of 144 (98.6%) was obtained for the availability of recycling facilities. The results showed that 52.7% of the LWPs versus 8.6% of the SWPs indicated that there were no recycling facilities in the City of Mbombela municipal area. However, 47.3% of the LWPs versus 91.4% of the SWPs indicated that there were recycling facilities in their local areas (Figure 3.8). Table 3.2 indicates that 1 (1.5%) of the LWPs preferred selling recyclables directly to recycling factories rather than to middlemen for better prices. Based on this preference, it may be assumed that this is why most (52.7%) of the LWPs versus only 8.6% of the SWPs indicated that there were no recycling facilities in their local towns. This could also be because of the desire by most LWPs to have similar recycling factories in their area as those that exist at Johannesburg in Gauteng, so that they could get better prices for their recyclables. However, 91.4% of the SWPs versus 47.3% of the LWPs indicated that recycling facilities were available locally, which suggests that they were most probably referring to the middlemen or scrap metal dealers. This is because it was found that most SWPs sold their recyclables to such buyers. The results also showed that some (36.8%) of the SWPs did not prefer a monthly, twice weekly or weekly collection frequency but rather 'other' frequencies (Figure 3.4). 'Other' frequencies refer to the fact that the SWPs could collect and sell recyclables even twice or three times a day, or as soon as recyclables have been found. The second preference of the SWPs (31.6%) was to collect waste on a daily basis (Figure 3.4). Therefore, the difference between the LWPs and SWPs in terms of the availability of recycling facilities was the volume of recyclables handled by these two groups of WPs. In most cases, the LWPs handled and accumulated bigger volumes of recyclables than the SWPs, and thus large volumes of waste mean longer collection frequencies and larger volumes supplied to bigger factories, whereas daily or hourly collections are sent to middlemen.

It was noted that in each of the towns under study there were more than two scrap dealer businesses where the SWPs sold their recyclables. They could generally do so without needing any transport, whereas most LWPs operating at the three landfill sites had to either send their recyclables to Mbombela CBD buy-back centres or to Johannesburg for better prices. They had to do this at least once a month. The LWPs from the Hazyview landfill site also sent recyclables to Sabie buy-back centres outside the City of Mbombela boundaries. Overall, the majority (99 or 68.8%) of the WPs indicated that there were local recycling facilities in the study area such as buy-back centres and scrap metal dealers. The study thus concludes that recycling facilities are available locally in the City of Mbombela area, and this makes it convenient for waste picking. A study by Dos Muchangos et al. (2014) in Maputo found that a lack of interest in recycling activities was caused by the unavailability of drop-off points for recyclables, while Kasinja and Tilley (2018) found that, in Blantyre (Malawi), there were no recycling facilities and, as a result, this curbed the desire or attempts to recycle waste. It may therefore be concluded that the availability of recycling facilities within the City of Mbombela municipal area creates opportunities for willing participants to collect and sell waste.

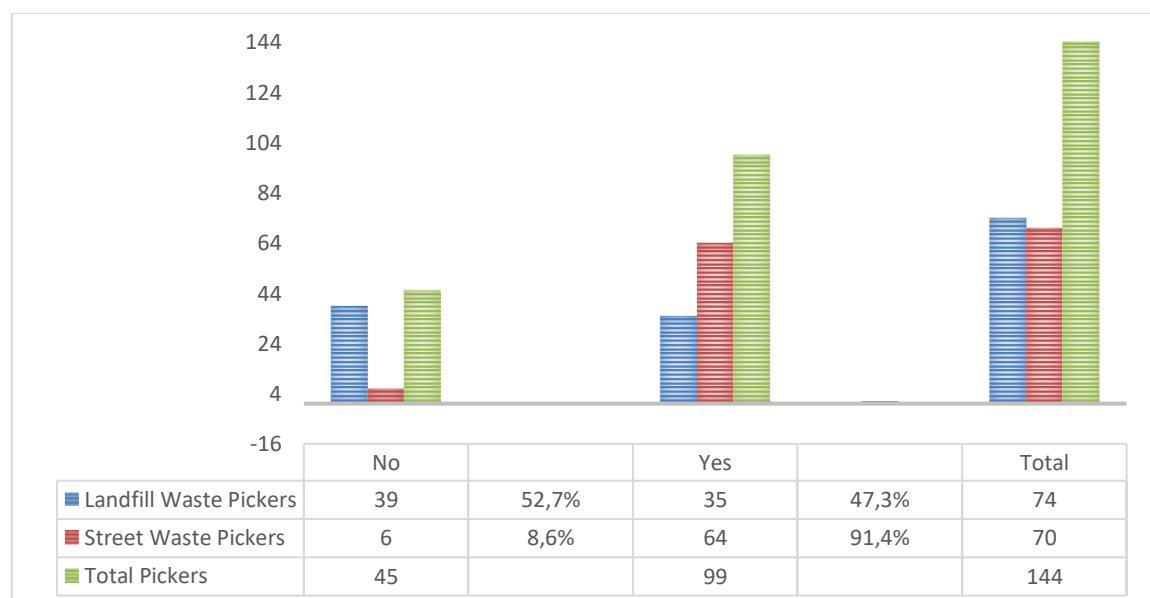


Figure 3.8: Availability of recycling facilities in the Mbombela area

3.4.7.2 Distance as a factor of convenience or inconvenience

The study found that distance was a factor of convenience or inconvenience, depending on the availability of transportation and the extent of the costs associated

with it. Table 3.4 shows that only 1(4.4%) of the SWP regarded waste picking activities as expensive because of the lengthy distances they had to travel to collect and sell recyclables. The distance factor is directly proportional to the transportation cost factor in recycling participation. Table 3.4 also records that 17 (58.6%) of the LWPs versus 9 (39.1%) of the SWPs indicated that transport expenses or transport of recyclable materials was making waste picking activities financially costly and thus inconvenient. Kasinja and Tilley (2018) found that, in Blantyre (Malawi), 68% of WPs sold their metal recyclables to one middleman because, amongst other reasons, his business was located close to where they recovered materials. Rutkowski and Rutkowski (2015) argue that location and distance determine the average amount of material that is collected in specific streets or at establishments. The current study thus concurs that the distance and the cost of transportation impact waste picking activities. Transport costs also become part of operational costs in waste picking activities, especially if such costs cannot be avoided.

3.4.7.3 The accessibility of recycling facilities

Only 98 (67.1%) responded to this question (Figure 3.9). Figure 3.9 shows that, of those who responded to this question, 97.1% of the LWPs and 93.8% of the SWPs indicated that recycling facilities in and around the City of Mbombela were easily accessible. Only 2.9% of the LWPs and 6.3% of the SWPs indicated that such facilities were not accessible. More SWPs than LWPs commented that recycling facilities were readily available, which endorsed the previous finding regarding the availability of such facilities. The study thus found that recycling facilities in the City of Mbombela were accessible and, as so many respondents made use of such facilities, the study concurs that accessibility is a convenient factor in waste picking practices.

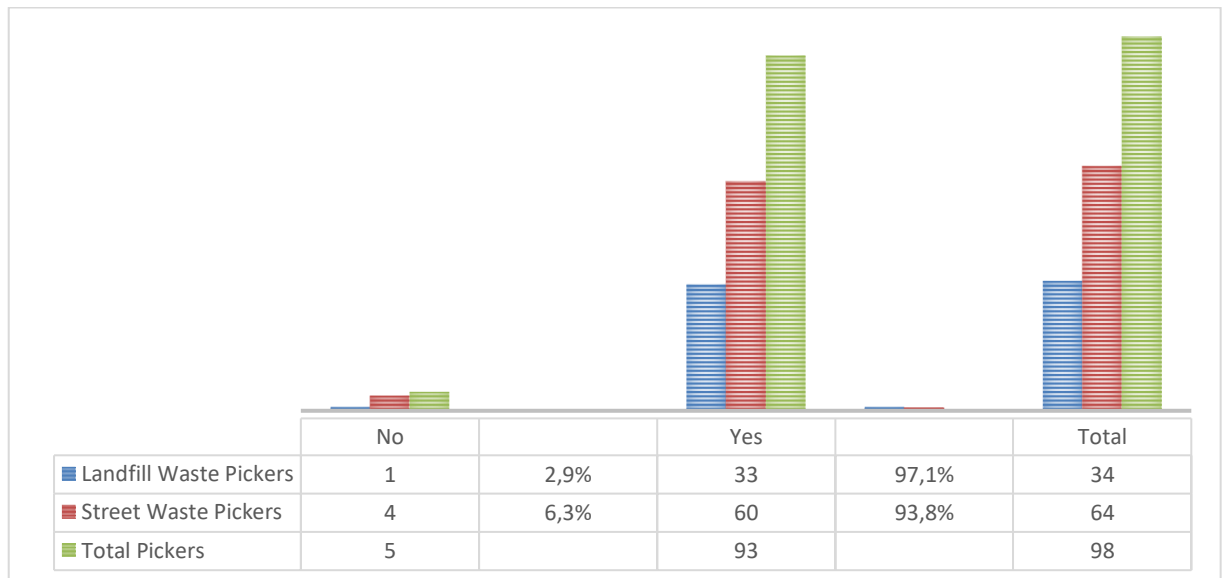


Figure 3.9: The accessibility of recycling facilities in the Mbombela area (n=98)

3.4.8 Unsafe work environments and unhealthy working conditions

This study found that health and safety were factors of inconvenience in waste picking. Table 3.6 shows that 134 (91.8%) responded to this question, which was a very good response rate. This may be due to the fact that health and safety issues are primary concerns among WPs. Of these respondents, 95.6% of the LWPs was concerned about health and safety due to ongoing exposure to health and safety hazards, especially at the landfill sites where working conditions appeared to be often adverse for waste picking. Conversely, 42.4% of the SWPs raised concerns about their exposure to health and safety hazards when they engaged in waste picking. In support of the health risks that WPs may be exposed to, Chokhandre et al. (2017) found that the persistent prevalence of illnesses was significantly higher for WPs than a comparison group of non-WPs. Clearly, the health and safety hazards that WPs are exposed to are factors of inconvenience that impact waste picking.

Table 3.6: Challenges and health and safety hazards (n=134)

	Landfill Waste Pickers (n = 68)		Street Waste Pickers (n = 66)	
	Frequency	%	Frequency	%
Recycling companies have closed down	0	0.0	1	1.5%
Time consuming	0	0.0	1	1.5%
Transport challenges	0	0.0	1	1.5%
Limited access to recyclable material	0	0.0	1	1.5%
Income earned is not what was expected / Hard work for little income	1	1.5%	1	1.5%
Lack of equipment (tools), trolleys, balling machines	1	1.5%	4	6.1%
Competition from other recyclers / There are many recyclers	2	2.9%	4	6.1%
Physically demanding – Carrying heavy materials / Walk long distances	0	0.0	5	7.6%
Prevented to collect recyclable materials by community / security	0	0.00	9	13.6%
Community criticise waste pickers/talk negatively of them/insult informal recyclers	2	2.9%	7	10.6%
Arrested without proper documents for copper / Commit crime to collect recyclable material	0	0.0	13	19.7%
Health risk / Safety risk / Lack of PPE	65	95.6 %	28	42.4%

Note: Respondents could supply more than one answer.

3.4.9 Intolerance of waste pickers by communities and official waste workers

The results that are presented in Table 3.6 that are discussed in this section are shaded in grey. The findings suggest that intolerance as a factor of inconvenience for the waste pickers in this study existed only to a limited extent. It was found that only 19.7% of the SWPs and none (0.0%) of the LWPs were concerned about being arrested when found in possession of copper recyclable items without proper documentation as proof of legal possession. Copper items and copper waste are highly lucrative items when resold and are usually collected (and often stolen) at source. Scholtz (2015) reports that all metal items have become the target of thieves and vandals. Because normal street waste collection of scrap does not yield good volumes for a better income, manhole covers in roads and electric cables look very tempting to WPs. Unconfirmed allegations suggest that illegal scrap collectors also

place orders for specific goods, which pressures WPs to procure such materials illegally (Scholtz, 2015). Thus, the value in copper causes it to be illegally sourced which may prompt law enforcement agencies to be on the look-out for culprits, and they might thus have targeted some SWPs.

Moreover, only limited numbers of waste pickers (2.9% LWP and 10.6% SWPs) were concerned that communities were intolerant of their practices and thus criticised, insulted, or spoke negatively about their activities. Also, only 13.6% of the SWPs seemed to be prevented from collecting recyclable materials by community members and security officials. Some of the SWPs may have been prevented from sourcing waste at landfills sites as the security guards on duty would not have allowed them access. Moreover, LWPs may have demarcated their areas of operation and guarded these areas against outsiders. Similarly, a study by Kasinja and Tilley (2018) found that only one WP complained that he had sometimes been chased away from or denied access to collect recyclable items from waste bins for no reason, despite the fact that those who denied him access had no use for the waste products that could have been recycled. Instead, this waste ended up being dumped or burnt. In the current study, this complaint was also made but by a minimal number (13.6%) of SWPs, which suggests that communities and officials in the study area were generally quite tolerant of SWPs and LWPs and allowed them to go about their business. According to the results, 86.4% of SWPs and 100% of LWPs never experienced intolerance. The low prevalence of intolerance thus suggests that it was not a major inconvenience factor and did not impact waste picking practices negatively for the majority of respondents in this study. Conversely, intolerance observations were recorded by Simatele et al. (2017), who found that many of the WPs in their study pointed out that harassment at the point of waste collection and during transportation was highly prevalent as residents considered them a nuisance. It was argued by the latter authors that this probably occurred because some WPs were known to remove waste from bins and scatter it indiscriminately at the site of sourcing. Sandhu et al. (2016) uncovered an extreme form of collusion when they found that WPs were only allowed to continue their activities after they paid an undisclosed amount to municipal sanitary workers. Dias (2016) refers to a membership-based organisation that played a key role in challenging prevailing prejudice towards and harassment of WPs, which was a problem that the latter study identified across five cities. The latter study thus proposed that intolerance was a

factor of inconvenience in waste picking activities. However, due to the low rates of intolerance found by this study that are contrary to the findings of earlier authors, it is argued that intolerance, although experienced by a limited number of SWPs and LWPs, was not a major factor of inconvenience in the study area. In fact, it could be seen as a factor of convenience for WPs because a large majority of both SWPs and LWPs was allowed to go about their business to earn a living.

3.5 Conclusion

This chapter presented data pertaining to an investigation to determine the influence of convenience or inconvenience factors on waste picking activities in the City of Mbombela area in the Republic of South Africa. The intensive literature review that was conducted illuminated various factors of convenience and inconvenience that impact waste picking, and these results guided aspects that were investigated by the current study. These aspects were: waste recyclability, availability and accessibility; the prevalence of waste markets; the price implications and the operational costs of waste; the benefits of waste picking; storage requirements; collection and transportation issues; the impact of distances to and from waste picking sources; the availability and accessibility of recycling facilities; the unsafe work environment associated with waste picking and recycling; unhealthy working conditions; and the intolerance of WPs displayed by community members, law enforcement officials and other waste workers towards WPs.

The literature suggests that certain factors of convenience encourage waste picking and guide WPs to prefer certain waste materials over others for recycling. The primary condition that is required for waste picking to be successful is that solid waste should have residual monetary value as a commodity that is recyclable and resellable (Velis, 2017). The literature highlights the importance of waste as a valuable recyclable resource (Mwanza and Mbohwa, 2017; Dos Muchangos et al., 2014) and supports the notion that WPs are important in the waste chain as they do not pick just any waste materials, but they select waste materials with resale value. This not only supports economic growth, but ensures the survival of people who may otherwise have been an economic burden on society and the state.

The study results show that some recyclables are much more preferred than others by WPs. For instance, aluminium was the resource most preferred by 53.4% of the

WPs, while PET-bottles came second at 48.6%, followed by plastic (48.6%), metal/steel/scrap (45.9%), and paper (36.3%) (Table 3.1). Comparatively, Kasinja and Tilley (2018) found that 21% of the WPs in their study recovered only metals, while 53% recovered only plastics and 26% recovered plastics and metals. Aluminium stood out as a preferred recyclable in the current study, probably because it is more available in the South African environment than in Blantyre (Malawi) where the latter authors conducted their study. Other recyclables that can be sold for money such as metal, steel, glass bottles, plastic and metal scrap seemed to be widely available for WPs and these were thus items of convenience for them.

The literature also suggests that the availability of recyclables is a convenient factor that encourages recycling participation. For instance, Kasinja and Tilley's (2018) study that was conducted in Zingwangwa township in Blantyre (Malawi) found that plastic and metal were the most available waste categories. In support of the role of WPs in the current informal waste management sector, Navarrete-Hernandez and Navarrete-Hernandez (2017) argue that the institutionalisation of WPs may allow them to collaborate with people in neighbourhoods to ensure that recyclable materials are available and utilised.

The study corroborates the view of an earlier study (Sandhu et al., 2016) that the unavailability of recyclables is a factor of inconvenience in waste picking participation. The responses indicated that 50% of the LWPs and 46% of the SWPs reported that recyclables were not readily available or easy to procure, while 40% of the LWPs and 43.2% of the SWPs reported that too many recyclers were competing for recyclable materials. Only 10% of the LWPs and 8.1% of the SWPs indicated that it was physically demanding to obtain recyclables, while only 2.7% of the SWPs had been denied access to landfill sites by LWPs (Figure 3.1). In concurrence with the challenges experienced by WPs in terms of the unavailability or scarcity of recyclables, Sandhu et al. (2016) found that WPs spent about 10 to 12 hours per day looking for recyclable waste materials.

However, the majority of the respondents (98 or 67.1%) in the current study indicated that the accessibility of recyclable materials was a factor of convenience and supported successful waste picking participation (Figure 3.2). Dias (2016) argues that WPs should be granted access to waste as a common-pool resource. A case in

point is that, in Nigeria, WPs have unrestricted access to the Ugwuaji landfill facility (Nzeadibe, 2008).

The current study results also indicated that accessibility was an important factor of convenience or inconvenience as, respectively, 86.7% of the LWPs versus only 46.5% of the SWPs found that recyclable waste was accessible (3.4.3). The finding that more LWPs than SWPs found recyclable waste more accessible may be attributed to the absence of a separation at source policy across South Africa (Godfrey and Oelofse, 2017). This means that more recyclables still go to landfill sites where only LWPs have access to them. SWPs have more limited access to waste unless they find recyclables before waste bins are emptied by service providers or if they have access to waste storage areas at households and businesses. In support of making waste accessible to WPs, a policy guiding waste picking in greater Santiago de Chile promotes waste pickers' monopoly to sustain the accessibility of recyclables (Navarrete-Hernandez and Navarrete-Hernandez, 2017). Sandhu et al. (2016) also found that, although some WPs no longer had access to recyclables, most operated at municipal bins, landfills and informal dump sites where they had access to waste.

The literature proposes that a good market price for recyclable materials is a factor of convenience that encourages recycling participation. It has also been determined that there is a relationship between the price paid for recyclables and the operational costs of waste picking. Kasinja and Tilley (2018) argue that the market will, at certain points, favour some recyclables over others, while in some cases the market may be seasonal. Waste paper, cardboard and polyethylene packaging materials are usually not recovered when there is no market for them (Nzeadibe, 2008). The demand and supply chain thus influences the market for recyclables and the prices paid for waste categories. When surveyed, respondents at recycling facilities indicated that significant volumes of recyclables were usually delivered by WPs who normally traded their wares at a price (Simatele et al., 2017).

