

THE IMPACT OF WASTE RECYCLING ON SUSTAINABLE JOB CREATION

By

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APPROVAL

This research project has been examined and is approved as meeting the required standards of scholarship for potential fulfilments of the requirements for the degree of Master of Business Administration at Regenesys Business School.

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DECLARATION OF ORIGINAL WORK

I, Bessy Tebogo Modisane, herewith declare that this dissertation for a Regenesys Business School Master of Business Administration degree has not been submitted for degree purposes at this, or any other university/institution. The thesis is my original work in design and execution, and contributions from other sources have been duly acknowledged.


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Date

ABSTRACT

The research study is about the impact of waste recycling on sustainable job creation in South Africa. It will aim to suggest a waste recycling strategy suitable for sustainable job creation. The researcher chose to conduct the study in the Gauteng province. The findings, conclusions and recommendations of the study will assist the waste recycling industry and the government to develop waste recycling strategies and in turn, lead to sustainable job creation.

According to a 2015 report by The Council for Scientific and Industrial Research (CSIR), just 10% of waste amassed in South Africa is being recycled. What is impressive is that this small percentage contributes R8.2 billion worth of resources into the South African economy. Today, the CSIR estimates that the recycling industry provides income opportunities for between 60 000 – 90 000 waste pickers alone, (CSIR |, 2015). The aim of this research proposal is to investigate, identify, and evaluate the potential impact of waste recycling industry as a long-term sustainable job opportunities creator in South Africa.

As the objective of the research is to analyse the impact of waste recycling on job creation, a quantitative research methodology has been undertaken for the study. Data was collected by using questionnaires, based on a Likert scale. The research population includes employees working in the Department of Forestry, Fisheries, and the Environment (DFFE), Gauteng Department of Agriculture and Rural Development (GDARD), City of Johannesburg Metropolitan Municipality, City of Tshwane Metropolitan Municipality, and from the private sector companies (service providers, buyers, sellers and processors, waste reclaimers) in Gauteng, South Africa. As a sampling frame was not available, a non-probability method of sampling (purposive sampling) was used in selecting samples. The collected data was analysed using descriptive statistics, correlation and regression analysis.

The study's findings suggest that the correlation between recycling intensity and indirect job creation; waste reduction and indirect job creation is statistically significant. This implies that if the intensity of recycling is increased, it will lead to indirect job creation. Similarly, if waste reduction is increased, indirect job creation will increase.

New industries, Small, Micro- and Medium-sized Enterprises (SMMEs), and waste reclaimers can largely benefit from such an increase in the intensity of waste recycling. Increased waste recycling would mean further business opportunities and more recognition for waste reclaimers.

The study findings also include 10 strategies including source segregation, optimising access to waste, access to finance, access to technical knowledge, access to training for reclaimers, recognising reclaimers as part of reverse logistics, reverse logistics, circular supply chain where waste is used as a raw material, and a circular supply chain. These are exciting sustainable solid waste recycling strategies, which could boost the economic growth of developing countries such as South Africa.

This will lead to a business environment where industry and government can partner together to reduce waste, and indirectly lead to job creation. The waste generated may be reused as a raw material for other products. Hence, a circular economy would be promoted where the waste of one industry may be used as a raw material for another industry.

The findings of this research study, though limited to a small sample size, suggests specific strategies and significant correlation between waste recycling and indirect job creation in the South African context. This is a new contribution to knowledge of the recycling industry in the country, and opens a wide scope of future research in a similar area with a more comprehensive research population.

ACKNOWLEDGEMENTS

I would like to acknowledge Dr Gerhard Van Wyk for his supervision of my dissertation, as well as the quality engagements we had in pursuit of the research work presented in this dissertation.

DEDICATION

I would like to dedicate this work to my family, especially my children, Ontshiametse and Karabo, who have been very inspirational and supported me during my pursuit of this research.

A special thanks to my husband Lucas, for always having confidence in me and granting me the time, space and encouragement I needed during this research work, including writing-up the dissertation.

ACRONYMS AND ABBREVIATIONS

AL	Aluminium
CSIR	Council for Scientific and Industrial Research
EPR	Extended Producer Responsibility
EU	European Union
GDARD	Gauteng Department of Agriculture and Rural Development
GDP	Gross Domestic Product
HDPE	High Density Poly Ethylene
HH	Household
IWMPs	Integrated Waste management Plans
LDPE	Low-density polyethylene
MSW	Municipal Solid Waste
NWIS	National Waste Information System
PET	Polyethylene Terephthalate
PSC	Programme Steering Committee
PVC	Polyvinyl Chloride
RRR	Reduce, Reuse, Recycle
SMME	Small, Medium and Microenterprises
VCA	Value Chain Analysis
WIEGO	Women in informal Employment: Globalizing and Organizing
WISA	Waste Integration in South Africa

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION AND BACKGROUND	13
1.1 INTRODUCTION	13
1.2 BACKGROUND OF THE STUDY	16
1.3 STATEMENT OF THE PROBLEM	16
1.4 RESEARCH QUESTIONS	17
1.5 RESEARCH OBJECTIVES	17
1.6 RESEARCH HYPOTHESES	17
1.7 RATIONALE/MOTIVATION FOR THE STUDY/JUSTIFICATION FOR THE STUDY	ERROR!
BOOKMARK NOT DEFINED.	
1.8 SIGNIFICANCE OF THE STUDY	18
1.9 ASSUMPTIONS OF THE STUDY	18
1.10 LIMITATIONS OF THE STUDY	18
1.11 DELIMITATION OF THE STUDY	18
1.12 THEORETICAL/CONCEPTUAL FRAMEWORK	19
1.13 SUMMARY OF THE CHAPTER	20
CHAPTER 2: LITERATURE REVIEW	21
2.1 INTRODUCTION	21
2.2 WASTE POSITION OF SOUTH AFRICA	21
2.3 RECYCLING	ERROR! BOOKMARK NOT DEFINED.
2.4 SOLID WASTE RECYCLING	22
SOURCE ADAPTED FROM: STATISTA, (2020)	24
2.5 RECYCLING VALUE CHAINS	24
2.5.1 Recovering Value From Waste	25
2.6 JOB CREATION AND THE RECYCLING ECONOMY	26
2.7 CIRCULAR ECONOMY	27
2.9 WASTE RECLAIMERS	30
2.10 Summary	31
CHAPTER 3: RESEARCH METHODOLOGY	33
3.1 INTRODUCTION	33
3.2 RESEARCH PARADIGM AND ORIENTATION	33
3.3 RESEARCH APPROACH	35

3.3.1 Research Approach To Data Collection	35
3.3.2 Research Approach In Data Analysis	36
3.4 THE QUANTITATIVE OR QUALITATIVE STRAND IN RESEARCH APPROACH	37
3.4.1 Coverage Of The Study	37
3.4.2 Target Population	37
3.4.3 Sample Size Calculation	38
3.4.4 Research Design	39
3.4.5 Sampling Methods	40
3.4.6 Data Collection Methods	42
3.4.7 Instrument For Data Collection	43
3.4.8 Pilot Study	43
3.4.9 Validity And Reliability	43
3.4.10 Administration Of Research Instruments	44
3.4.11 Ethical Considerations	44
3.4.12 Procedure For Hypotheses Testing	44
3.4.13 Measurements	45
3.5 SUMMARY OF THE CHAPTER	45
CHAPTER 4: DATA ANALYSIS	46
4.1 INTRODUCTION	46
4.2 PRESENTATION OF THE DATA	47
4.2.1 Respondent Profile - Age Group	47
4.2.2 Respondent Profile - Area Of Work For The Respondent	47
4.2.3 Respondent Profile - Gender Of Respondents	48
4.3 ANALYSIS OF THE DATA ACCORDING TO EACH RESEARCH OBJECTIVE	48
4.3.1 RESEARCH OBJECTIVE 1:	48
4.3.2 RESEARCH OBJECTIVE 2:	58
4.3.2.1 Source Segregation Increases The Quality Of Waste Input	58
4.3.2.2 Optimising Access To Waste Increases The Quality Of Waste Input	59
4.3.2.3 Access To Finance Assists In Increasing The Quality Of Waste Input	60
4.3.2.4 Access To Technical Knowledge Helps In Increasing The Quality Of Waste Input	61

4.3.2.5 Access To Training Helps Reclaimers In Increasing The Quality Of Waste Input.....	62
4.3.2.6 Recognising Reclaimers As Part Of Reverse Logistics Will Create A Sustainable Pool Of Reclaimers	63
4.3.2.7 Reverse Logistics Helps In Increasing The Revenues Of The Organisation	64
4.3.2.8 Circular Supply Chain Where Waste Is Used As A Raw Material	65
Helps In Increasing The Revenues Of The Organisation	65
4.3.2.9 Circular Supply Chain Is The Most Exciting Sustainable Solid Waste....	66
Recycling Strategy	66
4.3.2.10 Circular Supply Chain Will Boost The Economic Growth Of Countries Like South Africa	67
4.4 RELIABILITY OF THE DATA.....	67
4.5 CONCLUSION	69
CHAPTER 5: DISCUSSION OF RESULTS	70
5.1 INTRODUCTION	70
5.2 TRIANGULATION	70
5.2.1 Research Objective 1	70
5.2.2 Research Objective 2	72
5.3 CONCLUSION	74
CHAPTER 6: SUMMARY AND RECOMMENDATIONS	75
6.1 INTRODUCTION.....	75
6.2 SUMMARY OF THE FINDINGS	75
6.3 RECOMMENDATIONS	76
6.4 MY CONTRIBUTIONS TO KNOWLEDGE	77
6.5 CONCLUSION	77
REFERENCES.....	79
APPENDIX A – QUESTIONNAIRE	86

LIST OF FIGURES

Figure 1.1: Waste hierarchy	14
Figure 1.2: Waste management value chain and the circular economy.....	14
Figure 2.1: Volume of generated and landfilled waste in South Africa in 2017.....	21
Figure 2.2: Circular economy	25
Figure 2.3: Supply chain and waste generation	26
Figure 3.1: Age group.....	41
Figure 3.2: Department of work for the respondent.....	41
Figure 3.3: Gender of respondents	42

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

Solid waste management is a pressing challenge to a growing number of cities in developing countries today. Rapid urbanisation, new economic activity, and an increasing population growth, place multiple pressures on solid waste management systems. When basic services - such as waste collection and disposal are inadequate, then the economic, environmental, and human health effects disproportionately affect the urban poor (Anderson, et al., 2013).

On the other hand, the solid waste challenge presents us with a tremendous opportunity. Improving solid waste management provides a cleaner environment in poor and marginalized areas of cities and improves liveability for all city residents. A cleaner city helps to provide a more attractive environment for investment and tourism, which, in turn, improves a city's economic competitiveness, creating jobs and new business opportunities for local entrepreneurs. Solid waste management can also be linked to the development of new sources of energy, helping to tackle climate change.

The Polokwane Declaration signed in September 2001 committed South Africa to achieving 50% reduction in the volume of waste generated nationally, and 25% reduction in volumes of landfilled waste by 2012, and a zero-waste plan by 2022. The Polokwane Declaration was a call to action and since its adoption in 2001, the National Waste Management Act and the National Waste Management Strategy was developed in 2011. The National Waste Management Strategy provides the strategy and action plans to deliver on the mandate to reduce waste to landfills, (Recycling of Waste and Scrap in South Africa, 2021).