Best markets and even better prices are factors of convenience that drive high rates of waste picking. The current study found that 33.3% of the LWPs and 28.6% of the SWPs reported that an increase in price for recyclable materials would encourage them to participate more avidly in waste picking (Table 3.2). Some WPs expressed their dissatisfaction with unstable markets and inconsistencies in the prices buyers

of recyclables were prepared to pay. A study that was conducted in Blantyre, Malawi, found that there were four buyers of metal (two industries and two middlemen) but that 68% of the WPs sold their metal recyclables to one middleman only because he offered better prices and bought a variety of metals (Kasinja and Tilley, 2018). The literature and the results of the current study thus highlight the role played by waste buyers in encouraging or discouraging waste picking activities. Therefore, should waste picking be institutionalised as a recognised niche in the waste management chain, this role should be considered in future waste management policies in the quest to stabilise waste picking markets.

The literature also illuminates that various factors influence the operational costs associated with waste picking, and it has been established that high operational cost is a factor of inconvenience that impacts waste picking negatively.

In the light of the health and safety hazards that WPs are exposed to, Chokhandre et al. (2017) assessed the economic burden of morbidities and explored the expenditure incurred by treatments, workdays lost, and persistent illnesses among WPs. Their study determined that the average expenditure was much higher for WPs than for non-WPs. Although such an investigation was beyond the scope of the current study, the latter literature finding and the finding by the current study that under scored the hazardous nature of waste picking urge that the safety and health of WPs be considered by local authorities. This is because the health and safety of WPs should be accorded attention in policies and regulations regardless of the current informal nature of waste picking as a business endeavour in South Africa.

The current study showed that operational costs were incurred by waste picking activities, and it is thus underscored that such costs area factor of inconvenience in the recycling arena. However, for some WPs operational cost was not a primary consideration, as Figure 3.3 shows that 58.3% of the LWPs and 67.6% of the SWPs reported that their waste picking activities were relatively cheap (thus affordable). Conversely, 41.7% of the LWPs and only 32.4% of the SWPs reported that waste picking was a financial burden. Of the WPs who reported that waste picking incurred burdensome expenses, 58.6% of the LWPs versus only 39.1% of the SWPs were concerned about transport costs (Table 3.4). A limited percentage (10.3%) of the LWPs but a higher percentage (30.4%) of the SWPs was concerned about physical

hard labour, while only 10.3% of the LWPs and 8.7% of the SWPs were concerned about the limited income derived from waste picking (Table 3.4). Overall, it may be argued that the negative comments about the burdens associated with waste picking were relatively low (37.1%), and the data thus suggest that waste picking in the study area offered fairly viable opportunities for earning an income as the costs associated with it were not considered high by the majority (62.9%) of the respondents (Figure 3.3). In concurrence with the latter finding, Velis (2017) argues that the financial viability of recycling is versatile (thus either high or low), but he concludes that the sector remains vulnerable and subject to great price fluctuations.

The literature asserts that the availability of storage facilities or space is a factor of convenience, but when such spaces are not available, this becomes a factor of inconvenience. Storage space is thus a basic requirement when WPs engage in waste picking activities. Czajkowski et al. (2015) argue that sorting recyclables into various categories requires available space, and low waste collection frequencies may require storage on the WPs' properties or at landfill sites for a period of time. Rutkowski and Rutkowski (2015) found that a waste picker cooperative established the number of WPs for particular service areas based on estimated volumes of recyclables. The services included collection, transportation and storage shed services (Rutkowski and Rutkowski, 2015). The current study found that storage space for recyclables was normally available at landfill sites for LWPs (Figure 3.5; Photos 1 and 2). However, some SWPs also stored recyclables at their homes, especially those who wanted to sell large volumes at a time (Figure 3.6; Photos 3 and 4). It is logical to argue that, the higher the collection and resale frequencies, the lower the need for storage facilities of recyclable materials. Czajkowski et al. (2015) argue that a lower collection frequency of waste materials requires storage on the waste picker's property or elsewhere for a certain period. The current study found that the storage spaces at the landfill sites were large open areas, but they were without proper coverage to ensure protection during inclement weather or harsh sunlight (see section 3.4.6.2 and the accompanying photographs). Should LWPs work in such conditions for a long time, their health could be compromised. The study therefore supports Dias's (2016) argument that one of the biggest challenges faced by WPs in the informal economy is the need for safe sorting and storage spaces for recyclables.

Figure 3.4 shows that the collection frequency response rate was very low at 68 (46.6%). Of those WPs who responded, 42.9% of the LWPs versus 21.1% of the SWPs preferred a monthly collection frequency, followed by 22.5% of the LWPs versus 10.5% of the SWPs who preferred a weekly collection frequency, and 12.2% of the LWPs versus 31.6% of the SWPs who preferred a daily collection frequency. Only 10.2% of the LWPs but 36.8% of the SWPs preferred to collect waste as-and-when available, while only 12.2% preferred to collect waste every two weeks. If it is assumed that the WPs sold the waste at the same frequencies that they collected it, it may be argued that the WPs who employed a daily collection frequency needed storage for only a few hours from the time of collecting the recyclables to the time of sale. For the LWPs, temporary storage was normally allowed at the landfill sites (see photographs in section 3.4.6.2). However, the photographs also show that SWPs who wanted to sell in larger volumes had to store recyclables on their premises. The WPs who collected their recyclables on a monthly basis thus needed storage space for at least a month. It may thus be concluded that the higher the collection and sale frequencies of waste, the lower the need for storage space.

The study (Figure 3.7) found that, although the response rate for the need of transportation was below 50%, it was that a large number (64 or 95.5%) was in need for transportation for their recyclables. As a result, they either hired private vehicles or depended on middlemen who would buy and at the same time collect recyclables from landfill sites and from homes. Either method implies costs for the WPs. In Belo Horizonte, Brazil, door-to-door collection is done by WP cooperatives using vehicles or push-carts (Dias, 2016). Similarly, Stoeva and Alriksson (2017) state that recyclables are collected and transported by private entrepreneurs, while the DEA (2014) refers to the fact that WPs generally transport their collected materials to recyclers more frequently at their own costs rather than using formal business operators. Thus, the current study affirms the availability of transportation as a factor of convenience for waste picking, whereas it is a factor of inconvenience when transport is required but is not available.

The study also found that distance may be a convenience or inconvenience factor as it influences waste picking activities. The distances to waste sources and recycling or landfill sites thus needs to be considered when the location of recycling facilities is planned. In support of this argument, the DEA (2014) urges that more transfer stations be provided at municipal level to reduce the distances waste

pickers/collectors must travel. Distance influences the costs of transportation and other operational requirements (sorting, cleaning, fencing, guards) that are associated with waste picking activities, especially when such costs cannot be avoided. However, Table 3.4 shows that only 1(4.4%) of the SWP regarded waste picking activities as expensive because of the distances they had to travel to collect and sell recyclables. This low figure suggests that the areas of operation of the WPs in the Mbombela area might have been informally demarcated and that each group of WPs might have accepted responsibility for a specific area that was convenient for the collection, storage and re-sale of recyclables. Although this observation is conjecture as it has not been determined by the study if this was the case, the argument seems feasible in light of the minimal concerns regarding the distances to be covered. The distance factor is directly proportional to the transportation cost factor in recycling participation. Table 3.4 also records that 17 (58.6%) of the LWPs versus 9 (39.1%) of the SWPs indicated that the transport costs of recyclable materials made waste picking financially costly and thus inconvenient. Comparatively, Kasinja and Tilley (2018) found that 68% of WPs sold their metal recyclables to only one middleman because he was close to the waste collection point, while Rutkowski and Rutkowski (2015) argue that the choice of the location of recycling operations depends on the distance and average amount of material collected in specific streets, as well as on pickup access.

The literature suggests that the unavailability of recycling facilities may at worst contribute to non-participation in waste picking and, if waste picking does occur, it leads to a very low recycling rate. In concurrence with this view, Stoeva and Alriksson (2017) found that there were buy-back machines in some grocery stores where people could deposit plastic bottles and aluminium cans to increase recycling rates. Simatele et al. (2017) concur that increased support for WPs is required, especially in terms of access to recyclables through source separation programs and industry-provided buy-back centres to increase collection rates. The current study concurs that the availability of waste recycling facilities is a factor of convenience as it ensures successful participation in waste picking. The results showed that the LWPs felt that they had more ready access to waste than SWPs as 52.7% of the LWPs versus only 8.6% of the SWPs indicated that there were no recycling facilities locally in the City of Mbombela municipal area, whilst 47.3% of the LWPs versus 91.4% of the SWPs indicated that there were recycling facilities locally (Figure 3.8). Overall, the majority

(99 or 68.8%) of the WPs indicated that there were recycling facilities within the City of Mbombela municipality. They referred to buy-back centres and scrap metal dealers. The study thus concludes that recycling facilities are readily available in the City of Mbombela area, which makes waste picking a convenient informal enterprise. Dos Muchangos et al. (2014) state that the results of a survey that was administered in Maputo indicated a lack of interest in recycling activities if drop-off points for recyclables were unavailable. In support of this argument, Stoeva and Aliksson (2017) state that Swedish municipalities contract more packaging recovery organisations for the collection, transportation and processing of separated recyclable waste and that this is highly successful, while Rutkowski and Rutkowski (2015) describe business establishments receiving a waste collection service where a pair of WPs move collected material to a temporary transfer station with easy access for trucks. The literature thus proposes that access to recycling facilities is a crucial convenience factor if waste picking activities are to be encouraged. The current study found that recycling facilities around the City of Mbombela were accessible and the study thus corroborates the notion that accessibility is a convenience factor that stimulates the waste picking process. Figure 3.9 shows that, of those who responded to this question, 97.1% of the LWPs and 93.8% of the SWPs indicated that recycling facilities in and around the City of Mbombela were easily accessible. Thus only 2.9% of the LWPs and 6.3% of the SWPs indicated that such facilities were not accessible. It was also noted that the SWPs had the highest response rate in favour of the accessibility of recycling facilities, and this rate corresponded with the finding based on the previous question on the availability of such facilities. The study thus concludes that recycling facilities in the City of Mbombela area are accessible and that accessibility is a convenience factor that encourages waste picking in the study area.

The literature highlights the fact that WPs are exposed to various unhygienic conditions and safety hazards, which is a factor of inconvenience that might discourage waste picking activities. A study on the comparative rates of injuries between WPs and non-WPs found that the prevalence of injuries among WPs was higher (75%) as it was only 17% for the non-WP group (Chokhandre et al., 2017). Simatele et al. (2017) also found that the lack of infrastructure (such as safe road networks) was a serious challenge as WPs had to use the same roads as motorists which resulted in fatal accidents involving WPs. Similarly, a study by Dos Muchangos

et al. (2014), which was conducted in Maputo, found that air, soil and ground water was highly compromised at the landfill site and in adjacent areas, and the authors argued that this posed a great risk to environmental and public health. Chokhandre et al. (2017) found that the prevalence of illnesses among WPs was significantly higher than in a control group.

There is thus general agreement in the literature that health and safety hazards pose a factor of inconvenience in waste picking. It has thus been suggested that some preventive and control measures be instituted by all stakeholders that benefit from waste picking. In South Africa, waste regulations require that all WPs should undergo medical checks and be provided with PPE such as gloves and gumboots. WPs should also be made aware of health and safety matters (DEA, 2011). Whether these measures have been implemented for WPs is questionable at this point, however, as the researcher observed that most WPs operated without any protective gear.

The literature refers to the negative perceptions of and harassment of WPs by community members, officials and security guards (Sandhu et al., 2016; Schenck et al., 2016; Kasinja and Tilley, 2018). Such behaviour exposes unwarranted intolerance of WPs that should be addressed. The inconvenience and humiliation caused by intolerance towards WPs by some have the potential to disrupt waste picking activities and consequently to compromise any social, economic and environmental benefits that waste picking may have. Against this background, the DEA (2014) argues that the exploitation of WPs by formal recyclers, collectors and transporters is a factor of inconvenience that needs to be eradicated.

Intolerance towards WPs abuses their rights and exposes them to unnecessary harm and humiliation. In the current study, this complaint was also made but by a minimal number (13.6%) of SWPs, which suggests that communities and officials in the study area were generally quite tolerant of SWPs and LWPs and allowed them to go about their business. It was found that 86.4% of the SWPs and 100% of LWPs who answered the question had never experienced intolerance. The low prevalence of intolerance thus suggests that it was not a major inconvenience factor and did not impact waste picking practices negatively for the majority of respondents in this study. Conversely, intolerance observations were recorded by Simatele et al. (2017), as many of the WPs in their study pointed out that harassment at the point of waste collection and during transportation was highly prevalent as residents considered

them a nuisance. It was argued by the latter authors that this probably occurred because some WPs were known to remove waste from bins and scatter it indiscriminately at the site of sourcing. Sandhu et al. (2016) uncovered an extreme form of collusion when they found that WPs were only allowed to continue their activities once they had paid an undisclosed amount to municipal sanitary workers.

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CHAPTER 4

INCENTIVES AS STIMULANTS FOR RECYCLING IN THE CITY OF MBOMBELA AND SURROUNDING AREAS

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ABSTRACT

Introduction: Waste picking activities are an integral part of the waste recycling process as well as the waste management system. The study was conducted to determine the influence of incentives on waste picking participation in the area around the City of Mbombela. The literature suggests that various incentives and stimuli motivate waste pickers to participate in recycling. Based on the outcomes of this review, the following factors were explored: legislation and policies, knowledge and awareness, social pressure, infrastructure, socio-economic and financial incentives, incentives that are offered by local municipalities, environmental incentives, incentives that are associated with manufacturing industries, and energy or power generation incentives.

Methodology: This study investigated the determinants of recycling participation in the area surrounding the City of Mbombela. The data were collected from February to March 2019. A participatory method of data collection was used to understand the incentives that encouraged the participating waste pickers to engage in waste picking activities. Available WPs at three landfill sites – Hazyview, Barberton and Tekwane – and who operated in the streets of Hazyview town, Barberton town and Mbombela (Nelspruit) CBD were recruited. Only WPs who were willing to participate and sign a consent form were included in the study. The respondents were interviewed using a structured questionnaire and their responses were recorded in the available spaces by the principal researcher and a trained and knowledgeable assistant. A sample size of 149.4 (150) waste pickers was determined by using Yamane's (1967) formula. However, this ideal number was not achieved as 146 WPs effectively participated in the study.

Results and discussion: The study found that the majority of WPs had been encouraged or compelled by financial needs to engage in waste picking activities. Fewer had been motivated by friends while others had been motivated by family

members. Although social issues played an important role as drivers of waste picking, the study concluded that the majority of WPs felt compelled to engage in waste picking because of the financial benefits they reaped due to this form of gainful self-employment. The study also concluded that waste picking was motivated by multiple incentives and WPs' operations impacted the community, the economy, and the environment. In the latter instance, waste reduction and pollution prevention were found to be benefits of waste picking.

Conclusion: The fact that many WPs were compelled by their economic circumstances and financial needs to embark on waste picking indicated that much should still be done to educate all role-players in the waste management chain regarding the importance and wider impact of informal waste recycling practices. Based on the findings of the study, it is recommended that extensive education and awareness campaigns be launched regarding the importance of the environmental and economic impact that waste picking may have in the study area and, by extension, in areas that are plagued by similar environmental and economic constraints. Such programmes will also encourage more people to contribute to environmental sustainability through recycling activities while they may also encourage informal recycling that will, in turn, stimulate the economy by providing a livelihood for the poorest of the poor.

Key words: financial incentives, environmental incentives, waste pickers, recycling.

4.1 Introduction

Waste picking activities are an essential part of the waste recycling process and the waste management system. Waste pickers' work generally results in waste separation, waste reuse, recycling and the reduction of pressure on the environment (Awopetu et al., 2014) –particularly in terms of littering and pollution reduction. According to Dias (2016), a growing body of evidence outlines the contribution of informal waste pickers to a city's solid waste management system, the environment, the economy and the quality of public spaces. Waste pickers (WPs) therefore do not only meet their own economic needs, but their activities also benefit various communities, municipalities, and the environment (Yigit et al., 2015). Waste pickers play a vital role in municipal solid waste management and make a significant contribution to cities' economic growth as well as environmental wellness (Simatele et al., 2017; Nzeadibe, 2009). Clearly, informal waste picking activities are essential in the waste recycling process as WPs assist in reducing solid waste that ends up in landfills. Moreover, waste picking also contributes financially to the unemployed and to the environment as it reduces the effects of waste pollution.

Because waste recycling is essential for addressing the economic needs of poor communities and for environmental protection, various factors influence the viability of informal waste picking activities. According to Machete (2019), various studies have highlighted a number of positive and negative factors that influence community members' decision to participate in waste recycling. Remr (2019) also argues that the willingness of individuals to recycle waste is driven by a wide range of factors. The main factors that seem to affect waste sorting habits are infrastructure at municipal level, economic viability, socio-demographic characteristics, and the motivation that drives individuals to recycle waste (Butkus et al., 2018). Crociata et al. (2015) argue that the social and economic profiles of communities may predict recycling participation, and this view is supported by Schenck et al. (2016) who iterate that several international and South African studies assessed the social and economic circumstances of WPs operating in cities and towns.

Suttibak and Nitivattananon (2008) and Yau (2010) argue that the factors that impact waste recycling behaviour are generally multi-dimensional and that they include socio-demographic factors, housing characteristics, convenience, and incentives. It

was against the backdrop of the findings of earlier studies such as those cited above that the aim of the current study was to determine what impact various incentives (or benefits) had on waste picking participation in the City of Mbombela and its surrounding areas. In this study the term ‘incentives’ refers to all benefits and monetary rewards that motivate or stimulate waste pickers towards greater output in recycling.

Various types of incentives seem to impact waste picking (or informal recycling) just as there are various factors that influence recycling participation. Yau (2010) suggests that, to stimulate community participation in waste recycling, the first important step is to understand the factors that encourage people to recycle as well as those that discourage people from recycling. Awopetu et al. (2014) argue that waste picking is predominantly driven by poverty and a desire to earn a living. Siu and Xiao (2016) found that the participants they interviewed collected recyclables every day because they had to make a living, while Ghisolfi et al. (2017) argue that it is necessary to acknowledge the monetary incentives that the collection, screening and selling of recyclable materials provide. Yau (2010) further suggests that an incentive scheme for waste separation at source is a strong motivator that stimulates domestic waste recycling. Evidently, there are various types of incentives that stimulate people at community level to participate in informal waste recycling activities. In the waste management context, the use of the term ‘incentives’ has been categorised as extrinsic, intrinsic or social (Waltmann, 1992). These incentive categories are outlined in the next section.

4.2 Types of Incentives that Stimulate Recycling

Table 4.1 below summarises various authors’ views on the types of incentives that encourage recycling and/or waste picking.