The National Waste Management Strategy shifts the focus of waste management away from disposal of waste to avoidance, reduction, re-use, and recycling, before handling and final disposal. The strategy applies the principles of accountability, cradle-to-grave responsibility, equity, integration, waste avoidance and minimisation

in its action plans, which aim to move away from fragmented and uncoordinated waste management to integrated waste management (Hoornweg & Bhada, 2012).



Figure 1.1: Waste Hierarchy

Source adapted from: Hoornweg and Bhada-Tata, (2012)



Figure 1.2: Waste management value chain and the circular economy

Source adapted from: Mpact Recycling, (2020)

In 2019, 1,2 million tons of paper and paper packaging was diverted from landfills. 62% of all PET plastic beverage bottles produced in SA in 2019 were collected for recycling – which is an increase from 55% achieved in 2016, (CSIR | 2015). How recycling is collected differs from community to community. There might be a formal recycling collector, collectors who service residential areas, or local community collection points - such as schools, retirement villages or shopping malls. Good recycling practices can also contribute to economic growth, job creation, and reduce social and environmental costs.

This in turn positively impacts the circular economy, which refers to waste items being re-used or recycled, to be made into something new. It ensures they continue to contribute valuably, rather than reaching landfills where they become useless. According to the 2015 report by the CSIR, only 10% of waste in South Africa was being recycled and contributed R8.2 billion into the economy. The report estimates that the recycling industry employs around 60 000 – 90 000 waste pickers (CSIR |, 2015).

Informal waste pickers play an integral role in South Africa's waste industry. For generations, these men and women — known locally as reclaimers, waste pickers or *bagerezi* — have earned income from collecting, sorting and selling recyclable discards. They remove tonnes of waste from city streets and keep it out of municipal landfills. Their work is key to South Africa's impressive overall recycling rate of 57 per cent. Recently, the Pretoria-based Council for Scientific and Industrial Research estimated that reclaimers recycle as much as 90 per cent of South Africa's plastic and packaging, and save the public coffers 750 million Rand -- all without government support or compensation for their service, (Waste Integration in South Africa (WISA) | WIEGO, 2021)

Yet these workers remain vulnerable and poorly compensated actors in a highly profitable industry. The South African government has estimated that as many as 90,000 people rely on waste picking to earn a living. These informal workers provide a valuable service to municipalities and must be recognized and compensated for this work, (Waste Integration in South Africa (WISA) | WIEGO, 2021).

1.2 BACKGROUND OF THE STUDY

Waste management is a critical to the economic development of countries and their communities. There are typically four major waste generators in the waste value chain, namely (PAMSA, 2020):

- i. Residential (domestic)
- ii. Commercial (business)
- iii. Government buildings and office parks
- iv. Industrial

South Africa disposes approximately 56 million tons of waste to its 826 landfill sites and less than 40% of the waste materials are recycled (South Africa State of Waste Report, 2017). Municipal solid waste is waste originating from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, yard and garden, street sweepings, contents of litter containers, and market cleansing. Additionally, it includes the nation's hazardous waste, of which only 6% is recycled. Recycling just one ton of paper can save up to 26m³ of water, 1,5m³ of oil, and up to 3 m³ of landfill space (PAMSA, 2020).

The aim of this research proposal is to investigate, identify, and evaluate the potential impact of waste recycling industry as a long-term sustainable job opportunities creator in South Africa.

1.3 STATEMENT OF THE PROBLEM

Waste recycling and employment creation are both pressing challenges for the South African economy. According to the 2020 National Waste Management Strategy (NWMS), increased waste recycling and beneficiation can act as a catalyst and contributor to the circular economy, potentially creating up to 150 000 new jobs by 2024 (Burger, 2021).

This study aims to demonstrate that the waste recycling sector, which is currently marginalized as an economic sector, has the potential to realize its full potential and

contribute significantly to the economy - by creating a significant number of job opportunities in South Africa, thereby alleviating poverty and improving the livelihoods of vulnerable communities.

1.4 RESEARCH QUESTIONS

- What is the impact of waste recycling on job creation?
- What are the best solid waste recycling strategies?

1.5 RESEARCH OBJECTIVES

The research objectives are to:

- i. Analyse the impact of waste recycling on job creation.
- ii. Explore solid waste recycling strategies.
- iii. Recommend waste recycling strategies that can contribute to job creation.

1.6 RESEARCH HYPOTHESES

Ho1: There is no significant impact of waste recycling on job creation.

Ha1: There is a significant impact of waste recycling on job creation.

1.7 RATIONALE/ MOTIVATION FOR THE STUDY - JUSTIFICATION FOR THE STUDY

Sustainable job creation is one of the biggest challenges of the South African economy. Waste recycling is an untapped potential industry that can assist the South African economy in creating jobs (Burger, 2021). Therefore, the study can have far-reaching practical implications for the waste recycling industry and the country, provided the sector is recognized and supported by government and the private sector (Omotoso, 2017).

1.8 SIGNIFICANCE OF THE STUDY

The findings, conclusions and recommendations of the study will assist the waste recycling industry and the government to develop waste recycling strategies, and lead to sustainable job creation. The theoretical significance of this study is that it allows us to explore the impact of waste recycling on job creation. Several factors contribute to job creation - however, the research is limited with regards to the impact of waste recycling on job creation. This will add to an already existing body of knowledge.

1.9 ASSUMPTIONS OF THE STUDY

The following is the assumption of the study – waste recycling creates job creation. Hence, the null hypothesis that there is no significant impact of waste recycling on job creation will be tested.

1.10 LIMITATIONS OF THE STUDY

Availability of time is a serious limitation of the study and hence the sample size will be between 100 - 125 respondents. Due to the limited small sample size, the findings of the study cannot be generalised, leaving a big scope of future research.

The researcher has limited time to complete the dissertation and this resulted in the sample size being limited to 100-125 respondents for collecting data. Conclusions and recommendations based on a small sample cannot be generalised, leaving scope of future research with a larger sample size.

1.11 DELIMITATION OF THE STUDY

The scope of the research study is limited to the Gauteng province recycling industry, South Africa. As no other geographical area will be considered for this study, the

findings may not be generalizable and would need the research population to be more spread-out and include other provinces of the country.

1.12 THEORETICAL/CONCEPTUAL FRAMEWORK

The conceptual model proposed by the researcher in the absence of a theoretical framework is presented below –

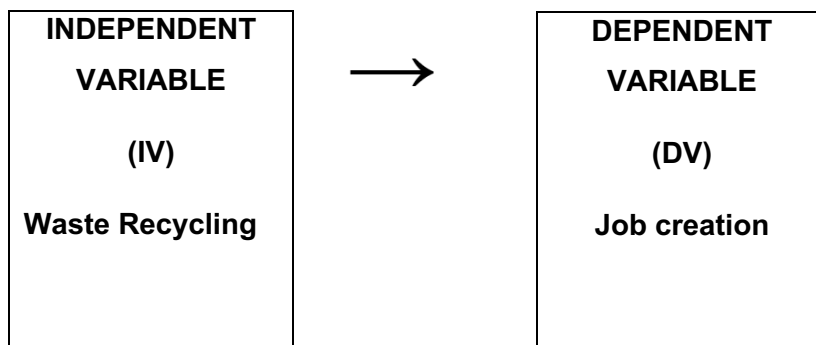
Waste recycling impacts Job creation

The variables-

Dependent variable (DV) – Job Creation

Independent variable (IV) – Waste Recycling

The conceptual model can be graphically presented as below



According to the proposed model, job creation is a dependent variable and waste recycling is an independent variable. Job creation depends on waste recycling. More waste recycling will result in more job creation.

The model will be assessed by assessing the null hypothesis, Ho: There is no significant impact of waste recycling on job creation.

1.13 CONCLUSION

The chapter introduced the research topic and delved into the study's background. The research problem was discussed, which led to the development of research questions and objectives. In addition, the chapter discussed the research hypotheses, based on the research objective. The chapter also included a brief discussion of the study's rationale and significance. The proposed conceptual model, as well as dependent and independent variables, were proposed. The chapter then included the study's assumptions, limitations, and delimitations.

Solid waste management is a pressing challenge to an increasing number of cities in developing countries today. According to the CSIR, only 10% of waste in South Africa is recycled, yet this small percentage contributes R8.2 billion of resources into the economy.

Informal waste pickers play an integral role in South Africa's waste industry. For generations, these men, and women—known locally as reclaimers, waste pickers or *bagerezi*—have earned income from collecting, sorting and selling recyclable discards. According to the 2020 National Waste Management Strategy (NWMS), increased waste recycling and beneficiation can act as a catalyst and contributor to the circular economy, potentially creating up to 150 000 new jobs by 2024 (Burger, 2021).

The main research objective of the study is to analyse the impact of waste recycling on job creation. The study uses job creation as the Dependent Variable (DV) and waste recycling as an Independent Variable (IV). The following chapter will discuss the literature review conducted for the research undertaken.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Solid waste recycling and job creation are the two major themes reviewed for literature. This literature review chapter is divided into several sections. The first section discusses the solid waste recycling plants, followed by a discussion on recycling value chains. The circular economy and its effect is explored in the literature, with a view to gaining insights into its effect on reverse supply chain used in recycling. The following section of the literature review will focus on job creation and recycling economy. The final section of the literature review examines the role of waste reclaimers. Finally, the chapter concludes with a summary.

The primary goal of this study is to investigate solid waste recycling, and the role it plays in job creation, by using existing literature, and to identify the gap in existing knowledge that necessitates the study.

2.2 WASTE POSITION OF SOUTH AFRICA

According to the 2018 State of Waste Report, South Africa generated fifty-five million tonnes of general waste, with only 11% being diverted from landfill in 2017. These trends, coupled with a limited growth in the Gross Domestic Product (GDP), are associated with increases in waste generation.

South Africa is experiencing severe constraints, in terms of the availability of landfill space, and challenges in operating and decommissioning landfills in a manner that is compliant with licensing conditions.

Commissioning and operating new landfills are a significant cost for local government and often resisted by communities from neighbouring potential sites. Furthermore, once disposed of to landfill, waste is no longer economically productive, and, in the absence of landfill gas capture, landfills generate methane which is a potent

greenhouse gas. (National Waste Management Strategy | South African Government, 2020)

2.3 RECYCLING

Recycling has been promoted as a cost-effective solution to environmental issues. Although many people have argued for recycling on moral grounds, an article in HBR (Recycling for Profit: The New Green Business Frontier, 2014) popularised the idea that recycling could provide a competitive advantage, resulting in a "*double dividend*" (i.e., a win for the environment and the economy).

Most states have heavily subsidised the expansion and development of recycling programmes based on this belief. Recycling advocates have emphasised the link between recycling and positive environmental and economic outcomes.

Relying on these correlations, however, ignores the endogenic problem caused by reverse causality and omitted variables. An important issue in recycling economics is whether these correlations between recycling and environmental/ economic outcomes are true causal effects (Makridis, 2021).