Table 4.1: Types of incentives in the waste recycling context

Incentive	Description	Source
Internal incentives (Intrinsic incentives)		
Knowledge and awareness (internal facilitator)	Knowledge is among the strongest predictors of recycling	1. Hornik et al. (1995)
Good infrastructure of recycling facilities	Infrastructure has an influence on waste recycling	1. Butkus et al. (2018)
External incentives (Extrinsic incentives)		
Economic / Financial incentives	1. Waste picking contributes to the economy 2. Monetary rewards contribute towards waste recycling	1. Dias (2016), Yigit et al. (2015), Simatele et al. (2017), Nzeadibe (2009), Crociata et al. (2015), Schenck et al. (2016), 2. Abila and Kantola (2019), Ghisolfi et al. (2017), Yau (2010)
Social influence (pressure)	1. Social profile predicts recycling participation 2. Recycling can be influenced by the commitment of family, friends and neighbours	1. Crociata et al. (2015), Schenck et al. (2016) 2. Hornik et al. (1995)
Recycling incentives provided by local municipalities: clean towns & less waste	Waste picking contributes to a city's solid waste management system	Dias (2016), Yigit et al. (2015), Simatele et al. (2017), Nzeadibe (2009)
Environmental incentives that encourage recycling activities: less waste to landfills	Waste picking benefits the environment and the quality of public spaces	Dias (2016), Yigit et al. (2015), Simatele et al. (2017), Nzeadibe (2009)
Recycling incentives provided by manufacturers: cheaper recyclable materials for manufacturing processes than raw materials	The recycling sector provides secondary resources to manufacturing industries which contributes to sustainable industrial processes	Nzeadibe (2009), Mwanza and Mbohwa, (2017)
Recycling incentives for energy generation: cheaper input materials such as methane gas	1. Energy efficiency can be encouraged through recycling 2. Waste should form part of input resources for energy generation	1. Giurea et al. (2018) 2. Machete (2019)
Legislative (policy) incentives	1. Appropriate legislation can serve as incentives for individuals to participate in recycling 2. Establishment of environmental regulations motivates informal WP activities 3. Regulated incentives will integrate waste pickers and formalise waste picking	1. Yau (2010) 2. Butkus et al. (2018) 3. Ghisolfi et al. (2017)

4.2.1 Internal incentives (intrinsic incentives)

To encourage waste recycling, internal incentives may be devised that will empower WPs through knowledge to understand the importance of recycling. This may be achieved through awareness initiatives and knowledge will thus become an internal incentive for WPs. Other incentives in this category include the establishment of recycling networks (i.e., a sound infrastructure) and proper public facilities, both of which will significantly affect sustainable recycling behaviours.

4.2.1.1 Knowledge and awareness (internal facilitators)

Knowledge about and awareness of the importance of good waste management and recycling practices will stimulate participation in informal waste recycling activities. A study by Dos Muchangos et al. (2014) suggests that a lack of interest in recycling activities is caused by a lack of interest in its outcomes, therefore the need exists to increase public awareness of the importance and value of informal waste picking activities. Yau (2010) also iterates this view and argues that, to make waste recovery more popular among communities, long-term efforts such as intensified public education and information strategies are needed. Miner et al. (2020) found that most residents in their study (84.2%) were willing to participate in e-waste management provided that they were armed with appropriate knowledge about the disposal and recycling of this particular form of waste. According to Mwanza and Mbohwa (2017), one of the twelve factors that influence sustainable recycling of MSW in developing countries is household education. Therefore, waste disposal education that stimulates knowledge acquisition and awareness underpins understanding of other indirect incentives for waste recycling that will motivate people to take part in waste sorting without expecting direct incentives.

4.2.1.2 Good infrastructure of recycling facilities

Properly designed and updated recycling facilities motivate recycling participation. Butkus et al. (2018) claim that internal incentives and externally enabled conditions such as infrastructure and proper waste containers had a higher impact on municipal waste sorting behaviour in the city of Siauliai than economic enforcement. Siu and Xiao (2016) observed that the availability of recycling networks and satisfaction with public facilities significantly affected sustainable waste sorting and recycling

behaviour. In supporting the need for sound infrastructure above financial incentives, Bernstad (2014) acknowledges the importance of infrastructure as a factor that drives participation in waste recycling. Giurea et al. (2018) state that proper infrastructure promotes the development of the agro-tourism sector which, in turn, promotes recycling. At a more basic level, Shaw and Maynard (2007) argue that the development of a kerbside recycling service through amendments to its design and delivery is most likely to promote better recycling behaviour at street level than for instance financial incentives. Various authors thus agree that a properly designed and an effectively implemented recycling infrastructure stimulates recycling participation.

4.2.2 External incentives (extrinsic)

External incentives that promote recycling participation include, but are not limited to, the following:

- Employment opportunities and job creation initiatives
 - Income generation strategies
 - Initiatives for economic growth
 - Well organised cooperatives for WPs
 - Levying of taxes
 - Environmental protection projects
 - Endeavours to increase the lifespan of landfills through lowering waste volumes.
- Some external incentives for waste recycling are discussed.

4.2.2.1 Economic / financial incentives

Employment opportunities create incentives for waste recycling activities. According to Simatele et al. (2017), 68% of the respondents in their study argued that employment and income generation was a sound basis for engaging in solid waste management and recycling. Nzeadibe (2009) states that, in many developing cities globally, the informal sector is one of the main employers of poor people. It is also emphasised by the DEAT (2005) that job creation is one of the objectives of promoting and expanding recycling initiatives. The unemployed are thus often incentivised to take part in recycling or waste picking activities as the collection and recycling of waste create job opportunities.

Valuable recyclable waste materials are sorted, collected, transported and sold to generate income. The sorted waste material is baled and sold to intermediaries that then sell it to waste recycling and scrap metal industries (Rutkowski and Rutkowski, 2015). E-waste may invite particular problems when dumped at landfills, but Miner et al. (2020) found that some e-waste (7.5%) was sold to recyclers, which limited this problem in the study area. Da Cruz et al. (2013) argue that, although costs are involved in the recycling process for selective collection, issues are experienced in terms of transport, sorting, storing. However, when waste is sold for cash in hand it becomes an incentive for waste recycling participation. The DEA (2014) for instance reported that the mean monthly income of WPs in 2014 was R1 430. Although not within the affluent range, this suggests that the sale of recyclables generates some income and this, in turn, serves as an incentive for waste pickers to persevere.

Some scholars argue that incentives for waste picking are directly proportional to the rate of recycling or waste picking participation. For instance, Jafari et al. (2017) found that, as the incentive amounts earned for waste increased, more residents became eager to participate in waste recycling activities. The introduction of regular incentive schemes was also found to have a positive impact on the amounts that were earned for the sale of recyclables (Yau, 2010). Czajkowski et al. (2015) also argue that a positive attitude towards household waste recycling behaviour is linked to incentives. Chokhandre et al. (2017) and Viljoen et al. (2016) state that WPs who work informally and earn an unsatisfactory income from waste recycling still view this activity as an incentive to persevere and they thus persist in collecting and selling recyclable items picked from municipal solid waste. The literature thus suggests that the higher the incentives for waste picking are, the higher the rates of waste picking and recycling become. According to Jafari et al. (2017), when the monetary incentive paid to Iranian waste pickers reached about 180 000 IRR (Iranian Rial), about 95% of the residents was encouraged to participate in a recycling program by returning recyclables for money. The DEA (2014) also found that 73% of waste picker participants strongly agreed that waste picking contributed in strengthening the economy.

There are some remarkable economic incentives that drive waste picking participation as waste separation and selling can be profitable. Moreover, it is in line with the waste management approach (Rakib et al., 2014). WPs are primarily motivated by incentives to persevere with their waste picking activities. Kasinja and

Tilley (2018) for instance recommend that, for WPs to be incentivised to recycle plastic, interventions have to focus on reducing transport costs. In their study, about 70% of the waste pickers had to pay high transport costs while bribery fees had to be paid by about 25% of the waste pickers in their study.

Waste picking also achieves other objectives such as economic growth. This occurs due to the lower cost of recycled waste materials that are used by local enterprises (Navarrete-Hernandez and Navarrete-Hernandez, 2017; Rakib et al., 2014). Well organised cooperatives for WPs may even pay taxes and provide complete social security as an incentive for their members (Velis, 2017). For instance, a respondent in the study by Czajkowski et al. (2015) stated: "Sorting waste allows me to reduce my future bills". Sandhu et al. (2016) found that the loss of door-to-door waste collection opportunities resulted in a substantial incentive reduction for WPs who suddenly became unemployed and cut off from access to domestic recyclables. Thus economic incentives stimulate participation in waste picking and, when the cost of recycling exceeds the incentives, recycling is negatively affected as pickers are demotivated.

However, incentives other than the monetary income of waste picking exist, such as a desire for social upliftment and environmental health. According to Sandhu et al. (2016), the informal waste recycling sector contributes positively to all the dimensions of sustainability which include environmental, economic, social and institutional contributions. Waste picking is multi-dimensional as WPs are service providers who are collecting and recycling urban waste, but they are also economic participants who provide a source of income for the disadvantaged while increasing the lifespan of landfills through lowering waste quantities (Dias 2016; Rutkowski and Rutkowski, 2015; Nzeadibe, 2008). For instance, Simatele et al. (2017) found that WPs contributed significantly to the collection of waste in the city of Johannesburg, as about 53% of recyclable glass bottles and 64% of scrap metal were received at recycling plants at the time of their study. Thus various incentives are associated with waste picking that make waste picking convenient for the WPs.

Conversely, when no incentives are associated with waste picking or waste recycling, it has a negative impact on waste picking activities. Hornik et al. (1995) warn that when incentives for waste picking are removed, the recycling system often collapses.

Similarly, the DEAT (2005) argues that a lack of incentives for residents to participate in waste separation at source is an obstacle that limits recycling. Yau (2010) also points out that a lack of economic incentives for waste picking is a factor that influences the choice, behaviour and participation of people in waste recycling. A study by Nzeadibe (2009) found that waste paper, cardboard and polyethylene packaging materials were often not recovered when no market existed for these materials. Thus waste pickers had no incentive to salvage these products. Undoubtedly, the absence or removal of incentives for recycling participation has serious repercussions for waste recycling and reduction.

4.2.2.2 Social influence (pressure)

Social pressure is another motivating factor that influences individuals' and organizations' waste recycling behaviour. Czajkowski et al. (2015) argue that social pressure and individual moral motivation are factors that impact how troublesome or satisfying recycling is for waste pickers. It has been argued that the sustainable development of agro-tourism provides a model that relies on social pressure as it channels informal waste recycling into three directions: economic, socio-cultural, and environmental (Giurea et al., 2018). For instance, a form of social pressure is prevalent in Hong Kong where there is a trend for property management companies, in collaboration with businesses, to develop incentive schemes that will boost waste recycling (Yau, 2010). Social pressure is thus a powerful motivating factor that influences individuals and organisations to engage in sound waste management practices such as minimisation, sorting, reuse, and recycling.

4.2.2.3 The recycling incentives provided by local municipalities

Waste picking is an activity that can benefit local municipalities and the communities residing in their areas of responsibility. However, for these benefits to materialise municipalities have to drive the informal waste picking sector through various incentives that will encourage waste picking (Simatele et al., 2017). Waste pickers may thus contribute significantly to municipal solid waste management and recycling, and therefore the role of the informal recycling sector in urban economies cannot be dismissed as unimportant (Nzeadibe, 2009). Sandhu et al. (2016) affirm that informal waste pickers play a significant role in recovering recyclable waste materials and making them available for production or consumption. A comparative study by

Machete (2019) ranked South Africa among the seven top waste generating countries in the world, yet it has the potential to reclaim valuable recyclable materials from municipal solid waste streams. Yigit et al. (2015) argue that WPs not only meet their own economic needs, but that their activities also benefit their communities, municipalities and the environment. Municipalities in particular benefit from the activities of WPs as these people reclaim what may otherwise have gone to waste. In fact, WPS reduce large volumes of waste from streets and landfill sites.

4.2.2.4 Environmental incentives for recycling activities

Waste picking (or waste recycling participation) also incentivises communities, often inadvertently, to protect the environment. Informal WPs play a vital role in municipal solid waste reduction and they make a significant contribution to cities' economic growth and environmental wellness (Simatele et al, 2017; Nzeadibe, 2009). Miner et al. (2020) agree and argue that, more specifically, several environmental problems may be linked to poor practices of e-waste disposal in neighbourhoods. They thus urge that good waste management practices, particularly recycling, should be implemented to incentivise communities to protect the environment as many residents in their study showed interest in environmental protection and waste recycling initiatives. Waste recycling may thus help to regain ambient environmental conditions in polluted areas (Rakib et al., 2014).

The DEA (2014) also argues that waste picking not only contributes to income generation, but that it also encourages environmental protection and conservation. Nzeadibe (2009) states that activities by the informal recycling sector in Enugu could contribute towards the attainment of some of the MDGs, particularly those related to poverty reduction, job creation, and environmental sustainability. Thus waste picking activities and informal waste recycling may facilitate processes that will enhance environmental sustainability.

4.2.2.5 Recycling incentives provided by manufacturers

Waste picking and recycling not only benefit manufacturing industries, but these activities also contribute towards the sustainability of natural resources. Nzeadibe (2009) argues that the role of the informal recycling sector in providing secondary resources to manufacturing industries should not be dismissed as unimportant. The

recycling of plastic waste, for instance, supports the sustainability of the production of new plastic products that are manufactured without using new resources, and this contributes to a sustainable industry while limiting the exploitation of natural resources (Mwanza and Mbohwa, 2017).

However, the regular separation of household waste is essential for the procurement of recyclable waste materials to sustain their further use as raw materials for the production of new products (Stoeva and Alriksson, 2017). Ghisolfi et al. (2017) concur with this view as they argue that the recycling rate of waste materials positively influences the stock of raw materials and that this reduces the exploitation of natural resources. The DAE (2014) states that 86% of recycling companies strongly agree that waste picking positively contributes towards recycling. It is thus evident that waste picking and waste recycling contribute significantly towards the sustainability of the manufacturing industry.

4.2.2.6 Recycling incentives that encourage energy generation

Commitment to good waste management practices and the eradication of pollution through the use of relevant technologies will ensure that communities reap the benefits of additional energy and power supply. Machete (2019) argues that waste should form part of the input resources for energy generation in developing countries. The latter author believes that this resource is a valuable commodity in the generation of power (energy) in countries that are recycling waste efficiently. Idowu et al. (2019) concur as they argue that landfill sites could potentially provide energy for many sub-Saharan African countries that experience challenges in energy and power supply. Giurea et al. (2018) also state that, with the support of regulations and proper infrastructure development, the agro-tourism sector could promote and encourage energy efficiency through recycling. Therefore, if a strong commitment exists to encourage sound waste management practices, countries can reap the benefits of waste recycling which will, in turn, support the provision of power and energy to all communities.

4.2.2.7 Legislatively (policy) influenced incentives

Indirect incentives that encourage waste recycling may be entrenched in legislation and policies that regulate waste picking activities and informal recycling. In a study

by Czajkowski et al. (2015), about two thirds of the respondents agreed that sorting waste would allow them to reduce the amounts due on future bills. This view reflects their expectation of positive effects should communities actively participate in waste collection and sorting at source level. In a later study, Simatele et al. (2017) found that the lack of policy integration and the neglect of the recycling sector by urban waste management policies resulted in compromised financial wellness – especially among the poor –and inappropriate working conditions for WPs. It is a known fact that municipalities are legally mandated to facilitate waste collection and treatment (Stoeva and Alriksson, 2017) but, according to Shaw and Maynard (2007), only 5% of the respondents in their study indicated that penalties for failure to recycle at household level would lead to a positive change in recycling behaviour. Thus non-compliance with recycling obligations will affect indirect incentives and may prevent people from avoiding penalties or fines for poor household level recycling or waste separation.

Recycling can legislatively be incentivised, especially if economic instruments that impact specific waste streams are targeted (Republic of South Africa, 2016). In 2005, the DEAT (2005) reported that there was an increased usage of economic instruments aimed at providing incentives for recycling, recovering the full costs of waste disposal, and providing funds to initiate recycling. However, this process has not come off the ground and, anyway, it should never be implemented haphazardly as it is important to create an appropriate legal and financial platform to incentivise small-scale and community programs such as composting waste (Dos Muchangos et al., 2014). It is also necessary to understand which incentives encourage people to recycle before formulating policies or schemes, otherwise the efforts to promote waste recycling may be fruitless (Yau, 2010). Legislation can thus drive some incentives for stimulating individuals' participation in informal waste recycling activities while it also plays a role in achieving solutions for waste management issues as it may introduce and enforce the provision of recycling incentives.

In dealing with recycling behaviour, researchers and environmentalists have focused mainly on policy and management initiatives (Siu and Xiao, 2016). Giurea et al. (2018) argue that the stringent regulation of waste management in Trentino has demonstrated that a legislative framework could be effective. Butkus et al. (2018) endorse the notion that the establishment of environmental regulations will motivate

the informal management of municipal waste, whereas Ghisolfi et al. (2017) argue that legally endorsed incentives are essential to ensure the integration of waste pickers into the formal process of waste recovery. Legislation thus plays a critical role in establishing incentives that will drive informal recycling participation.

4.3 *Materials and Methods*

Waste recyclers who operated at landfill sites and in the streets of the city and selected towns comprising the study area constituted the population of the study. However, as the number of this population is high and because people who engage in this form of waste recycling are often inaccessible, the study focused on recyclers called 'waste pickers' who are also known as primary waste collectors. Keller (2014) advises that, in studies of this nature, a reasonable proportion of a population should be selected as representative of that entire population. It was impossible to determine the total population of recyclers because of the informal nature of waste picking (Machete, 2017) but, based on an estimate by the DEA (2011) of the average number of 'trolley pushers' (or street waste pickers) in every category B1 municipality of South Africa, as well as the number of landfill pickers per municipal landfill site, it was estimated that the total population from which the study could draw its sample was N=239 (see section 1.5.3). This figure comprised two types of recyclers, namely street and landfill waste pickers.

The data were collected from February to March 2019. A participatory method of data collection was used to understand the challenges that the waste pickers faced (Simatele et al., 2017). Every waste picker at the landfill sites and in the streets who was available at the time of data collection was approached and, if willing to participate, they were informed of the purpose of the study and requested to sign a consent form. The questionnaires were completed in writing by the chief researcher and an assistant as not all WPs could read and write. Kasinja and Tilley (2018) state that such structured questionnaires may be administered to waste pickers for data collection. In some instances, snowball sampling was used to recruit street waste pickers as originally recruited waste pickers provided the names of other street waste pickers who were visited at their homes, in the streets and at buy-back centres where they were recruited for data collection (Kasinja and Tilley, 2018).

The WPs were approached individually for the interviews. The chief investigator and the trained assistant completed the questionnaires in writing. Szolnoki and Hoffmann (2013) support the use of face-to-face structured interviews because this process helps to avoid spoilage or incomplete questionnaires. A difference that was observed was that the LWPs were better organised than the SWPs as the former had representatives on site. The purpose of the visit was first explained to these representatives who then called all the LWPs and recruited their participation. Time for questions and answers was allowed. The LWPs went back to their waste sorting stations and were then approached one by one and interviewed. Each WP's responses were recorded on a separate copy of the same questionnaire. Kasinja and Tilley (2018) approached and interviewed WPs upon observing them recovering materials from streets, households, and open dumps. The advantage of using a structured questionnaire was that it assisted the investigators to adhere to the objectives and not to deviate in any way (Subbo and Moindi, 2008). In this manner, the same questions were posed to all the participants in the same way.

A sample size of 149.4 landfill and street waste pickers was determined by using Yamane's (1967) formula as was explained in Chapter 1. However, only 146 waste pickers were effectively recruited from the three landfill sites – Hazyview, Tekwane and Barberton – and the three central business areas – the City of Mbombela and the towns of Hazyview to the north and Barberton to the south of Mbombela.

4.4 Results and Discussion

When asked why they engaged in waste picking activities, the majority (39.7%) of the WPs stated that they had been compelled by circumstances, 34.9% had been motivated by friends, and 21.9% had been motivated by family members. It was also found that the WPS were primarily compelled by social and economic (financial) incentives to participate in waste picking activities. The WPs who were satisfied with the financial incentives that waste picking yielded were more likely to continue with this activity than the WPs who were not satisfied with the income that waste picking yielded. Apart from the financial incentives, some participants admitted that they were also encouraged by environmental incentives to persevere in waste picking activities. It was concluded that WPs were encouraged by multiple incentives and that their activities benefited their communities, the economy, and the environment. More

specifically, the environment benefitted through waste reduction and pollution (litter) prevention.