Makridis (2021) adds that new data on Household Hazardous Waste (HHW) recycling in California between 2004 and 2017 show that increases in recycling per household are associated with small improvements in environmental quality, such as the air quality index and days the air is considered unhealthy, as measured by U.S. Environmental Protection Agency (EPA) criteria.

2.4 SOLID WASTE RECYCLING

Razzaq (2021) conducted a study to estimate the municipal solid waste (MSW) recycling effect on environmental quality and economic growth in the United States.

The study employed bootstrapping autoregressive distributed lag modelling for investigating the co-integration relationship among MSW recycling, economic growth, carbon emissions, and energy efficiency utilised quarterly data over a 27-year period.

The research study confirmed a uni-directional causality from MSW recycling to economic growth, carbon emissions, and energy efficiency. In addition, these outcomes signify that any policy intervention related to MSW recycling, produces significant changes in the level of economic growth and carbon emissions (Razzaq, 2021).

Huang et al., (2020) conducted a study with to identify the socioeconomic drivers of solid waste recycling, investigating its evolution in China from 2005 to 2017. The study found that there was an increase of solid waste recycling driven mainly by the growth of recycling intensity, population increase and changes in the structure of GDP, which was partly offset by per capita GDP changes.

The study recommended that policymakers increase the amount of investment in solid waste recycling capacity in rural areas to enhance recycling intensity contributing to the overall recycling effort (Huang et al., 2020).

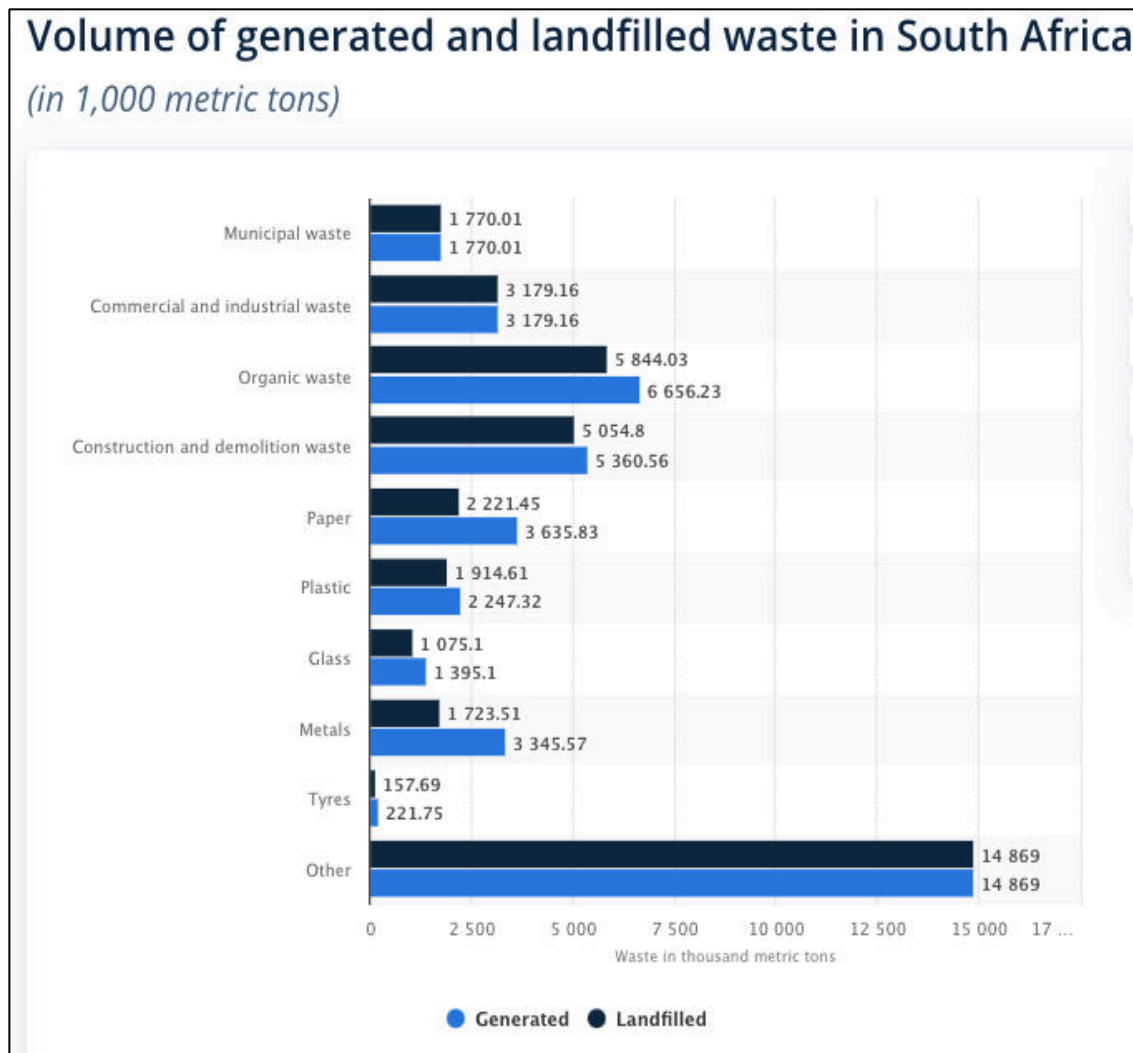
Waste generation and economic activity need to be decoupled to achieve the waste minimisation efforts of Reduce, Reuse and Recycle (RRR). Taušová, (2019) reviewed the state of communal waste recycling in 36 European Union (EU) countries, with a focus on the reduction of waste production with simultaneous increase in recycling rates.

The study concluded that the evaluation of waste production and recycling can be used for government policy in waste management, and for individual communities dealing with communal waste (Taušová, 2019).

One of the key drivers for sustainable waste management process that has gained traction and recognition is recycling of the waste.