4.4.1 Social influence as a stimulant of waste picking activities

4.4.1.1 Response: People motivated by family members to become WPs

A question that was posed asked whether the WPs had been motivated by family members to participate in waste picking. The results that are presented in Figure 4.1 indicate that a mere 5.3% of the LWPs versus 54.9% of the SWPs were not motivated by family members to become WPs, while 28% of the LWPs versus 15.5% of the SWPs were motivated by family members to become WPs. Unfortunately, 66.7% of the LWPs and 29.6% of the SWPs did not specify who had motivated them to become WPs.

The reason for this low response rate could not be determined. It may only be surmised that some of the WPs may have been unwilling to involve non-respondents in their answers. Moreover, a number of WPs hailed from neighbouring countries and had come to South Africa to seek a better way of life. Waste picking might not have been one of their first choices and they might thus have felt embarrassed to expand on the origin of this choice of self-employment. What could be determined was that, although family members' influence on these WPs' choice of employment was low, they did impact this choice to some extent, possibly as an only alternative to a life of abject poverty.

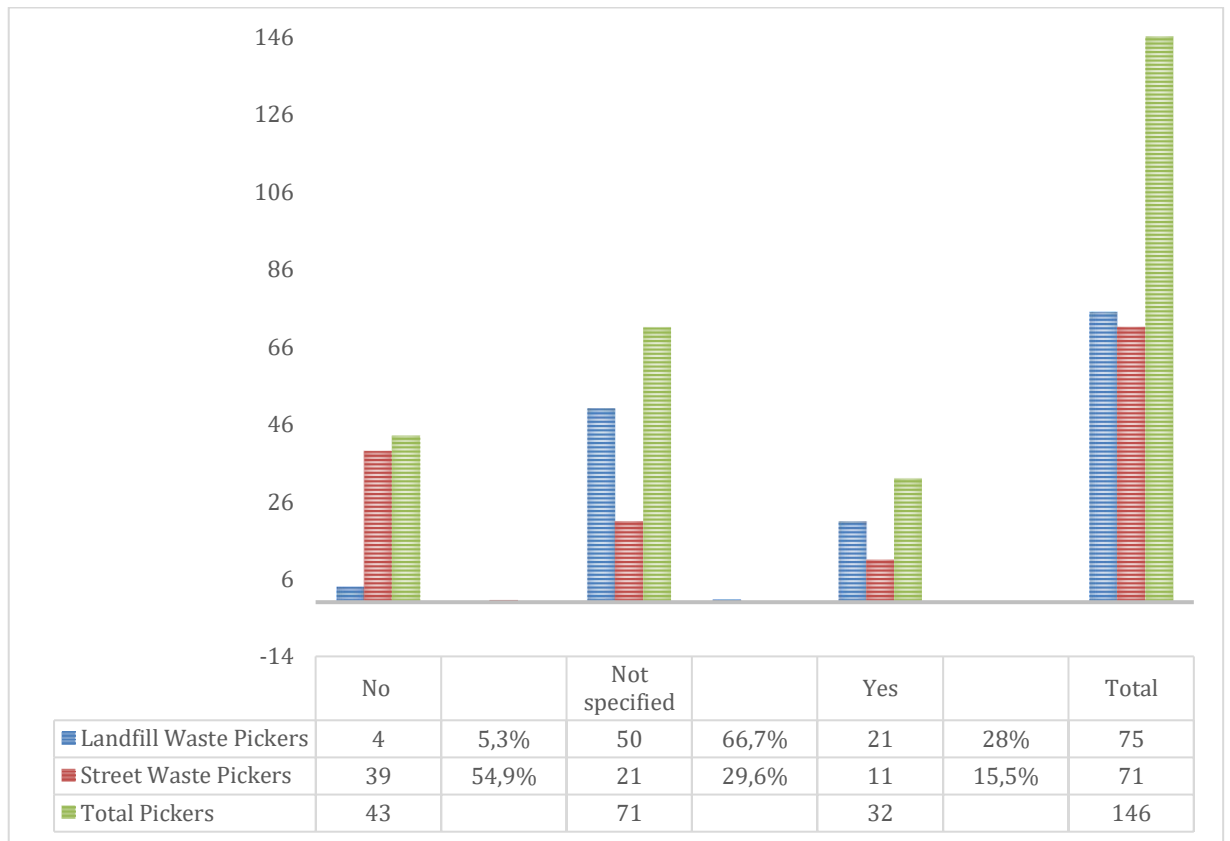


Figure 4.1: Motivated by family members to become WPs

Table 4.2: Statistics for Figure 4.1

Statistic	DF	Value	Prob
Chi-Square	2	43.3814	<.0001
Likelihood Ratio Chi-Square	2	48.2626	<.0001
Mantel-Haenszel Chi-Square	1	27.4997	<.0001
Phi Coefficient		0.5451	
Contingency Coefficient		0.4786	
Cramer's V		0.5451	

Table 4.2 shows that there was a significant difference in the percentage reflected in Figure 4.1 for the two groups of LWPs and SWPs ($P < 0.0001$).

4.4.1.2 Response: WPs who had been motivated by friends to participate in waste picking

The results in Figure 4.2 indicate that 5.3% of the LWPs versus 46.5% of the SWPs were motivated by friends to become WPs, while 36% of the LWPs versus 33.8% of the SWPs were motivated by friends to become WPs. Again, 58.7% of the LWPs versus 19.7% of the SWPs did not specify whether friends or family members motivated them or not.

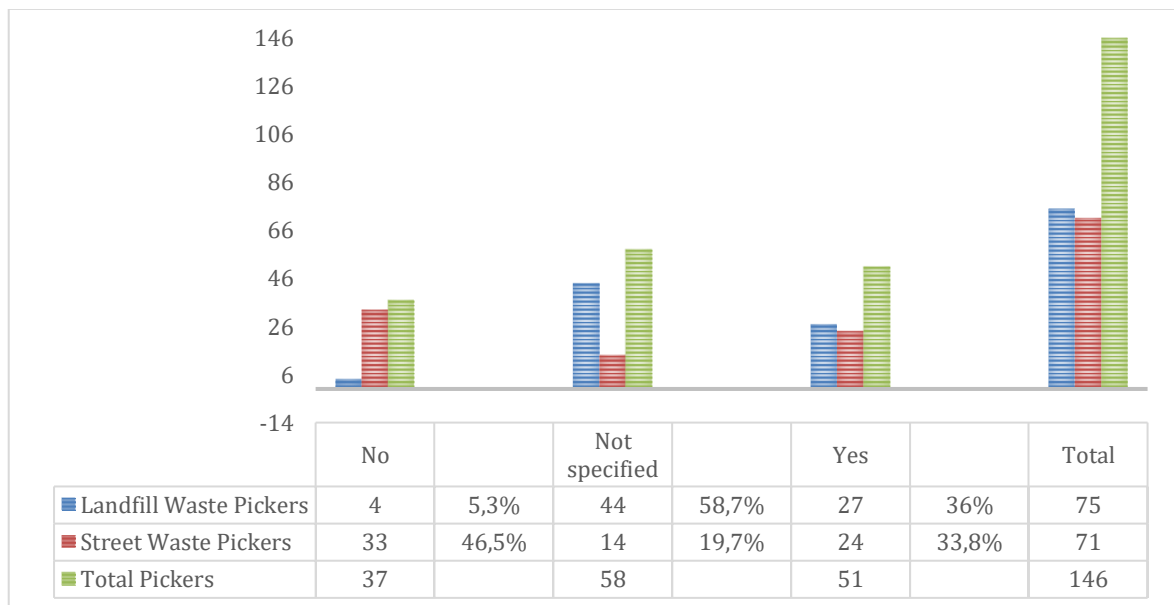


Figure 4.2: WPs who had been motivated by friends to become waste pickers

Table 4.3: Statistics for Figure 4.2

Statistic	DF	Value	Prob
Chi-Square	2	38.3426	<.0001
Likelihood Ratio Chi-Square	2	42.3078	<.0001
Mantel-Haenszel Chi-Square	1	11.4647	0.0007
Phi Coefficient		0.5125	
Contingency Coefficient		0.4561	
Cramer's V		0.5125	

Table 4.3 shows that there was a significant difference in the percentages reflected in Figure 4.2 for the two groups: LWPs and SWPs ($P < 0.0001$).

4.4.1.3 WPs who were compelled by circumstances to become waste pickers

The results reflected in Figure 4.3 indicate that 5.3% of the LWPs versus 29.6% of the SWPs had not been motivated by circumstances to become WPs, while 30.7% of the LWPs versus 49.3% of the SWPs were motivated by circumstances to become WPs. Also, 64% of the LWPs versus 21.1% of the SWPs did not specify whether circumstances had motivated them or not.

It may be surmised that the circumstances that compelled the participants to become waste pickers were associated with economic or financial difficulties as waste picking is notoriously associated with low income members of communities. Although some (43.2%) of the respondents did not specify what had pushed them to become waste pickers, the reasons for their abstinence were not evaluated in further depth.

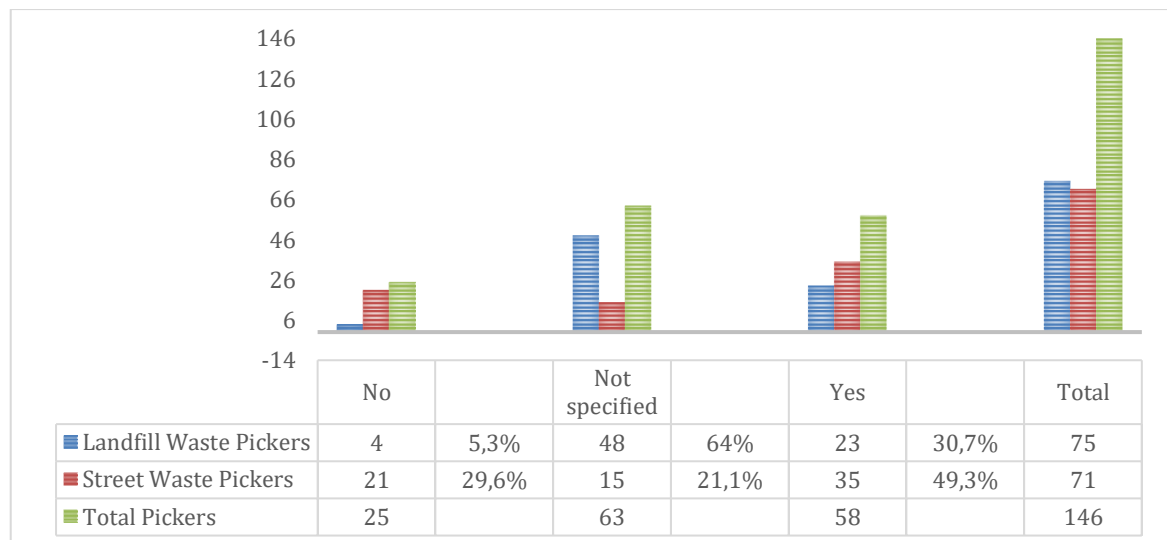


Figure 4.3: WPs who had been compelled by circumstances to participate in waste picking

Table 4.4: Statistics for Figure 4.3

Statistic	DF	Value	Prob
Chi-Square	2	31.2423	<.0001
Likelihood Ratio Chi-Square	2	33.2434	<.0001

Statistic	DF	Value	Prob
Mantel-Haenszel Chi-Square	1	0.2207	0.6385
Phi Coefficient		0.4626	
Contingency Coefficient		0.4198	
Cramer's V		0.4626	

Table 4.3 shows that there was a significant difference in the percentage reflected in Figure 4.3 for the two groups of LWP and SWP ($P < 0.0001$).

4.4.2 *Reasons why people engage in waste picking*

The results presented in Figure 4.4 show that 81.3% of the LWP versus 90.1% of the SWP were motivated by factors such as income generation, job opportunities, poverty alleviation and the eradication of hunger to engage in waste picking. Only 9.3% of the LWP versus 7% of the SWP had been motivated by the ideals to clean the environment, serve the community, and protect animals. Some people merely enjoyed waste picking. Also, 5.3% of the LWP versus 2.8% of the SWP had been motivated by the fact that waste picking was helping them to support and provide for their families, while 2.7% of the LWP and none (0%) of the SWP had been motivated by the fact that waste picking was a self-employment opportunity or a form of entrepreneurship. Lastly, 1.3% of the LWP versus 0% of the SWP had been motivated by the convenience of waste picking as anyone could recycle and have access to recyclables. It was concluded that the majority of the WP had been motivated by financial incentives to participate in waste picking activities. Yau (2010) suggests that a possible way of enhancing waste recycling is to institute economic/financial incentives to encourage informal waste picking as a vital link in the waste management chain. Siu and Xiao (2016) concur, as they also found that some respondents had been motivated by economic incentives to become WP.

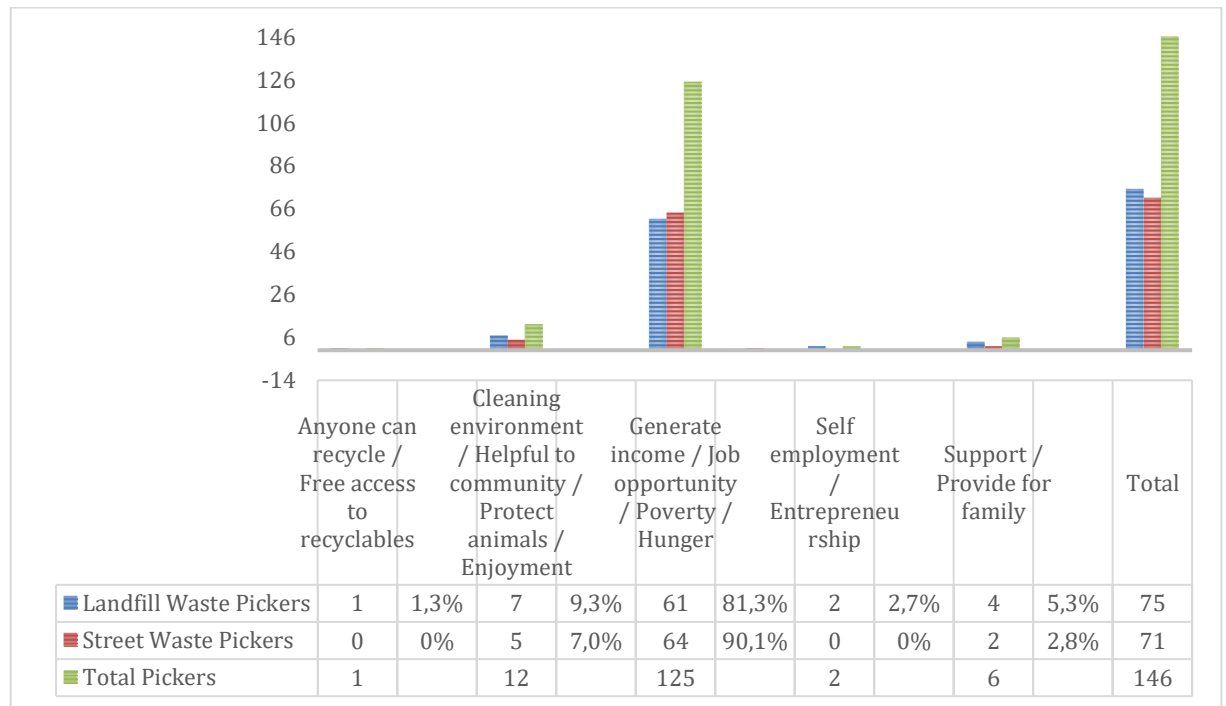


Figure 4.4: Reasons why people engage in waste picking

4.4.3 Factors that encourage waste picking

4.4.3.1 Selling price, income, and convenience

Figure 4.5 indicates that the response rate for this question was 88.4%. The majority of the WPs (31.0%) reported that an increase in the price of recyclable materials would stimulate them to intensify their waste picking efforts. The second highest group of both LWPs and SWPs (25.6%) indicated that generating an income from selling recyclables would encourage them to increase their waste picking activities, while the third group of WPs (12.4%) indicated that access to more recyclables would help to enhance their waste picking activities. The fourth highest category of WPs (11.6%) mentioned that access to resources would motivate them, while the fifth group (7.8%) felt that access to transport would motivate them to expand their waste picking activities. Although price and income were the predominant incentives for waste picking (31.0% and 25.6% respectively), other factors of convenience also featured as stimulants of waste picking, such as: (1) access to more recyclables (12.4%), (2) access to resources (11.6%), and (3) transport (7.8%) respectively (Figure 4.5). These findings corroborate those of Yau (2010) who states that, in addition to economic incentives, waste recycling is also likely to be stimulated by convenience factors such as care for the environment and the availability of transport.

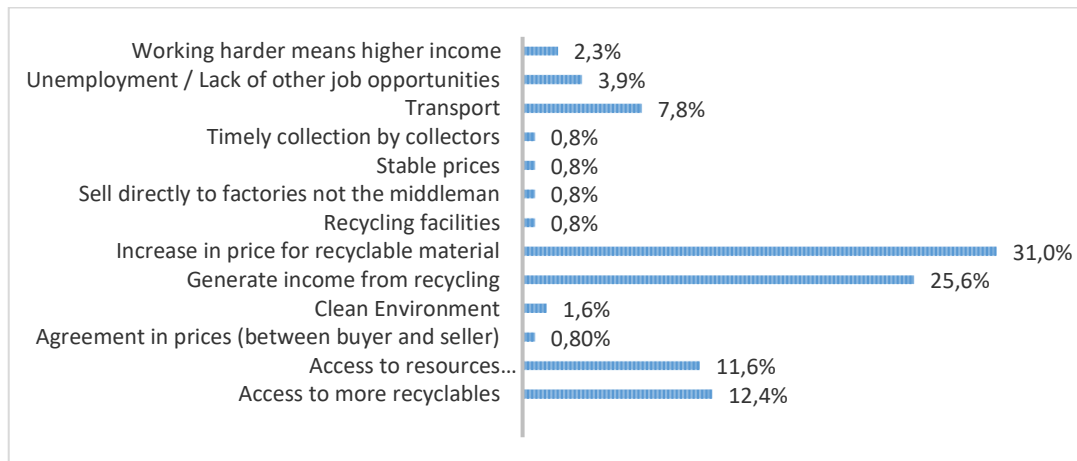


Figure 4.5: Factors that stimulate waste picking

4.4.3.2 Recycling as a cost-effective way of earning a living

Figure 4.6 shows that a total of 90 participants (61.6%) viewed waste picking as not very costly. The results show that 64.6% of the SWPs and 52.4% of the LWP did not spend much on recycling, while 30.9% of the LWP versus 22.9% of the SWPs found that recyclables were accessible. A low number of respondents (4.8% LWP versus 2.1% SWP) reported that they made some income from recycling, while 2.4% of the LWP and 2.1% of the SWP reported that they did recycling at their own pace. However, a few individuals had a different view as 2.4% of the LWP versus 0% of the SWP reported that transport was expensive, while another 2.4% of the LWP versus 2.1% of the SWP reported that there was competition in recycling. Only 4.2% of the SWP and none (0%) of the LWP reported that recycling was a difficult work, while 2.4% of the LWP and again 0% of the SWP indicated that both parties (WP/seller and middleman/buyer) should benefit through recycling. This was to express a view against the exploitation of waste pickers.

In Figure 4.6 it is also clear that the accessibility of recyclables contributed towards minimising the operational costs which, in turn, maximised profit rates which motivated WPs to persevere in this self-employment field. Ghisolfi et al. (2017) argue that, if the selling of collected waste materials is not financially viable, then incentives to persevere in waste picking will change and impact this endeavour negatively. The predominant reason for persisting in waste picking was therefore the potential to make a profit. Therefore, the fact that the operational costs were deemed low was an indication that this informal form of waste picking and recycling should be encouraged by the formal waste management sector.

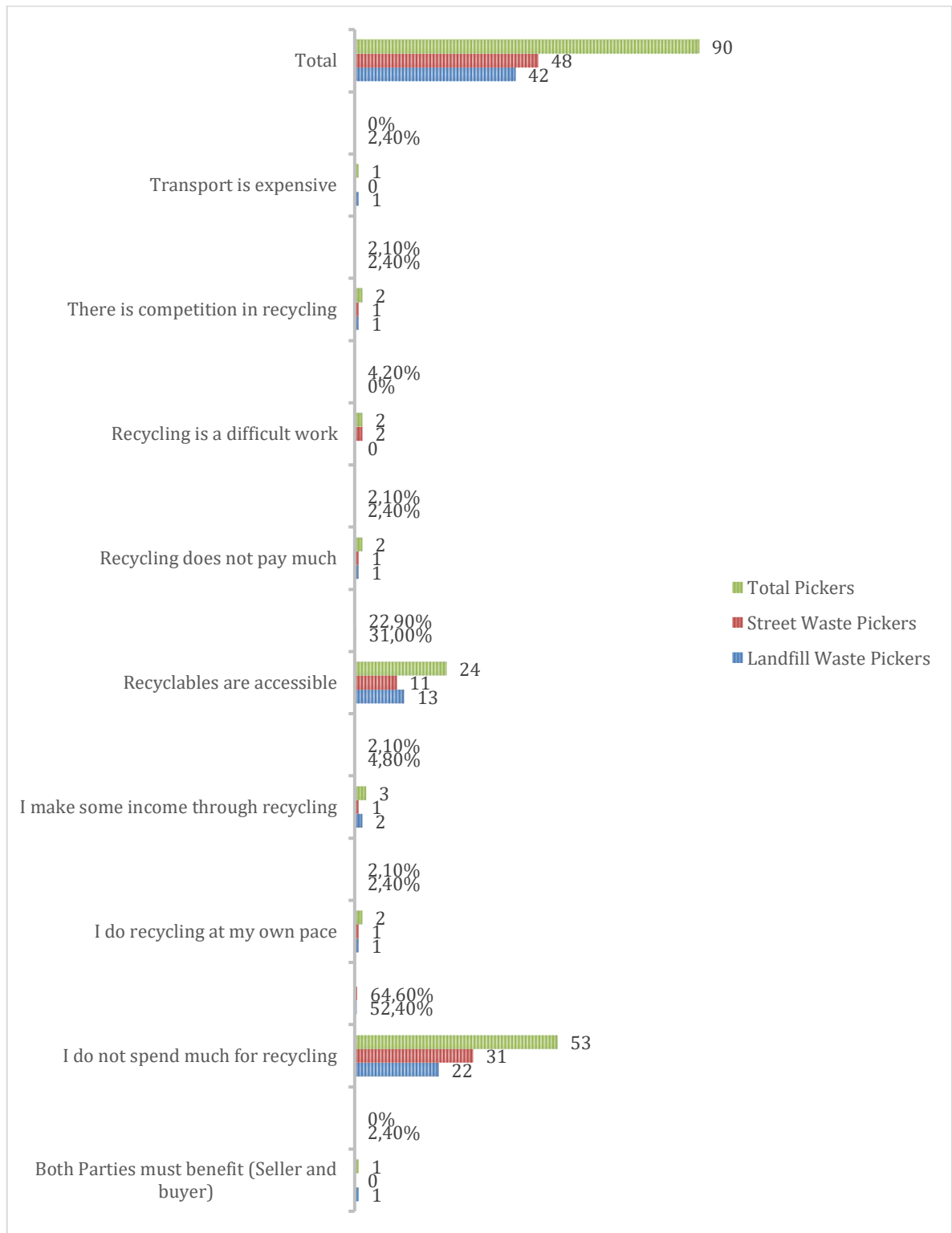


Figure 4.6: Reasons for considering recycling as a cost-effective way of earning a living

4.4.3.3 Reasons for viewing recycling as financially burdensome

The response rate to the question whether waste picking was financially burdensome (i.e., expensive to sustain) was very low at 35.6% (Figure 4.7). Of the WPs who

considered waste picking to be expensive, the majority (50.0%) pointed out that transportation costs were burdensome, while 19.2% reported that waste picking was physically demanding. Only a small percentage (9.6%) was concerned about insufficient pay-offs or income being generated compared to their financial investments and efforts. The most predominant concern was therefore transportation costs which was a concern that could be linked to the impact of financial incentives on waste picking. The complaint of the physical demanding nature of waste picking was an inconvenience factor, while insufficient income also relates to low financial incentives that demotivate WPs. In concurrence with the concerns of the WPs about low financial yields and high transportation costs, Velis (2017) disputes the financial viability of recycling and argues that the sector remains vulnerable and subject to great price fluctuations.

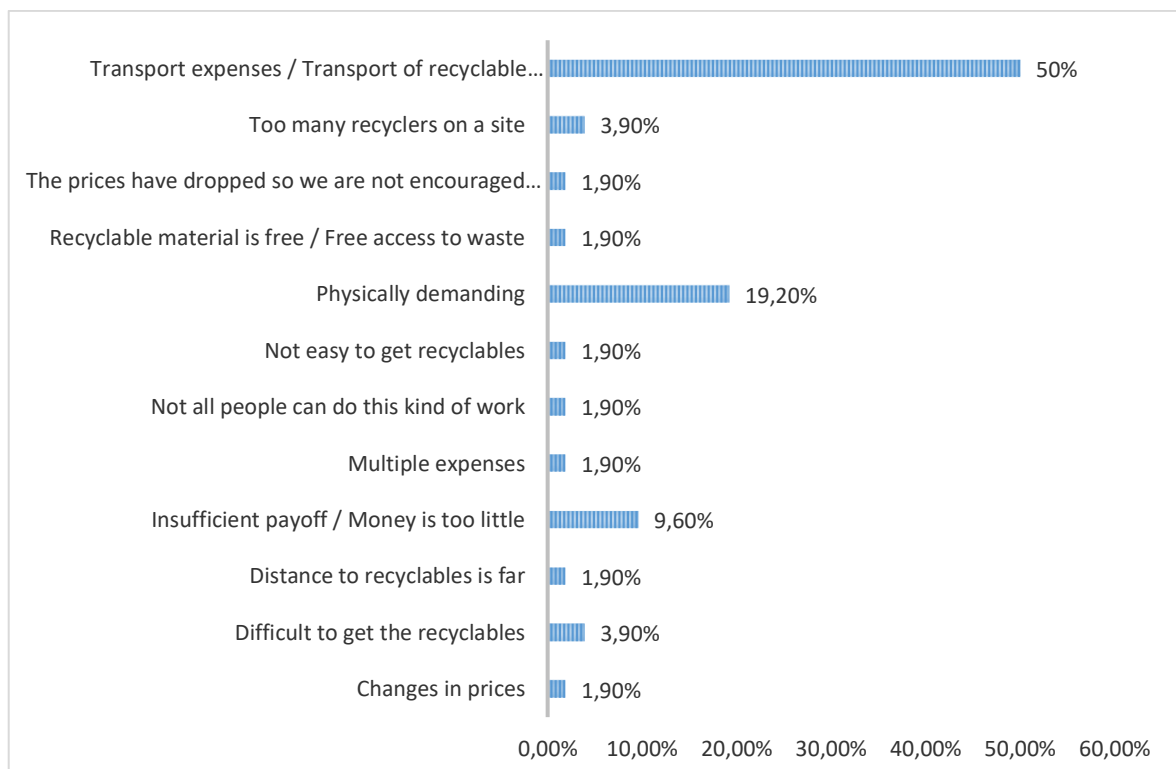


Figure 4.7: Reasons why recycling is viewed as financially burdensome

However, Ghisolfi et al. (2017) argue that some self-employed WPs recognise the benefits of waste picker cooperatives funded by municipalities as these bodies provide access to motorised transport and an infrastructure that will support waste picking and informal recycling. It is proposed that addressing the issues of concern of WPs will motivate them. These issues are presented in Figure 4.7 that clearly indicates the top three concerns: (1) transportation costs, (2) the physically

demanding nature of waste picking, and (3) the need for financial incentives and rewards.

4.4.3.4 The level of satisfaction with waste picking incentives

The combined response rate to this question that assessed whether the WPs were satisfied with recycling incentives was (100%) (Figure 4.8). The results show that 33.3% of the LWPs and 40.9% of the SWPs were not satisfied with the incentives associated with the selling of recyclables. Conversely, 66.7% of the LWPs and 59.2% of the SWPs were satisfied with the incentives offered for selling recyclables. The results indicate that more (66.7%) LWPs than SWPs (59.2%) were satisfied with the incentives. The fact that the majority felt content with their trade suggests that they would continue their waste picking activities which, in turn, suggests that the environment (the study area) may be positively affected by waste pickers. This notion is supported by Yau (2010), who states that people who are positively stimulated by financial incentives to engage in waste picking almost automatically change their attitude and demonstrate pro-environmental behaviours.

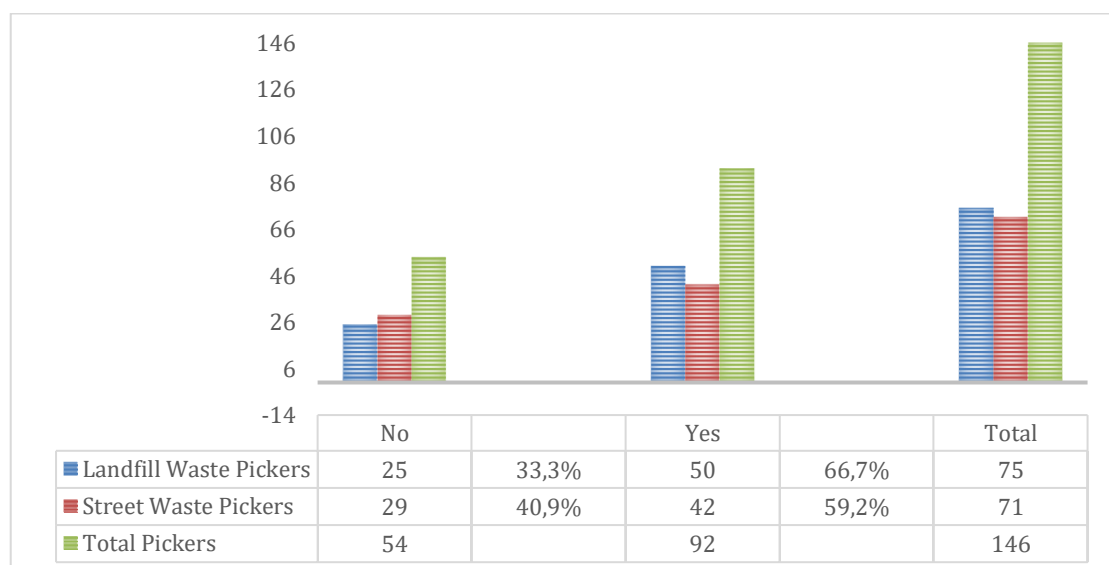


Figure 4.8: The level of satisfaction with waste picking incentives

4.4.3.5 Other incentives associated with recycling participation

Figure 4.9 indicates that the response rate to the question that measured the benefits of waste picking was 96.6%. Of these respondents, 47.5% reported that waste picking was an easy way of earning money, while a surprising low percentage (14.2%) indicated that waste picking assisted them to support their families. A limited

number (10.6%) indicated that waste picking contributed to the sharing of knowledge about effective waste picking as this knowledge helped to educate and encourage others to recycle waste. The other incentives that were mentioned were that waste picking provided them with job opportunities that were better than doing nothing (9.9%), while some (9.9%) also indicated that waste picking was helping to clean the environment and that the community thus benefited from recycling. Another incentive that was referred to, although to a limited extent (2.1%), was that waste picking contributed to crime avoidance or reduction. In concurrence with these benefits of waste picking, Dias (2016) found that, in cities with irregular household waste collection coverage, WPs continued to provide waste collection services as they harvested waste as a livelihood while they also provided a vital public service. Simatele et al. (2017) also acknowledge that, in as much as solid waste collection contributes significantly to the livelihoods of WPs, it also contributes extensively to municipal solid waste management in the form of collecting, sorting, trading and processing waste. Evidently, waste picking has multiple benefits for WPs, the community, the economy, and the environment which benefits from waste reduction and pollution prevention.

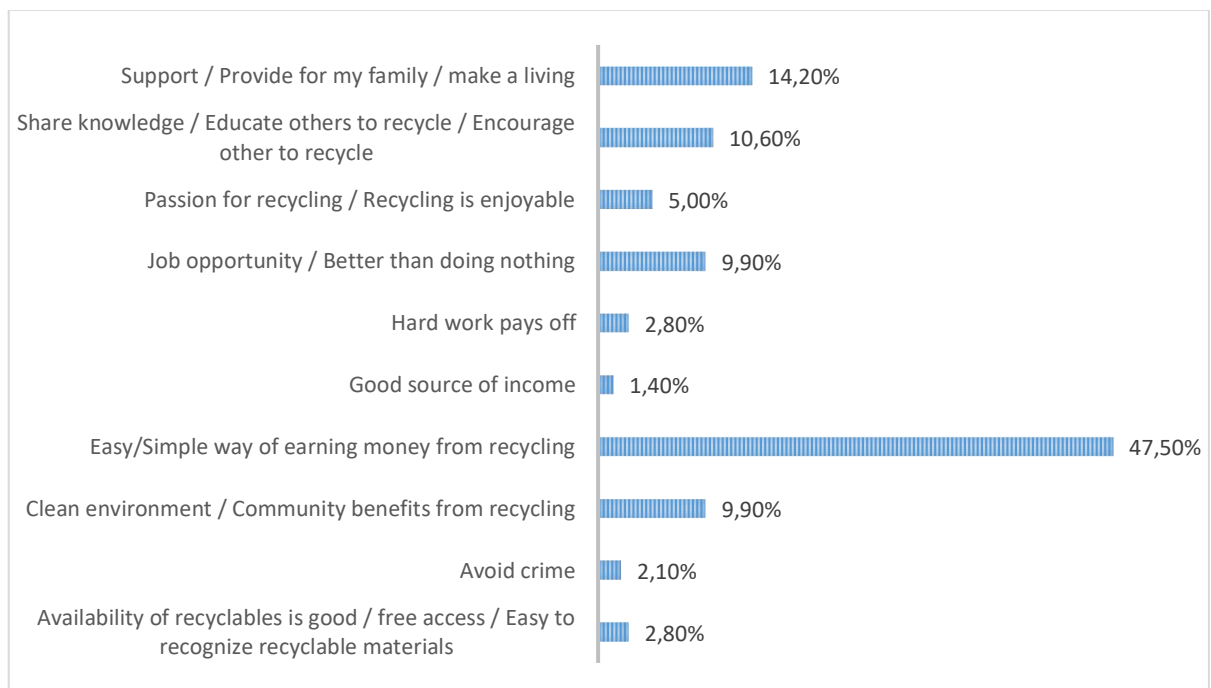


Figure 4.9: Rating of other incentives resulting from recycling participation

4.5 Conclusion

The literature review indicated that compliance with recycling obligations is driven by external incentives such as avoidance of penalties or fines arising from non-compliance. The same literature also proposes that legislation promotes incentives to encourage individuals to participate in waste recycling activities. It is undeniable that legislation plays a critical role in driving recycling incentives to encourage better participation in recycling activities, whether these practices are formal or informal. The DEA (2016) provides incentives for producers to reduce the use of virgin materials and rather recycle materials for manufacturing purposes.

The literature also indicates that the education level of residents underpins the knowledge and awareness of waste recycling requirements. This knowledge, in turn, provides insight into and understanding of various environmental incentives associated with waste recycling. In fact, it is this insight and understanding that motivate people to participate in waste sorting without expecting external incentives. The reviewed literature also suggests that social influence (or pressure) is a factor that motivates good waste recycling practices such as waste minimisation, sorting, reuse and recycling. Moreover, an effectively designed and managed recycling infrastructure also stimulates recycling participation.

The unemployed are incentivised to participate in waste recycling by means of waste picking as this offers job opportunities and financial rewards. For instance, selling recyclable waste materials generates income, and this is a strong incentive for WPs to engage in this informal recycling activity. It is evident that the higher the incentives in waste picking are, the higher the rate of waste picking and recycling activities becomes. Evidently, economic incentives stimulate waste picking as an income generating activity that is practised by people of all age groups. However, when the cost of waste picking and recycling exceed the expected profit, this form of recycling is negatively affected as WPs will be demotivated.

Conversely, various incentives that drive waste picking make recycling convenient and a desirable activity, particularly for the poor who live in the vicinity of landfill sites. It is also evident that the absence or removal of incentives that encourage recycling participation has serious repercussions for waste picking, especially when a particular waste stream is seasonal and has no or limited monetary value at times.

Municipalities reap various benefits from WPs' activities as these informal workers reclaim and reduce volumes of waste along the streets and from landfill sites. Good waste management practices, including the activities of informal recyclers, will thus incentivise communities to properly manage waste which will, in turn, enhance the visual appeal of the environment and contribute to more healthy lifestyles.

Waste pickers who provide recyclable materials to the manufacturing industry contribute significantly towards limiting the exploitation of raw materials, and this promotes environmental and industrial sustainability. By committing and adhering to good waste management practices, society will reap rewarding benefits such as the generation of cost-effective sources of energy and the potential for sustainable power generation.

Based on the question that determined who influenced the WPs to engage in this form of self-employment, it was found that 28% of the LWPs versus 15.5% of the SWPs were motivated by family members to participate in waste picking activities, while 36% of the LWPs and 33.8% of the SWPs were motivated by friends to become WPs. However, it was found that the majority (30.7% of the LWPs and 49.3% of the SWPs) was compelled by circumstances to participate in waste picking activities. This was not surprising as the demanding economic climate in South Africa at the time of the study impacted poor communities in particular. The majority of the WPs (81.3% LWPs and 90.1% SWPs) was thus motivated by economic (or financial) incentives to participate in waste picking activities (Figure 4.4). It was also determined that the WPs engaged in waste picking to generate income, as a job opportunity, for poverty alleviation, and the eradication of hunger (Figure 4.4). The latter reasons are all associated with low financial income and poverty. Some WPs (9.3% LWPs and 7% SWPs) also rated a desire to care for the environment as a reason for engaging in waste picking (Figure 4.4). It may thus be concluded that people in the study area were predominantly motivated by financial incentives to become waste pickers. This finding concurs with Siu and Xiao (2016) who argue that WPs are driven by economic incentives to become WPs (or waste recyclers). Yau (2010) suggests that one possible way of enhancing waste recycling is to institute economic or financial incentives, while Shaw and Maynard (2007) also make brief comments regarding the potential use of financial incentives to motivate or stimulate recycling behaviour.

The current study established that, although price and income were predominant incentives for waste picking (31% and 25.6% respectively), other factors of convenience also featured as stimulants of waste picking, namely: (1) access to more recyclables (12.4%), (2) access to resources (11.6%), and (3) transport (7.8%) (Figure 4.5). These findings support those of Yau (2010) who state that, in addition to economic incentives, waste recycling is also likely to be stimulated by convenience factors such as care for the environment and available transport.