South Africa waste recycling data for 2017 is provided by Statistics SA.

FIGURE 2.1 Volume of generated and landfilled waste in South Africa in 2017



Source adapted from: Statista, (2020)

Figure 2.1 suggests that others, followed by organic waste and construction and demolition waste, are the largest contributors of solid waste in South Africa.

2.5 RECYCLING VALUE CHAINS

Silva de Souza Lima Cano et al., (2022) conducted a critical review aimed at clarifying the diverse terminology used to describe recycling value chains globally, and provides an overview of the current state-of-the-art of MSW recyclable waste materials management, in developed and developing economies, emphasising their potential in

promoting circularity. The study proposed a typology for describing the management of recyclable waste materials across the globe, and highlights that each of the three types of recycling value chains developed is a highly complex, context-specific system, deeply constructed on long-term political, organisational, and institutional aspects. The study reveals how different forms of governance affect coordination in recycling networks and, by extent, their recycling performance.

However, according to Godfrey and Oelofse (2017), even though South Africa has been recycling waste for more than 30 years, most of the recycled waste has been driven by informal waste pickers driven by socio-economic conditions. Jaligot et al., (2016) developed and applied value chain analysis (VCA) to the informal recycling sector, and demonstrated using the Zabaleen in Cairo, Egypt as a case study.

VCA identifies the most highly connected indicators on which to focus interventions, as these are likely to have the greatest impact on the overall system. The research findings indicated that the most critical steps are improving the quality of waste inputs into the value chain through source segregation, optimising access to waste and upgrading recycling activities - through access to finance and technical knowledge (Jaligot et al., 2016).

2.5.1 Recovering Value from Waste

The potential for recovering value from waste appears to be limitless. Less than 30% of the 11.5 billion tonnes of waste produced is recycled. This situation presents an excellent opportunity to close the economic cycle and keep valuable resources from ending up in landfills and the oceans. In the developing world, the low rates of recycling and reuse have shown to be an opportunity for a segment of society to improve their life quality (Torres ,2017).

According to a United Nations Report, more waste picker families are now helping to repurpose waste, not only by collecting it, but also by sorting it and participating in emerging closed-loop business opportunities, (Torres, 2017).

The report goes on to use the example of the United States to suggest that waste is becoming a resource that is lifting people and families out of poverty and providing

cheap raw materials for the manufacture of goods. Construction of socially inclusive housing blocks made entirely of diverted plastic waste (e.g. Conceptos Plásticos); production of industrial paint for construction made with Styrofoam (e.g. Idea-Tec); and production of skateboards made entirely of discarded plastic fishing nets are some examples (e.g. Buro). These closed-loop solutions are emerging in South America, where waste pickers play an important role in the consolidation of new value chains that help repurpose waste by transforming it into raw material, (Torres, 2017).

2.6 JOB CREATION AND THE RECYCLING ECONOMY

The World Wide Fund for Nature (WWF) has undertaken research to identify the barriers to the recycling of plastic packaging and the inclusion of post-consumer recycled content in packaging applications, specifically as viewed by the plastics value chain. Godfrey, (2021) conducted a study to quantify economic activity in the informal recycling sector in South Africa.

The analysis from data of tonnages and price data shows that the mean estimate of money paid by the private sector to the informal waste sector through the purchase of recyclables at intermediaries, such as buy-back centres, was ZAR625 million in 2012, increasing to ZAR872 million in 2017. This private sector *'investment'* in the local recycling economy has led to direct and indirect job creation and improved livelihoods, particularly for a large, well-established, and effective informal waste sector, and has indirectly funded municipal waste diversion strategies, saving municipalities in both the collection and disposal of waste (Godfrey, 2021).

Majeed, et al., (2016) conducted a detailed assessment of the economic contribution of the informal waste management sector, using a case study performed in Bahawalpur, a medium-sized city of Pakistan.

The study investigated the current recycling conduct of the society and scrutinises the economic role of main stakeholders involved in recycling, including waste pickers, itinerant buyers, and waste traders. The study found that the recovery activity is profitable for key stakeholders involved, and generates a revenue of approximately 6.05 billion Rupees or 6 million USD/year. Furthermore, the results suggest that the

informal waste management sector is proficiently involved in waste recovery activities. and its integration with formal sector can work optimally at both ends (Majeed, 2016).

Viljoen et al., (2019) investigated the entrepreneurial opportunities and value-adding activities of buy-back centres in the recycling industry by collecting information from 67 buy-back centres across South Africa. It was concluded from this study that a recycling model that increases the volumes of recyclables recovered by buy-back centres through informal sector activities is required.

2.7 CIRCULAR ECONOMY

A circular economy is an industrial system that is intended to be restorative or regenerative. It replaces the concept of end-of-life with restoration, shifts toward the use of renewable energy, eliminates the use of toxic chemicals that impair reuse and return to the biosphere, and strives for waste elimination through superior design of materials, products, systems, and business models. (WEF, 2022)

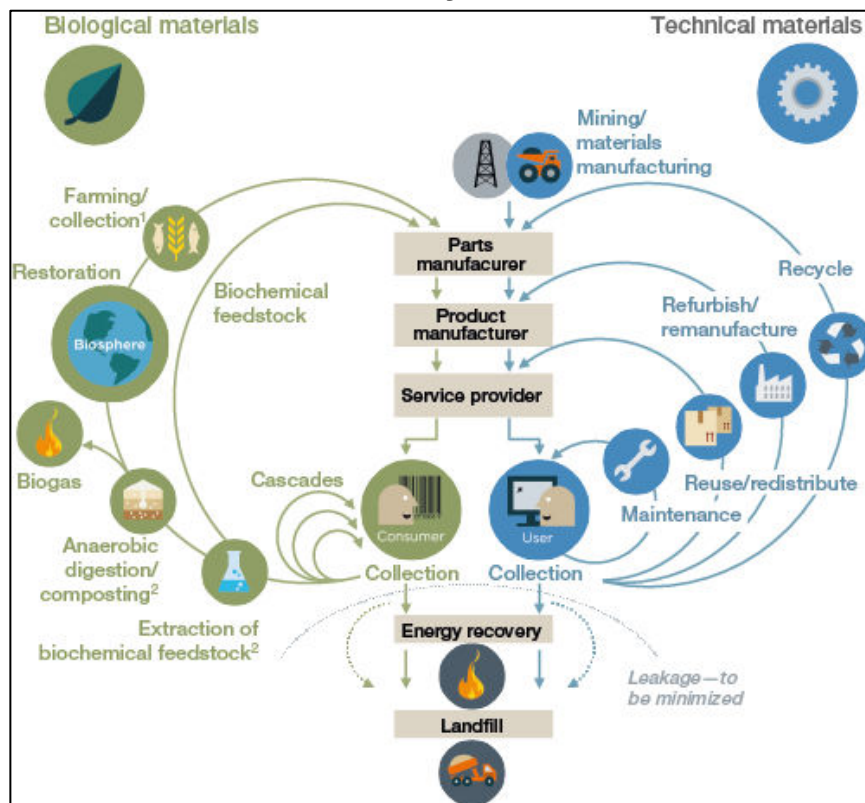
The World Economic Forum report further asserts that as illustrated in Figure 2.2, such an economy is based on a few simple principles. Primarily, a circular economy seeks to eliminate waste. There is no such thing as waste, because products are designed and optimised for a cycle of disassembly and reuse.

These tight component and product cycles define the circular economy and distinguish it from disposal and even recycling, which waste significant amounts of embedded energy and labour. Secondly, circularity establishes a clear distinction between a product's consumable and durable components. Unlike today, consumables in the circular economy are mostly composed of biological ingredients or 'nutrients' that are at the very least non-toxic, if not beneficial, and can be safely returned to the biosphere, either directly or through a series of subsequent uses.

Durables, on the other hand, such as engines and computers, are made of technical nutrients that are unsuitable for the biosphere, such as metals and most plastics. These are intended to be reused from the start, and products subject to rapid technological advancement are intended to be upgraded.

Thirdly, the energy required to power this cycle should be renewable by nature, reducing resource dependence and increasing system resilience (to oil shocks, for example). (WEF, 2022)

FIGURE 2.2 Circular Economy



Source adapted from: EMF (2012)

The Circular Economy (CE) is gaining traction among academics, businesses, and policymakers as a promising strategy for promoting both sustainability and competitiveness (Murray et al., 2017). China, Japan, the United States, and the European Union, among others, have issued policies encouraging the use of a CE (Winans et al., 2017). However, in addition to this top-down approach, businesses must make greater bottom-up efforts (Bressanelli et al., 2019).

CE differs from the linear economy, or the traditional method of producing, selling, and disposing of goods, in that it decouples economic growth from resource extraction and environmental losses (Elia et al., 2017). Companies that redesign their CE supply chain may reap environmental (Genovese et al., 2017), social (Ongondo et al., 2013), and economic benefits (Cucchiella et al. 2015). In this regard, supply chain management and configuration activities are critical. For example, a Life Cycle Assessment has shown that circular supply chains for insulation materials – in which waste is used as raw materials – can reduce carbon dioxide emissions by 60% (Nasir et al., 2017). Implementing reverse logistics for

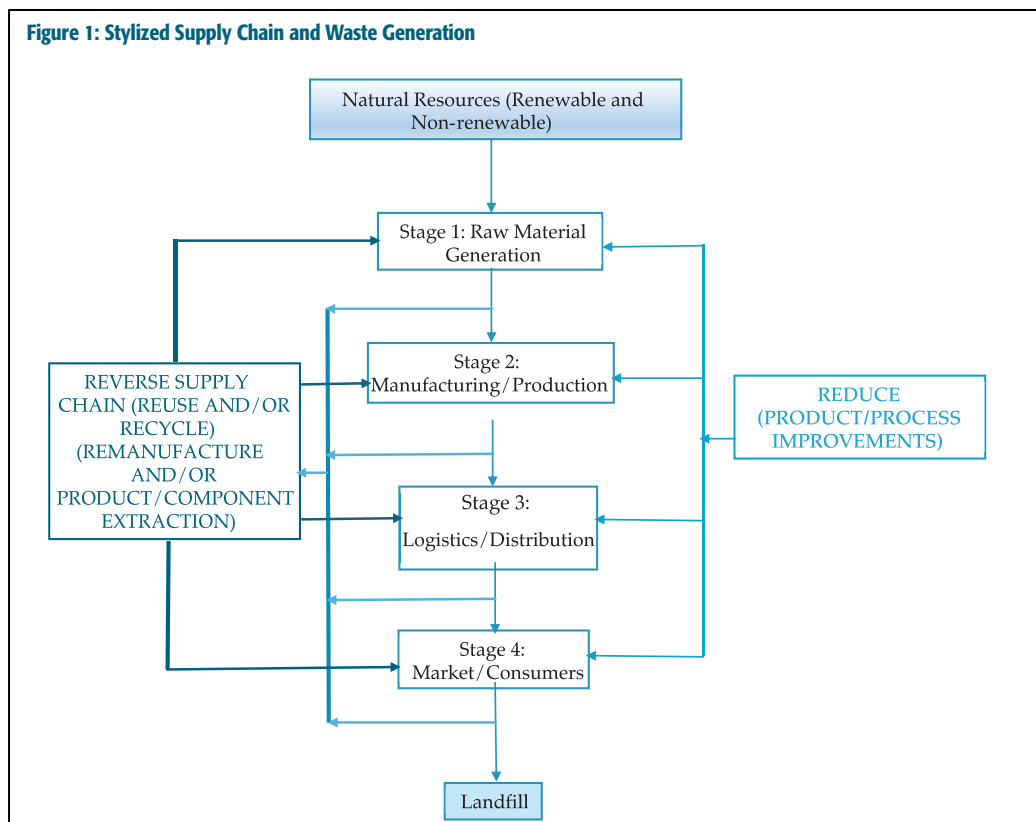
Waste Electrical and Electronic Equipment (WEEE) collection and renovation in Europe has the potential to generate approximately 2.15 billion euros in revenue through electronic waste recycling (Cucchiella et al. ,2015).