The current study found that waste picking in the study area was deemed operationally cheap, as the majority – 64.6% of the SWPs and 52.4% of the LWPs – did not have to spend much on their recycling activities. When the operational costs of engaging in waste picking or recycling are low, it suggests that incentives to engage in such activities are maximised.

In terms of accessibility, 30.9% of the LWPs and 22.9% of the SWPs found that recyclables were accessible. Although the rate of accessibility of recyclables is relatively low, it supports the finding of the low operational costs and forms part of the financial incentive factor as a driver of waste picking that motivates WPs to sustain their waste picking operations. Waste picking incentives should motivate WPs, otherwise they may not continue their waste picking activities. In this regard, Ghisolfi et al. (2017) argue that, if selling the collected waste material to the formal waste recycling system is not financially viable over time, WPs will discontinue their informal waste picking activities. However, although not the majority, some WPs in the current study considered waste picking to be expensive, and 50.0% of the WPs was concerned about high transport costs as this affected their desired financial yields. The WPs' second concern was the physically demanding nature of the work, which could be regarded as an inconvenience factor. Concerns about financial costs and physical demands have the potential to negatively impact the ultimate objective of WPs, which is to generate an income. Similar to these concerns, Velis (2017) also argues that the financial viability of the informal waste recycling sector makes it vulnerable to price fluctuations. Based on a finding of their study, Ghisolfi et al. (2017) support the notion of cooperatives for waste recyclers, arguing that such organisations may facilitate access to motorised transport. Moreover, a better waste recycling infrastructure that incorporates waste pickers and that is funded by municipalities is also a strong recommendation.

Overall, the low negative responses that were recorded suggest that waste picking was deemed a worthwhile operation by the majority of the participants. For instance, only some individuals felt that transport was expensive (2.4% LWPs and 0% SWPs), while a small portion (2.4% of the LWPs and 2.1% of the SWPs) reported that there was competition in recycling. Moreover, only 4.2% of the SWPs and 0% of the LWPs reported that recycling was a difficult work.

In terms of the level of satisfaction of the WPs with the financial benefits of waste picking and the income that selling recyclables yielded, the current study found that the majority (66.7% LWPs and 59.2% SWPs) was satisfied, while only 33.3% of the LWPs and 40.9% of the SWPs were not satisfied. The fact that the majority was satisfied with the financial yields of their labours means that they would be more likely to persist in their waste picking activities than the unsatisfied and discouraged group. This finding concurs with a finding by Yau (2010), and the study thus corroborates the notion that people are positively stimulated by financial incentives to take pro-environmental behaviour seriously. Furthermore, the study concurs that waste picking is driven by multiple incentives that benefit WPs, communities, the economy, and the environment. Important benefits are income generation (which by extension means that family livelihoods are protected to some extent), waste reduction, and pollution prevention.

In light of the findings, the study recommends that measures be taken to improve the earnings of all WPs to the extent that those who are dissatisfied are also encouraged to persevere (section 4.4.3.2 and Figure 4.7). This will improve informal waste picking and recycling rates, thereby increasing environmental protection and sustainability.

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CHAPTER 5

GENERAL DISCUSSION

5.1 Introduction

The key findings of this study are summarised in this chapter. These findings relate to the research questions that were presented in Chapter 1 and the applicability and relevance of the recommendations that are based on the findings are discussed. Moreover, the study findings and recommendations are discussed in relation to those of previous studies. The contribution of this study towards the waste picking participation process and to the recycling industry is included in the discussion. The chapter concludes with recommendations for interventions and improvements in waste picking participation activities and suggestions are offered for future research.

5.2 Summary of the Findings

5.2.1 Determinants of recycling participation

The literature suggests no relationship between recycling and any particular age group, which the current study corroborates. The study results further revealed no noteworthy difference between the four categories of waste picker age groups as they were almost equally distributed (Figure 2.2). The results further revealed that all age groups (18 to 84 years) participated in waste picking activities (2.4.1). These results did not deviate from those reported by the DEA (2014) as the latter survey recorded the age of waste pickers to range from as low as 16 years to as high as 83 years.

The literature argues that gender does not determine recycling participation as both males and females participate relatively equally in waste picking activities. However, there may be variances in gender ratio participation, but this also does not favour one gender over the other in general (2.4.2). Although some studies propose that neither males nor females are more dominant in the waste picking phenomenon, others state that either males or females are dominant. The probability may thus not be ruled out that, either due to the time or the location of a study, only a particular gender may have been represented and this could have occurred due to factors that were not evaluated in the study. The current study found a balance between males and

females as 50% males and 50% females of a total sample of 146 WPs (Figure 2.3) participated in the study. This sample was achieved due to random selection based on the availability of waste pickers at landfill sites and in the streets of the selected study area. This 50:50 gender split was on a par with the findings of a DEA survey (2014).

Some studies found that the majority of recycling participants were highly educated as they were either studying towards degrees or in possession of college or university degrees, while the lowest percentage group was still well educated as they had a secondary school education (Butkus et al., 2018; Chu and Chiu, 2003; Stoeva and Alriksson, 2017). Nguyen et al. (2015) also found that the rate of those holding degrees was 53.9%. Some studies thus identify education as a significant factor and argue that it will ensure the sustainability of waste picking practices. On the other hand, Schenck et al. (2016) found that LWPs generally had a better schooling track record than SWPs and they thus argue that LWPs may be better at recycling than their less qualified SWP counterparts. The current study found that, in the City of Mbombela and surrounding areas, only 1.4% of the participating WPs had a tertiary (post-school) level of education and that 44.5% either had no education at all or a primary school education. However, 53.4% had a secondary school education (2.4.3). Unfortunately, 0.7% of the WPs did not specify their education level. Although the reason for this finding was not explored in depth, the prevalence of relatively educated WPs may be attributed to the fact that the South African education system compels schooling up to Grade 9.

The literature indicates that a high unemployment rate causes many people to live in poverty and that many such people resort to informal waste picking to alleviate poverty and hunger (2.2.4). Studies have thus suggested that waste picking activities contribute effectively towards poverty alleviation in many developing and underdeveloped countries (2.2.4). The current study also found that the main reason for waste picking in the City of Mbombela area (as indicated by 85.6% of the WPs) was to alleviate poverty (2.4.4). Various factors associated with this overarching purpose were also recorded, such as earning an income and support of families.

The literature furthermore reveals an association between urbanisation and population growth, which are both associated with a high consumption of resources

and high waste generation (2.2.5). It has also been proposed that, in urban areas, there is often a higher waste generation rate per person than in less affluent areas due to the higher affluence levels of urban residents (2.2.5). Affordability of consumables is further extended to waste generation according to the following flow model: *urbanization* → high population → high income/economically active → high resource consumption → high rate of waste generation/pollution. Consequently, the fact that urban areas already have a high population that generates high volumes of waste attracts people to cities where they engage in waste picking activities to alleviate poverty (2.2.5). Waste picking thus has the potential to become a solution for the growing waste problem in urban areas and cities, especially in areas with inadequate waste removal services (2.2.5). The current study found that 96% of the participating WPs resided within the City of Mbombela and surrounding areas (Hazyview, Nelspruit and Barberton), while the remaining 4% hailed from neighbouring local municipalities such as Bushbuck Ridge and Nkomazi (2.4.5.2 and Figure 2.6). Evidence also showed that 15% of the WPs had migrated from neighbouring countries – particularly Mozambique and eSwatini – to the City of Mbombela and surrounding areas in search of job opportunities (2.4.5.3 and Figure 2.7).

The high unemployment rate in the formal economy increases the self-employment rate in the informal economy. One such self-employment endeavour is waste picking (2.2.6). The commodity known as waste materials has significant business potential for economic growth and creates employment opportunities for the unemployed as it offers recycling initiatives (2.2.6). It is thus evident that waste recycling does not only address waste problems, but that it also addresses the need to reduce unemployment (2.2.6). This notion is corroborated by the current study as not only the unemployed and students took part in waste picking, but some people who were already employed and pensioners also participated in this activity to complement their monthly income (2.4.6). The data also showed that the majority (88.4%) of the participants had been unemployed in the formal sector and they thus found employment in waste picking (Figure 2.8).

It is noteworthy that income generation is the predominant determinant factor that impacts recycling participation for different categories of people in the City of Mbombela and surrounding areas (2.2.7). The current study showed that

opportunities exist for WPs to trade waste as a commodity and thus to generate an income (Figure 3.7 and Figure 3.8). In some instances, this income was relatively limited at R10 per day. The middle income group earned R1 175 per week (about R167.00 per day in a 7-day week), while the maximum income was R11 500 per month (about R380.00 per day in a 30-day month) (Table 2.4). Earning enough to support a healthy livelihood is an important factor that determines waste picking participation and recycling. However, earnings depend on the extent of the waste picking operation of the individual (2.4.7).

5.2.2 Convenience and inconvenience factors that impact waste picking activities

The literature proposes that there are certain factors of convenience that influence preferences for particular types of waste materials over others. The primary consideration is that the solid waste that is recycled should have a market and monetary value, as only then will people recycle such materials (Velis, 2017). The literature thus highlights the types of waste that are considered valuable resources for recycling (Mwanza and Mbohwa, 2017; Dos Muchangos et al., 2014). WPs will not simply pick any waste material, but they will search for waste materials that have buy-back value. This value that is attached to waste materials is driven by demand. In this context, the study determined that some recyclables were preferred over others, which means that their recyclability rate was higher than that of others. Aluminium was the most preferred commodity as 53.4% of the WPs preferred to recycle it. PET bottles and plastic were second on the preference list (48.6%) while scrap metal was the third most preferred recyclable at a preference rate of 45.9% (3.4.1 and Table 3.1). Comparatively, Kasinja and Tilley (2018) found that 21% of the WPs in their study recovered only metals, 53% recovered only plastic, while 26% recovered plastic and metals.

The literature also reveals that the availability of recyclables is a factor of convenience that encourages waste recycling participation. For instance, Navarrete-Hernandez and Navarrete-Hernandez (2017) propose that the institutionalisation of WPs will allow them to collaborate with residents to ensure that recyclable materials are available. Kasinja and Tilley (2018) also found that plastic and metal were the most available waste categories in the Zingwangwa township of Blantyre in Malawi.

The current study found that the unavailability of recyclables is a factor of inconvenience in waste picking participation. The results showed that 46.8% of the WPs reported unavailability, scarcity and difficulty in finding recyclables, 42.6% reported a high number of WPs competing for recyclables, and 10.6% reported other reasons as indicated in Figure 3.1 and paragraph 4.4.2. In concurrence with the challenges experienced by WPs in terms of the unavailability or scarcity of recyclables, Sandhu et al. (2016) found that WPs spent about 10 to 12 hours per day looking for recyclable waste materials.

The literature has established that accessibility of recyclable materials is a factor of convenience that impacts successful waste picking participation. Dias (2016) argues that WPs should be granted access to waste as a common-pool resource. In Nigeria, WPs have unrestricted access to the Ugwaji landfill facility (Nzeadibe, 2008). The current study also underscores the fact that accessibility is an important factor of convenience in waste picking activities (3.4.3). The results showed that 67.1% of the WPs indicated that recyclables were accessible, while 32.9% reported that recyclables were inaccessible (Figure 3.2). In comparison, the policy on WP that steers this phenomenon in greater Santiago de Chile promotes waste-picker monopoly to sustain the accessibility of recyclables (Navarrete-Hernandez and Navarrete-Hernandez, 2017). Sandhu et al. (2016) found that, although some WPs no longer had access to recyclables, other WPs who picked waste from municipal bins and at landfill and informal dump sites still found that recyclables were available to them, particularly at landfill sites.

The current study found that a good price for marketable recyclable materials was a factor of convenience for recycling participation. It was also determined that there was a relationship between the prices yielded for recyclables and the operational costs of the waste picking process (3.4.4). Kasinja and Tilley (2018) argue that the market is at times favourable for some recyclables while it is unfavourable for others. For instance, waste paper, cardboard and polyethylene packaging materials are usually not recovered when there is no market for them (Nzeadibe, 2008). Thus, the demand and supply chain has an influence on the waste market, while this market is also influenced by the prices that traders are prepared to pay for recyclables. Recycling facilities usually receive a significant volume of recyclables delivered by WPs who normally trade these items at a certain price (Simatele et al., 2017). Best

markets and prices are therefore factors of convenience that encourage high rates of waste picking. In the current study, 31.0% of the WPs reported that an improved price for recyclable materials motivated them to participate more avidly in waste picking, while a limited number of WPs indicated their dissatisfaction with unstable markets and inconsistent prices (Table 3.2). In Blantyre in Malawi, 68% of the WPs sold their metal recyclables to one middleman because he offered better prices. This trader was preferred although there were four other buyers of metal and two industries and middlemen (Kasinja and Tilley, 2018).

The literature suggests that a number of factors impact the operational costs of waste picking and that these factors inconvenience waste pickers (3.2.5). Chokhandre et al. (2017) assessed the economic burden of morbidities and found that costs incurred for treatment, workdays lost and the persistence of illnesses among WPs meant that expenditure rates were much higher for them than for non-WPs. However, the impact of morbidities and healthcare on the recruited waste pickers was not investigated by the current study. The study did find, however, that several other operational costs impacted waste picking as factors of inconvenience, such as the distances they had to cover between pick-up and deposit points (3.2.5). On the positive side, it was found that 62.9% of the WPs found this form of employment affordable (i.e., limited operational costs) while only 37.1% complained that the waste picking process was expensive (Figure 3.3). Of those who found waste picking expensive, 50% was concerned about transport costs while 19.2% was concerned about the physical demands of this form of labour. Only 9.6% was concerned about the limited income that waste picking yielded (Table 3.4).

The literature suggests that the availability of storage facilities for retrieved waste can be either a factor of convenience or inconvenience for waste pickers, but storage space was highlighted as a prerequisite for successful waste picking (3.2.6). Czajkowski et al. (2015) argue that sorting recyclables into different categories requires sufficient space and often results in low collection frequencies as it is time consuming. Collecting waste materials thus requires storage facilities at a WPs property or at landfills, sometimes for an extended period of time. Support in this regard is often needed, and therefore waste picker cooperatives in some countries support WPs by offering transport and storage facilities (Rutkowski and Rutkowski, 2015; Dias, 2016). The current study found that storage was a factor of convenience

when available and inconvenience when not available (3.4.6.2). Generally, however, waste was stored at some homes and at landfill sites if the pickers could not sell it immediately after sourcing.

The need for storage seemed to impact the frequencies at which the WPs in the current study preferred to collect waste (Figure 3.4). For instance, 36.8% of the WPs preferred a monthly collection frequency, while 19.1% preferred a weekly collection frequency. Very few (17.6%) of the WPs used a daily collection frequency, whereas 17.7% preferred an as-and-when collection frequency. Some (8.8%) preferred to collect waste every second week (Figure 3.4). The WPs who used a daily collection programme may have needed storage for only a few hours (3.4.6.2), while the LWPs needed to store their recyclables for longer periods, as is evidenced by the photographs (3.4.6.2). It thus seems logical that high collection frequencies are associated with a lower need for storage space (3.4.6.2), except where space is available such as at landfill sites. For instance, 36.8% of the WPs collected recyclables on a monthly basis, and they thus needed storage space to accommodate a month's recycled products before they were collected and sold (Figure 3.4).

The literature proposes that the collection as well as transportation of recyclables is a crucial factor that may either encourage or discourage waste picking (3.2.6.). The DEA (2014), for instance, reported that WPs frequently transported their collected waste to recyclers at their own cost rather than making use of formal transport operators. The DEA (2014) found that 33.3% of LWPs and 73.2% of SWPs, thus an average of 52.7%, did not have access to collection services to transport their products to buy-back centres and that they therefore did so themselves. Thus more than half of the WPs transported their collected recyclables to buy-back centres or waste recycling companies (DEA, 2014). The current study found that a large number (95.6%) of the WPs needed transportation to get their recyclables to buy-back centres (3.4.6.3). As a result, they either hired private vehicles or depended on middlemen who would buy and at the same time collect recyclables from landfill sites and from their homes (3.4.6.3). Figure 3.7 indicates that 92.5% of the WPs used transport provided by private service providers. Only 3% used their own transportation, while the remaining 4.5% was not in need of transportation as they

sold their recyclables on site. Similarly, Stoeva and Alriksson (2017) found that recyclables were collected and transported by private entrepreneurs.

The current study found evidence that distance influenced waste picking activities and recycling, and this factor thus needs to be considered when planning the location of recycling drop-off and collection points and facilities (2.3.7). In support of this proposal, the DEA (2014) argues that more transfer stations should be provided at municipal level to reduce the distances waste pickers have to travel. Distance is thus a factor of convenience or inconvenience as it can influence the costs of transportation, which is part of the operational costs of informal waste recycling. However, Table 3.4 shows that only 1.9% of the WPs regarded waste picking activities to be very expensive because of the distance they had to cover to find recyclables. Fifty percent (50%) of the WPs also indicated that the cost of transportation made waste picking inconvenient (Table 3.4). In concurrence, Kasinja and Tilley (2018) found that 68% of the WPs in their study sold their metal recyclables to one middleman because his business premises was close to where the WPs recovered these materials. Rutkowski and Rutkowski (2015) also argue that the choice of the location of a recycling facility depends on the distances WPs have to cover as well as the volumes of waste they collect and need to transport.

The current study found that the unavailability of recycling facilities may at worst result in people's non-participation in waste picking or, alternatively, in low recycling rates (3.2.8). To address this challenge, Stoeva and Alriksson (2017) support the practice of placing buy-back machines in stores where residents may deposit plastic bottles and aluminium cans in return for cash. Simatele et al. (2017) urge that active support for WPs is required, especially as they need access to recyclables through source separation programs and industry-provided buy-back centres to increase waste collection rates. Based on the findings, the current study concurs that the availability of waste recycling facilities is a factor of convenience that will drive successful participation in waste picking (3.4.7.1). This is because an overall majority (68.7%) of the WPs indicated that there were recycling facilities in the City of Mbombela area such as buy-back centres and scrap metal dealers (Figure 3.8). Dos Muchangos et al. (2014) agree that such facilities are a necessity as, in Maputo, a survey questionnaire outcome suggested that a lack of interest in MSW recycling was caused by the unavailability of drop-off points for recyclables. Stoeva and Alriksson

(2017) concur and cite the example of Sweden where municipalities contract packaging recovery organisations for the collection, transportation and processing of separated recyclable waste. Rutkowski and Rutkowski (2015) also support the impact of the establishment of collection facilities on streets from where WPs may move collected materials to a temporary transfer station which has easy truck access. An overall result (Figure 3.9) of the current study was that 94.9% of the respondents indicated that recycling facilities within and around the City of Mbombela were easily accessible. Accessibility was therefore a factor of convenience for informal waste picking and recycling processes in the study area (3.4.7).

The literature argues that WPs are exposed to a number of unhygienic conditions as well as health and safety hazards and that these are factors of inconvenience that discourage or threaten waste picking activities (3.2.10). A comparative study on the rate of injuries sustained by WPs and non-WPs showed that the prevalence of injuries was high (75%) among WPs and low (17%) among the comparison group (Chokhandre et al., 2017). Simatele et al. (2017) also found that the lack of sound infrastructure such as secure road networks was a serious challenge, as WPs used the same roads as motorists which had resulted in some fatal accidents. Similarly, Dos Muchangos et al. (2014) found that elements such as the air, soil and ground water in Maputo were highly compromised at a landfill site and in adjacent areas, and this posed environmental and public health risks. Chokhandre et al. (2017) found that the persistence of illnesses was significantly higher among WPs than among non-WPs. The current study also found that health and safety hazards were factors of inconvenience and that they might impact waste picking activities negatively. Some preventive and control measures should thus be instituted by authorities and other role-players in the waste management system, particularly where informal waste pickers operate (3.4.8). Moreover, waste regulations require that all WPs should undergo medical checks and that they should wear PPE such as gloves and gumboots. These should be provided by municipalities, while WPs should also be made aware of health and safety matters through education initiatives (DEA, 2011). According to the literature, there are wide-spread negative perceptions about and harassment of WPs by community stakeholders that occur as a result of intolerance and prejudice (3.2.11). Intolerance towards waste pickers poses a risk for these people and, if it persists, will negate the social, economic and environmental benefits of waste picking (3.2.11). In concurrence with this view, the DEA (2014) argues that

the exploitation of informal recyclers by formal recyclers, collectors and transporters is a factor of inconvenience that hampers recycling participation. The study thus acknowledges that intolerance is a factor of inconvenience that impacts waste picking activities negatively. However, it was found that intolerance of waste pickers in the study area occurred only to a limited extent. Table 3.6 shows that only 8.9% of the SWPs and none of the LWP (0.0%) were concerned about being arrested when found in possession of copper recyclable items without proper documentation as proof of legal possession. Moreover, only limited numbers of waste pickers (SWPs 4.8% and LWPs 1.43%) were concerned that communities were intolerant of their practices and thus criticised or insulted them or spoke negatively about them and their activities (3.4.9 and Table 3.6). Also, only the SWPs (6.16%) seemed to be prevented from collecting recyclable materials by community members and security officials (Table 3.6). Conversely, a study that was conducted by Simatele et al. (2017) found that in Johannesburg many WPs were harassed at points of collection and disposal.

5.2.3 Incentives as a stimulant for recycling participation

Compliance with recycling obligations are driven by indirect incentives such as avoiding penalties or fines arising from non-compliance (4.2.1). Legislation and regulations may thus become incentives that will stimulate individuals' decision to participate in waste recycling activities (4.2.1.1).

Education, knowledge and awareness provide insight and understanding about other more indirect environmental incentives that will drive waste recycling and motivate people to take part in waste sorting, even without expecting direct incentives (4.2.1.2). Social pressure can be another motivating factor that will encourage people to adopt good waste management practices such as minimisation, sorting, re-using, and recycling (4.2.1.3). The study also demonstrated that a properly designed and effectively implemented recycling infrastructure will stimulate recycling participation (4.2.1.4).

According to the literature, employment and even self-employment among the poor are incentivised through the creation of job opportunities for poverty-stricken communities whose members participate in waste recycling activities (4.2.2.1). The literature indicates that the selling of valuable waste materials generates income and

incentives for enhanced waste recycling participation (4.2.2.1). Therefore, the higher the incentives for waste picking are, the higher the rates of waste picking and recycling activities will be (4.2.2.1). In addition, it is evident from the literature that economic incentives stimulate waste picking participation but, where the costs of recycling exceed the outcomes of incentives, recycling is negatively affected as pickers get demotivated (4.2.2.1). There are numerous incentives from waste picking activities and good incentives make waste picking more attractive for WPs. Conversely, the absence of incentives to encourage recycling participation has serious implications for the waste picking process, especially for a particular waste stream that is not supported by incentives (4.2.2.1).

The literature maintains that municipalities reap some benefits from waste picking as these workers informally reclaim and reduce the volumes of waste along the streets and at landfill sites (4.2.2.2). Good waste management practices, including recycling, also incentivise communities to care for the environment (4.2.2.3). According to the literature, waste picking contributes significantly towards the growth of manufacturing industries as recyclable materials are provided is a practice that lowers the cost and diminishes the need for raw materials. This promotes the sustainability of these industries and the environment (4.2.2.4). Therefore, through commitment to good waste management practices, incentives are provided and benefits are reaped by society and industries. Moreover, cost-effective alternative sources of energy may be produced if informal and formal recyclers collaborate (4.2.2.5).

Waste picking is not an activity that occurs naturally to people as an option when they are in search of jobs, and therefore waste pickers are generally persuaded by others to engage in this activity. In the current study, 28% of the LWPs and 15.5% of the SWPs were motivated by family members to participate in waste picking activities (4.4.1.1), while 36% of the LWPs and 33.8% of the SWPs were motivated by friends to become WPs (4.4.1.2). However, possibly due to the demanding economic climate in South Africa at the time of the study, it was not surprising that more waste pickers (30.7% LWPs and 49.3% SWPs) were compelled by circumstances to participate in waste picking activities (4.4.1.3).

The majority of the WPs (81.3% LWPs and 90.1% SWPs) was thus motivated by economic (or financial) incentives to participate in waste picking activities (Figure

4.4). It was also determined that the WPs engaged in waste picking to generate income, as a job opportunity, for poverty alleviation, and the eradication of hunger (Figure 4.4). Although limited to a few respondents (9.3% LWPs and 7% SWPs), the second highest rated reason for engaging in waste picking was associated with the WPs' desire to care for the environmental (Figure 4.4). It was thus concluded that the WPs was predominantly motivated by financial incentives to become and persist in their activities as waste pickers. This finding concurs with Siu and Xiao (2016), who also found that WPs were driven by economic incentives to become WPs (recyclers). Yau (2010) suggests that one possible way of enhancing waste recycling is to institute economic/financial incentives, while Shaw and Maynard (2007) also make brief reference to the potential use of financial incentives to motivate or stimulate recycling behaviour.

The current study also established that, although price and income were predominant incentives for waste picking (31% and 25.6% respectively), other factors of convenience also featured as stimulants for waste picking, such as: (1) access to more recyclables (12.4%), (2) access to resources (11.6%), and (3) transport (7.8%) (Figure 4.5). These findings are corroborated by Yau (2010), who state that, in addition to economic incentives, waste recycling is also likely to be stimulated by convenience factors such as care for the environment and available transport.

Of those WPs who considered waste recycling as a cost-effective way of earning an income, 64.6% of the SWPs and 52.4% of the LWPs were satisfied with the operational costs of waste picking. Only 30.9% of the LWPs and 22.9% of the SWPs indicated that recyclables were cheap due to it being accessible (Figure 4.6). Therefore, the fact that the operational costs of waste picking were deemed low is an indication that this informal form of waste picking and recycling should be encouraged by the formal waste management sector (4.4.3.1). The accessibility of recyclables contributes towards minimising the operational costs of recycling and therefore maximises recycling incentives, and WPs benefit more than LWPs as they do not have to pay for transport or for acquiring recyclables. Therefore, whatever amount that is gained from selling easily obtained recyclables is a benefit because it is profitable, and this will encourage WPs to persevere (4.4.3.1). Incentives to continue their waste picking activities should thus be devised to motivate WPs, otherwise they

may not persevere (4.4.3.1). Ghisolfi et al. (2017) argue that, if the selling of waste material is not financially viable over time within the formal system, WPs will desist.

The results also showed that, among those who found waste picking to be financially burdensome, 50.0% pointed out that transportation costs were a negative factor while 19.2% reported that waste picking was physically demanding. A small percentage (9.6%) was concerned about insufficient pay-offs or income being generated compared to the efforts they exerted and the investments they had to make (Figure 4.7). The most predominant concern was transportation costs which could be linked to the impact of financial incentives on waste picking. Therefore, these concerns have the potential to negatively impact the ultimate objective of WPs to generate an income (4.4.3.2). In line with these concerns of low financial benefits and high transportation costs, Velis (2017) argues that the financial viability of the informal recycling sector remains vulnerable due to high rates of transportation and price fluctuations. It is against this backdrop that Ghisolfi et al. (2017) propose the consolidation of waste pickers in cooperatives, as such structures may ensure that they have access to motorised transport and infrastructure funded by municipalities.

In terms of the level of satisfaction with the income yielded by selling waste recyclables (4.4.3.3), the results (Figure 4.8) show that more (66.7%) LWPs were satisfied with the incentives than SWPs (59.2%) and thus that more (40.9%) SWPs were not satisfied than LWPs (33.3%) who were not satisfied. However, the majority of both groups (66.7% LWPs and 59.2% SWPs) was satisfied with the monetary incentives they received from the sale of recyclables (4.8). The fact that the majority felt content with their trade suggests that they might continue their waste picking activities which, in turn, suggests that the environment (the study area) may be positively impacted by WPs and their activities (4.4.3.4). This notion is supported by Yau (2010), who states that people who are positively stimulated by financial incentives to engage in waste picking almost automatically change their attitude and demonstrate pro-environmental behaviours.

Therefore, the study corroborates the findings of cited studies that waste picking is driven by incentives and that it has multiple benefits for WPs, the community, the economy, and the environment. Waste reduction and pollution prevention are

significant goals, and thus the role that WPs can play towards achieving these ideals should not be underestimated.

5.3 Contributions of the Study

5.3.1 Providing knowledge about waste picking and recycling

The study puts the factors that encourage and discourage waste picking into perspective and thus corroborates what other studies have termed the ‘convenience’ and ‘inconvenience’ factors that impact waste picking. Moreover, as the study highlights the important role that waste picking can play in generating income for the poorest of the poor in communities that have historically been marginalised, its recommendations may contribute to policy formulation that may formalise, even to a limited extent, the valuable work that informal waste pickers do in local communities.

5.3.2 The waste picking/recycling industry

The study identified potential improvement and growth areas for waste picking and the informal waste recycling industry. As knowledge deficiency exists regarding waste picking and the contributions that this informal industry can make towards waste reduction and the use of recycled materials by manufacturing industries, the information that this study provides will generate new interest in waste picking and the role it can play in alleviating the shortages of raw materials that are required to manufacture specific products.

5.4 Main Conclusions

5.4.1 Determinants of waste picking

- Age is not a factor that determines participation in waste picking as people of all ages participate in this informal waste recycling activity.
- Gender is also not a factor that determines participation in waste picking and recycling. For instance, a random sampling method resulted in a 50:50 ratio of male and female participation in the current study.
- A relatively high level of education is a determinant of sustainable and informed waste picking and recycling practices. However, as only just over 50% of the WPs in the City of Mbombela and surrounding areas had a secondary school or tertiary

education, it may be concluded that unsustainable waste picking practices could prevail in the study area.

- Poverty is a waste picking determinant. The main reasons for waste picking in the City of Mbombela and surrounding areas for the majority of the waste pickers (85.6%) were associated with poverty alleviation.
- Unemployment – and the resultant need for employment – is a determinant of informal waste picking and waste recycling participation. The study found that the majority (88.4%) of the randomly selected WPs was unemployed and that waste picking was their only alternative.
- Income generation is a determinant of waste picking and waste recycling participation.
- Living in urban areas and in towns near landfills is a determinant of waste picking and recycling. Even migrants flock to these areas to earn a living from waste picking. The study found that 15% of the participating WPs had migrated from neighbouring countries such as Mozambique and eSwatini to the City of Mbombela in search of job opportunities.

5.4.2 Concluding remarks about convenience and inconvenience factors as drivers of waste picking

- Some waste materials are more recyclable and convenient than others. Aluminium is highly desirable as most WPs in the current study (53.4%) picked and recycled this commodity. PET bottles and plastic were second on the list and preferred by 48.6% of the WPs. Metal/steel/scrap metal items were the third most preferred recyclables of 45.9% of the WPs.
- The unavailability of recyclables is a factor of inconvenience that hinders or limits waste picking participation.
- Waste accessibility is an important factor of convenience that encourages waste picking participation.
- Available markets and good prices are factors of convenience that encourage waste picking.
- Operational costs, when high, impact waste picking participation negatively. Costs associated with waste picking and waste recycling can therefore be a factor of inconvenience.

- Access to a storage facility is a factor of convenience when available, or a factor of inconvenience when not available. Access to safe storage will therefore partly ensure successful waste picking participation.
- Reliable transportation is a factor of convenience for waste recycling. The study found that 95.5% of the WPs needed transportation and many were prepared to pay for this service even if it meant reducing their spendable income.
- The distance between waste source and deposit point is a factor of convenience when close or of inconvenience when far. Distance of necessity impacts the cost of transportation.
- The availability and accessibility of waste recycling facilities impact successful participation in waste picking.
- Health and safety hazards are inconvenience factors that impact waste picking activities negatively. Appropriate health hazard preventive and control measures should therefore be instituted by local authorities and other role-players to protect waste pickers against untoward health hazards.
- Intolerance and prejudice are factors of inconvenience that may impact waste picking negatively. However, these factors impacted the WPs in the current study to a limited extent as it was noted that they could continue about their business in the study area in a relatively undisturbed manner. This suggests that tolerance of waste picking among the community and formal waste workers is a factor of convenience that encourages waste picking.

5.4.3 Concluding remarks about incentives as drivers of waste picking

- Some WPs (30.7% LWPs and 49.3% SWPs) were compelled by circumstances to participate in waste picking activities.
- The majority of the WPs (81.3% LWPs and 9 0.1% SWPs) was motivated by financial incentives to participate in waste picking activities. This suggests that poverty and the need for gainful employment are drivers of waste picking participation in the study area.
- Environmental concerns were also mentioned as a reason for participating in waste picking and recycling, although this aspect was referred to by only a few participants.
- Multiple incentives served as drivers of waste picking in the study area and the benefits of this form of self-employment positively impacted the WPs themselves,

their families, their communities, the economy, and the environment. In the latter instance, waste reduction and pollution prevention may have been the most important benefits, but evaluating the actual impact of waste recycling on the environment in the study area was beyond the scope of this investigation.

5.5 Recommendations

The following recommendations are offered:

- Educational and awareness programs should be introduced by local authorities to educate WPs about waste management and recycling to contribute towards environmental sustainability and the development of sustainable informal waste picking business.
- As waste picking has the potential to contribute to poverty alleviation and offer alternative employment for a large number of people, the waste picking industry should be afforded some form of formalization or compensation.
- Recognition should be given to the potential of waste picking activities to protect the environment and ensure the reuse of recyclable materials.
- As the bulk of recyclable materials is generated in urban areas or towns, waste minimisation, sorting, re-use and recycling should start in urban areas to minimise landfilling and its associated risks.
- It will be beneficial for society, the environment and the economy if all people are educated about the recyclability (i.e., the residual value) of waste materials that are thrown away on a daily basis. This may slowly but surely change waste recycling behaviour at household and business level.
- Residents and business owners should be educated to understand the importance of making recyclable materials available to and accessible for WPs and recyclers, as this has wide benefits for both WPs and society.
- Competitive markets must be developed and promoted locally to reduce the costs of recycling and to support the thriving of waste recovery businesses.
- The availability and accessibility of recycling facilities such as storage, transportation, and buy-back centres at central locations should be ensured to improve convenience.
- To curb intolerance of WPs, public awareness and cooperation with the WPs should be encouraged.

- Some health and safety control measures should be instituted and enforced by local authorities and beneficiaries of informal waste picking activities. Such measures will help to prevent WPs' exposure to health and safety hazards.
- A surprising finding was that tolerance of WPs and their activities existed in the study area. This positive attitude could be enhanced through public awareness programmes to ensure cooperation with and wide tolerance of WPs. However, WPs should also be sensitised to the need of residents to keep their areas and streets in pristine condition, and the littering that is associated with indiscriminate waste picking should thus be addressed by local authorities.
- The fact that WPs are compelled by circumstances to embark on waste picking for financial reasons indicates that too little has been done to educate people about the value and role of WPs in society. Their importance should thus be emphasised from relevant platforms. The study thus recommends that environmental awareness campaigns be launched by relevant role-players to sensitise all communities to the value and benefits of waste recycling by all.

5.6 Recommendations for Future Research

It is recommended that research be done in the following areas:

- The impact of high education levels on waste picking and recycling activities still needs additional and extensive research.
- As the current study focused mainly to economically marginalised groups, it is necessary to conduct further studies among more affluent communities to determine the extent of waste sorting and recycling practices among middle and upper class residents.
- The extent of the volumes of recyclable and non-recyclable waste materials that remain untreated on landfill sites needs to be evaluated to determine their potential impact on the environment in the future.
- Financial management, operational costs and profit margins associated with waste picking may be investigated to determine the sustainability of waste picking for societies that may be impacted by poor formal waste management practices.

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ANNEXURES

- 1. Annexure A: Questionnaire**
- 2. Annexure B: Consent form**
- 3. Annexure C: Access permit from the City of Mbombela**
- 4. Annexure D: Maryna Viljoen Statistics Consulting Services**
- 5. Annexure E: Ethical clearance**
- 6. Annexure F: Ethical clearance renewal**

ANNEXURE A: Questionnaire

Recycling Practices in the City of Mbombela, South Africa

Dear Participant, you are hereby humbly requested to assist Philix Mnisi in his studies by completing this questionnaire and then submit it to him. Your information herein will not be used for any other purposes except for the study as intended.

INSTRUCTIONS:

- Please mark your answer with an 'X' or write your answer on the space provided
- Be honest with your answers
- The information in this questionnaire shall remain confidential
- The questionnaire will take approximately 10-15min to complete

For office use only:

Number:

SECTION A: DEMOGRAPHIC INFORMATION

1. What is your age? _____ years

1-3
 4-5

2. What is your gender? ☐ Male ☐ Female

6

3. What is your highest level of education?

- ☐ No schooling
☐ Grade 0 - 4
☐ Grade 5 - 7
☐ Grade 8 - 10
☐ Grade 11 - 12
☐ Diploma
☐ Degree

7

4. What is your nationality? _____

8

5. In which township/ village/surbub are you situated? _____

9-10

6. What is your employment status? _____

11-12

7. Do you receive any grant from the government? ☐ Yes ☐ No

13

7.1 If yes, please specify the grant you receive:

- ☐ Child Support Grant
☐ Older Person's Grant
☐ Disability Grant
☐ Care Dependency Grant
☐ Foster Child Grant
☐ Grant in Aid
☐ War veterans grant

14
 15
 16
 17
 18
 19
 20

8. Please indicate your income per month:

21

SECTION B: CONVENIENT FACTORS OF COMMUNITIES

9. Does your waste get collected from home? ☐ Yes ☐ No

22

9.1 If yes, who collects the waste? _____

23-24

9.2 If yes, how often is waste collected? ☐ Daily

25

☐ Weekly ☐ Every second week ☐ Monthly ☐ Other, please specify: _____	26-27
10. Does your recyclables get collected? ☐ Yes ☐ No	28
10.1 If <u>yes</u> , who collects the recyclables? _____	29-30
10.2 If <u>yes</u> , how often is the collection? ☐ Daily ☐ Monthly ☐ Weekly ☐ Other, please specify: _____ ☐ Every second week	31
11. Do you find waste recycling convenient? ☐ Yes ☐ No	32-33 34
11.1 Please elaborate on your answer above: _____ _____	35-36 37-38
12. In your view, recycling is: ☐ Cheap ☐ Expensive	39
12.1 Please elaborate on your answer above: _____ _____	40-41 42-43
13. In your view, recycling is: ☐ Accessible ☐ Inaccessible	44
13.1 Please elaborate on your answer above: _____ _____	45-46
14. Are recycling facilities or activities available in your area? ☐ Yes ☐ No ☐ Don't know	39
14.1 If <u>yes</u> , are they easily accessible? ☐ Yes ☐ No	40
14.2 If <u>yes</u> , are they easy to use? ☐ Yes ☐ No	41
15. What can encourage you to recycling more?	42
SECTION C: INCENTIVE FACTORS OF COMMUNITIES	
16. Have you ever been motivated by these individuals to recycle?	
16.1 Family members ☐ Yes ☐ No	1
16.2 Friends ☐ Yes ☐ No	2
16.3 Forces by circumstances ☐ Yes ☐ No	3
16.4 Please elaborate how you were motivated? _____ _____	4-5

17. Please list 5 reasons why do you think people engage in recycling:

_____	_____
_____	_____
_____	_____

		6-7
		8-9
		10-11
		12-13
		14-15

18. From above list, please list in order of importance according to you (1= the most important reason of recycling; 5 = the least important.)

1.	_____
2.	_____
3.	_____
4.	_____
5.	_____

		16-17
		18-19
		20-21
		22-23
		24-25

SECTION D: ECONOMIC AND OTHER LOCAL FACTORS

19. In your knowledge, which waste is easily recyclable

1.	_____
2.	_____
3.	_____
4.	_____
5.	_____

		26-27
		28-29
		30-31
		32-33
		34-35

20. Which recyclables generate more income?

	36
--	----

21. How often do you recycle?

☐	daily
☐	Weekly
☐	Monthly
☐	Other (Specify)

	37
--	----

22. What is the estimated weight of recyclables do you collect (p/kg)?

			38-40
--	--	--	-------

23. Will you say the earnings from recyclables motivates you to continue with it?

☐ Yes	☐ No
------------------------------	-----------------------------

	41
--	----

23.1 Why do you say so?

	42-43
--	-------

24. What are the positive issues that relates to waste recycling that you would like to share with anyone who wants to start recycling:

	44-45
--	-------

25. What are the negative issues that relates to waste recycling that you would like to share with anyone who wants to start recycling:

	46-47
--	-------

	48-49
--	-------

Thank you so much for taking time, effort, to honestly and patiently complete this study questionnaire. Your assistance is highly appreciated. Kind regards, Philix Mnisi

ANNEXURE B 1: Consent form

Informed Consent and Information Document

Dear Research Participant

You are hereby humbly requested to voluntarily assist Mr. Philix Mnisi in his academic research project by completing some set of questions on a questionnaire provided, that only relate to your experience(s) with waste picking (recycling) both positive and negative. The information will later be evaluated and analyzed to interpret and understand the general issues that influence waste recycling, the study will then conclude by giving some recommendations that will improve and maintain the recycling industry for the benefit of the society.

The study is about assessing waste management practices and factors influencing recycling behavior of communities in the City of Mbombela, Republic of South Africa.

In order to achieve this, participants will be asked questions based on below five (5) specific objectives, so each objective have some set of questions.

The specific objectives are:-

To assess waste management practices, the association between community's demographic factors that influence recycling.

To assess the association between socio-cultural factors of communities and recycling.

To assess the association between convenient factors of communities and recycling.

To assess the association between incentive factors of communities and recycling.

To assess economic and other local factors that influence recycling participation.

The information will help improve or build on the body of knowledge for recycling, at the same time it will be used to improve the recycling activities and conditions in the near future locally, nationally and internationally.

It will also help the researcher to obtain his Master's degree from Central University of Technology.

The ethical codes of standards are strictly adhered to during the study processes.

The participants have rights to decide to participate and to withdraw their participation at any time of the process with no consequences.

The provided information may not be used for any different purpose other than for this academic research as intended and not by any other person other than the intended researcher (Philix Mnisi).

The questionnaire's information may not be too personal, will remain confidential and safely destroyed before disposal 12 months later after completion of the study.

Participants should not be minors who are below the age of 18 years old, but at least 18 years and above.

Participants are expected to sign the consent form which is not a contract and not binding in any way.

Your willingness to voluntarily help me collect the data for my study project is highly appreciated

Yours faithfully



Philix Mnisi

01 October 2018

E-Mail: Philix.Mnisi@transnet.net/ Philix.Mnisi@gmail.com

Cellphone: 083701 6311 / 082 508 3995

Participation Informed Consent

I,hereby grant my full consent to participate in the study “Recycling Practices in the City of Mbombela, South Africa”. As I have read and understood the information document about the study, and it was further explained in a clear language by the researcher to my understanding that participation is voluntarily, and that should at the later stage I decide to withdraw my participation, nothing will prevent me from doing so at any time and there are no consequences for such decision.

I further confirm that I am not below the age of 18 years

Thus signedaton this date.....of20.....

1. Witness SignatureDate.....

2. Witness SignatureDate.....

Your willingness to voluntarily participate is greatly appreciated

Annexure B2: Consent form

Satiso Semvumo nembhalo lwati

Mhlanganyeli welincwaningo lotsandzekako

Uyacelwa ngecutfobeka lokukhulu kutsi ulekelele Mr. Philix Mnisi kutelusu lwakhe lwelucwaningo lwetempfundvo, ngecutsi uphendvule luhlu lwemibuto ephepheni lwemibuto lonikwe lona, lemibuto icondzone nebungweti bakho nge kubutwa kwadodi pheceleti I Waste picking(Recycling) bubi ne buhle bayo. Lolwati lotasinika lona lutawubese luyahlolwa lubuye futsi luhlaliywe kuze luchaze futsi luvisise into lebanga I waste recycling, lesifundvo sitawuphetfwa ngecutniketa tindlela tsite letitawenta ncono futsi ticine lemboni yekuvuselelwa kabusha kwadodi kuze kuzuze umphakatsi.

Lesifundvo simayelana nekuhlola imikhuba ye waste management netici letibangela kuvuselela kabusha kwetiffo kulelidolobha lase Mbombela, Neningizimu Africa kuze kuphumelele lomtamo, bahlanganyeli batawucelwa kutsi baphendvule imibuto lesekele letinhloso letibhalwe ngaphansi, inhloso ngayinye inemibuto yayo.

Letinhloso leticondzile nguleti:-

Kuhlaliya imikhuba yekuphatfwa kwadodi, inhlanganiso phakatsi kwelinani lebanfu emphakatsini netinfo letibanga kuvuselwla kabusha kwadodi

Kuhlaliya inhlanganiso phakatsi kwetici temasiko yemphakatsi nekuvuselelwa kabusha kwadodi

Kuhlaliya inhlanganiso phakatsi kwesigci senhlalo yemphakatsi nekuvuselelwa kabusha kwadodi

Kuhlaliya inhlanganiso phakatsi kwetinfo leticucutela umphakatsi ne kuvuselela kabusha kwadodi

Kuhlaliya temnotfo nalokunye tinfo tendzawo letinemtselela kutekutibandzakanya kutekuvuselelwa kabusha kwadodi

Lolwati lutawusita ekwenteni ncono nekwakha umtimba welwati kwetekuvuselelwa kabusha kwadodi, futsi luphindze lusentjetiswe ekwenteni ncono timo ne misebenti lefaka kuvuselelwa kabusha kwadodi maduzane noma eminyakeni letako kulenzawo, kulelive nasemaveni angaphandle kweleNingizimu Africa. Lolwati lutawuphindze futsi lusite lomcwangingi kutsi aftole tiku takhe te Master's degree enyuvesi yase Central University of Technology.

Imigomo yekodi yekutiphatsa alandzelwa ngalokukhulu kucophelela kuletinxubomgomo talesifundvo. Bahlanganyeli banemalungelo ekukhetsa kungenela futsi nekuhoxisa kuhlanganyela kwabo nganoma ngasiphi skhatsi ngaphandle kwekubhekana nelicala.

Lolwati lolutawuniketwa angeke lusentjetiswe kulenye injongo ngaphandle kwalenjongo yeluncwaningo lwetempfundvo futsi ngeke isentjetiswe ngulomunye muntfu ngaphandle kwake umncwangingi (Philix Mnisi)

Loluhla kwemibuto ngeke lukubute ngemphilo yakhe, lutawugcinwa luyimfihlo futsi lutawubhubhiswa ngendlela levikelekile etinyangeni letilishumi nakubili nasekucedwa ngalesifundvo.

Bahlanganyeli akumele kube bantwana futsi iminyaka levumelekile icala kutelishumi nesiphohlango kuya etulu.

Bahlanganyeli balindzelwe kutsi bafake luphawu noma basayine kulelifomu lemvumo, lelifomu akusiso sivumelwano noma sibopho sanoma ngayiphi indlela.

Kutimisela kwakho ekungisiteni kutsi ngicoce idatha yetifundvo tami kuyabongeka kakhulu.

Lotsembekile



02 October 2018

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ANNEXURE B3: Consent form

Lifomu lekubambha lichaza

Mine,ngaloku nginiketa imvumo lephelele kuhlanyela kulesifundvo "Recycling practice in the City of Mbombela". Ngilifundze ngaluvisisa lolwatimbhalo ngalesifundvo, lolwati ngalesifundvo luphindze lwachazwa kahle ngu mncwaningi ngelulwimi lelivisisekako ngakhona kuvisisa kutsi kungenela loluncwaningo kusento sekuvolontiya futsi noma ngingafisa kungasahlanganyeli ngingaphuma ngaphandle kwekubhekana nesijeziso sesincumo sami.

Ngiyavuma kutsi ngineminyaka lelishumi nesiphohlongo malengetulu

LisayiweKuphiMhlaka.....Inyanga20.....

1. Fakazi SisayinoLusuku.....

2. Fakazi..... SisayinoLusuku.....

Kufuna kwakho ekubambeni lichaza kulesifundvo kuyancomeka

Papila ra Vuxokoxoko ni mpfumelelo “Informed Consent and Information Document”

Eka Muhlanganyeli ka vulavisisi bya tidyondzo

Laha wa komberiwa hi ku titsongahata leswaku u pfuna Mr. Philix Mnisi eka tidyondzo ta yena ta vulavisisi, hikuva u tata maphepha ya swivutiso leswi u nga ta nyikiwa swona, ku ya hi ntokoto ni vutivi bya wena bya switirhisiwa ni swixaviisiwa leswi kumekaka laha ku lahliweke leswi va n'wana va nga ha swilaviki (nyikani vunene ni vubhihi lebyi mi hlanganaka na byona eka tindzhawu leti). Timhaka leti ti ta xiyaxiyiwa ni ku kambisisiwa leswaku ku kumiwa mhaka leyi tolovelekeke matlhelo hinkwawo leyi nga na nkucetelo eka timhaka ta ku hlawula ka switirhisiwa leswi kumekaka laha kulahliweke chaka kona. Dyondzo leyi yi ta hetelela hi ku katsa switsundzuxo leswi nga ta pfuna ni ku hlalisa mabindzu lawa yo rhwalela switirhisiwa ku suka eka leswi lahlliweke xikan'we ni tiko hinkwaro

Dyondzo leyi yi kambisisa matikhomelo hi tlhelo ra swatichaka ni swilo leswi nga na nkucetelo etimhakeni ta ku tirhisiwa ka swilo leswi ngi a swilahlwile tani hi chaka endzhawini ya Masipala wa Mbombela, eAfrika Dzonga.

Kuva ku fikeleriwa leswi, muhlanganyeli u ta tutisiwa swivutiso mayelana ni swikongomelo nkulu swa ntlhanu swa dyondzo leyi, hikwalaho xikongomelo xihi na xihi xi na swivutiso swo karhi.

Swikongomelo swa kona hileswi swi landzelaka:-

Ku kambisisa maendlelo ni matikhomelo hi tlhelo ra chaka, ni vuxaka lebyi nga kona eka mintlawu ya vanhu ni ku hlawula switirhisiwa leswi humaka echakeni leti lahlliweke.

Ku kambisisa vuxaka lebyi nga kona exikarhi ka vanhu ni mintolovelolo xikan'we ni ndzhavuko wa vanhu ni nkucetelo lowu swi nga na wona eka kuhlawula switirhisiwa leswi humaka echakeni leri lahlliweke.

Ku kambisisa vuxaka lebyi nga kona eka swilo leswi olovisaka maendlelo ni nkucetelo lowu swi nga na wona eka kuhlawula switirhisiwa leswi humaka echakeni leri lahlliweke.

Ku kambisisa vuxaka lebyi nga kona eka ntshovelo ni nkucetelo lowu swi nga na wona eka kuhlawula switirhisiwa leswi humaka echakeni leri lahlliweke.

Ku kambisisa vuxaka lebyi nga kona eka swatimali, swin'wana ni swin'wana xikan'we ni nkucetelo lowu swi nga na wona eka kuhlawula switirhisiwa leswi humaka echakeni leri lahlliweke.

Vuxokoxoko lebyi byi ta pfuna ku aka ni ku antswisa vutivi hi tlhelo ro tirhisa nakambe ka switirhisiwa leswi ngi a swi lahlwile tani hi chaka, nakambe ni ku antswisa tindzhawu leti mintirho yo tano yi endleriwaka eka tona ni ma endlelo ya kona, leswi swi ta pfuna kwala ndzhawini ya laha kaya, ni tiko ra hina hinkwaro xikan'we in matiko ya misava hi nkawawo.

Nakambe swi ta pfuna mudyondzi hi tlhelo ra vulavisisi lebyi, leswaku a fikelela tidyondzo ta yena ta mpimo wa le henhla leti endliwaka na Central University of Technology.

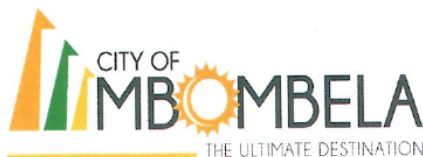
Maendlelo lamanene ya nawu ni vumunhu ma ta landzeleriwa ngopfu loko ku ri karhi ku endliwa dyondzo leyi.

Muhlanganyeli un'wana ni Un'wana u tshuxekile ku hlanganyela kasi hambu kuri ku tshika ku hlanganyela eka nkarhi wihi ni wihi wa vulavisisi handle ko vekiwa nandzu.

Vuxokoxoko lebyi byi nga ka byi nga tirhiseriwi swin'wana leswi hambaneke ni xikongomelo xa dyondzo leyi, naswona a byi nga tirhisiwi hi munhu un'wana ehandle ka mudyondzi (Philix Mnisi).

ANNEXURE C: Access permit from the City of Mbombela

Civic Centre
1 Nel Street
Mbombela 1201
Republic of South Africa



P O Box 45
Mbombela 1200
Republic of South Africa
Tel: +27 (0) 13 759-9111
Fax: +27 (0) 13 759-2070

DEPARTMENT COMMUNITY SERVICES

Enquiries: Lesiba Maluleke
Tel Nr: 013 759 2239

12 December 2018

The Chair: Health Sciences Research Ethics Committee
Dr SM Le Grange
For Attention: Mrs M Marais
Block D, Room 104,
Francois Retief Building
P o Box 339 (G40)
Nelson Mandela Drive
Faculty of Health Sciences
University of the Free State
Bloemfontein
9300

Dear Dr SM Le Grange

Permission for site access to Waste land fill sites and transfer station(s)

This serves to confirm that a permission is hereby granted to Mr. Philix Mnisi (Student No. 217013332) for the purpose of his study data collection through interviewing and observations of the waste pickers.

Hope you find all in good working order.

Kind Regards



L S MALULEKE
SENIOR MANAGER: SOLID WASTE MANAGEMENT

ANNEXURE D1:



Maryn Viljoen

Statistics Consulting Services

maryn.viljoen@vodamail.co.za
082 823 5731

Protocol and research methodology consultation • Ethical consultation • Database construction and capturing of data
Analyzing data using statistical software packages (SPSS Version 9.1.1) • Statistics consultation services to analyze and interpret data
Conveys results with statistical tables and figures where needed

The Chairperson: Health Sciences Research Ethics Committee (HSREC)

For Attention: Mrs. M.G.E. Marais
Block D, Room 104
Francois Retief Building
Faculty of Health Sciences
University of the Free State

4 May 2018

Title: "RECYCLING PRACTICES IN THE CITY OF MBOMBELA, SOUTH AFRICA"

Researcher: Mr. P. Mnisi (Student number: 217013332)
Master of Health Sciences in Environment
Department Of Life Science
Faculty of Health and Environmental Sciences
Central University of Technology, Free State

I have seen and read through this protocol. I gave input and recommendations and will be the biostatistician responsible for the analysis of the data.

Maryn Viljoen
M.Sc. Risk Analysis (UFS)
maryn.viljoen@vodamail.co.za
082 82 35 731

ANNEXURE D2:



Maryn Viljoen

Statistics Consulting Services

maryn.viljoen@vodamail.co.za
082 823 5731

Protocol and research methodology consultation • Ethical consultation • Database construction and capturing of data
Analyzing data using statistical software packages (SAS version 9.1.3) • Statistics consultation services to analyze and interpret data
Conveys results with statistical tables and figures where needed

The Chairperson: Health Sciences Research Ethics Committee (HSREC)

For Attention: Mrs. M.G.E. Marais

Block D, Room 104

Francois Retief Building

Faculty of Health Sciences

University of the Free State

28 January 2019

Title: "RECYCLING PRACTICES IN THE CITY OF MBOMBELA, SOUTH AFRICA"

Researcher: Mr. P. Mnisi (Student number: 217013332)

Master of Health Sciences in Environment

Department Of Life Science

Faculty of Health and Environmental Sciences

Central University of Technology, Free State

I have seen and read through the proposal that was conditionally approved by the HSREC. I specifically considered the recommendations by the HSREC to review the methodology of the proposal as well as the calculation of the correct sample size. I've assisted the researcher to recalculate and report the correct population and sample size. I will be the biostatistician responsible for the analysis of the data.

Maryn Viljoen

M.Sc. Risk Analysis (UFS)

maryn.viljoen@vodamail.co.za

082 82 35 731

ANNEXURE E:



Health Sciences Research Ethics Committee

24-Jan-2019

Dear Philix Muisi

Ethics Clearance: Recycling Practices in the City of Mbombela, South Africa

Principal Investigator: Philix Muisi

Department: CUT - Central University of Technology

APPLICATION APPROVED

Please ensure that you read the whole document

With reference to your application for ethical clearance with the Faculty of Health Sciences, I am pleased to inform you on behalf of the Health Sciences Research Ethics Committee that you have been granted ethical clearance for your project.

Your ethical clearance number, to be used in all correspondence is: UFS-HSD2018/0575/2901

The ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the HSREC for approval to ensure we are kept up to date with your progress and any ethical implications that may arise. This includes any serious adverse events and/or termination of the study.

A progress report should be submitted within one year of approval, and annually for long term studies. A final report should be submitted at the completion of the study.

The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 30, 21 CFR 36; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.

For any questions or concerns, please feel free to contact HSREC Administration: 051-4017794/5 or email EthicsFHS@ufs.ac.za.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours Sincerely



Dr. SM Le Grange

Chair : Health Sciences Research Ethics Committee

Health Sciences Research Ethics Committee

Office of the Dean: Health Sciences

T: +27 (0)31 401 7794/7794 | E: ethicsfhs@ufs.ac.za

IRB 0000240; RDC 230408-011; ICHG0005107; PWA00012704

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www.ufs.ac.za



ANNEXURE F:



Health Sciences Research Ethics Committee

04-May-2020

Dear Philix Maisi

Ethics Number: UFS-HSD2018/0575/2901

Ethics Clearance: Recycling Practices in the City of Mbombela, South Africa

Principal Investigator: Philix Maisi

Department: CUT - Central University of Technology

SUBSEQUENT SUBMISSION NOTED

With reference to your recent submission for notification of the Health Sciences Research Ethics Committee. The HSREC took note of the following:

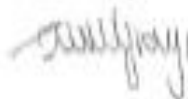
Continuation Report and annual approval to 23 Jan 2021

The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act, No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4, The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.)

For any questions or concerns, please feel free to contact HSREC Administration: 051-4017794/5 or email EthicsFHS@ufs.ac.za.

Thank you for submitting this matter for the attention of the HSREC.

Yours Sincerely



Dr. SM Le Grange

Chair : Health Sciences Research Ethics Committee

Health Sciences Research Ethics Committee

Office of the Dean: Health Sciences

T: +27 (0)51 401 7795/7794 | E: ethicsfhs@ufs.ac.za

IBB 00011992; REC 230408-011; KIRG 0010066; FWA 00027947

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