However, several obstacles may prevent these benefits from being realised, making the transition to CE difficult (van Loon et al.,2018). The literature, for example, widely acknowledges the uncertainties about the quantity, quality, and timing of product returns that arise in closed-loop supply chains, transferring such uncertainties in - for example, capacity planning for renovation activities - such as remanufacturing (Linder & Williander, 2017).

2.8 REVERSE SUPPLY CHAIN AND RECYCLING

Waste generation can be linked to multiple stages of the supply chain - beginning with the process used to generate raw materials, and ending with waste generated by end users/ customers.

FIGURE 2.3 – Supply Chain & Waste Generation



Source adapted from: Mahajan and Vakharia, (2016)

Based on the framework in Figure 2.3, it is clear that for effective waste management across the supply chain, firms within the chain can take either a proactive (associated with Reduce), or a reactive (associated with Reuse and/or Recycle) approach. Individual firms can benefit from the reactive approach, which focuses on extending product life by - for example, offering both new and remanufactured products in the market and profiting from recycling efforts. More supply chain firms are discovering reverse supply chains to be a profitable proposition, in terms of reuse and/or recycling. Firms are seizing the opportunity to introduce remanufactured products into the market alongside new products, attempting to reuse and recycle components salvaged from the products (Mahajan & Vakharia, 2016).

The entire field of reverse supply chain research is motivated by the observation that it is possible to reduce landfill waste by reusing, remanufacturing, and recycling used products/ components. Reverse supply chains, according to Blackburn et al., (2004), are organized to manage activities such as used product acquisition, transportation of used products to sorting facilities, inspection, sorting, and disposition of collected products, remanufacturing (or refurbishing) of returns, and the creation of secondary markets for remanufactured products.

The extant research on reverse supply chains has clearly documented that the activities are not only profitable, but can also result in reducing the landfill waste (Mahajan & Vakharia, 2016).

2.9 WASTE RECLAIMERS

Waste reclaimers are community members that are recycling waste for sustaining their livelihoods. They typically operate as individuals, or as groups in landfills, or as collectors from households/residential areas, using self-made trolleys. They are the active recyclable waste collectors. Waste reclaimers typically select recyclable waste that is of high monetary value and light in weight, such as cardboard (K4), aluminium cans and PET bottles. (Stats, 2018). It is estimated that there are currently over 50 000 informal landfill and kerbside waste reclaimers/ pickers in the South Africa. According to Plastics South Africa, it is estimated that the informal sector supplies 80% to 90% of packaging waste to recyclers (Home, 2021).

Informal waste pickers (IWPs), also known as reclaimers, are critical components of the world's waste management and recycling economies. In South Africa, only about 10% of urban households separate their waste, with the majority of recyclable items being discarded (Stats, 2018). However, thanks to the efforts of reclaimers, who salvage recyclable materials from waste at the curb and on landfills, South Africa has recycling rates, comparable to many European nations for some materials - such as metals, plastics, and PET.

These efforts save South African municipalities millions of dollars, with a study by Godfrey et al., (2016) estimating R750 million (\$48 million USD) in potential landfill costs saved per year. Furthermore, these efforts help to reduce greenhouse gas emissions and demand for non-renewable raw materials, and sustain nearly 100,000 jobs across the country (Godfrey et al., 2016). Despite these vital contributions, reclaimers in South Africa have historically been scorned and treated as nuisances and criminals by both the state and the communities through which they travel.

2.10 CONCLUSION

Solid waste recycling can impact economic growth and contribute to controlling carbon emissions. Informal waste pickers contribute significantly to the value chain activities of waste recycling. They are the collectors of waste. According to Plastics South Africa, it is estimated that the informal sector supply 80% to 90% of packaging waste to recyclers (Home, 2021). The results of research studies suggest that the informal waste management sector is proficiently involved in waste recovery activities, and its integration with formal sector can work optimally at both ends (Majeed, 2016).

Municipal solid waste (MSW) recycling produces significant changes in the level of economic growth and carbon emissions. However, most of the recycled waste of South Africa has been driven by informal waste pickers, driven by socio-economic conditions.

This can be improved by focusing on the value chain analysis of waste management. The local recycling economy has led to direct and indirect job creation for a large, informal waste sector. Waste reclaimers typically select recyclable waste that is of high

monetary value (Stats, 2018). According to Plastics South Africa, it is estimated that the informal sector supply 80% to 90% of packaging waste to recyclers (Home, 2021).

The role of circular economy as opposed to linear economy in the waste recycling supply chain suggests a solution for making waste recycling into a profitable business opportunity.

This chapter focussed on reviewing the available literature with regards to the research objectives and research variables discussed in Chapter 1. The next chapter will focus on the research design and methodology suitable for conducting the research study.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter discusses the research methodology that will be used to achieve the three research objectives introduced in chapter one: analysing the impact of waste recycling on job creation, exploring solid waste recycling strategies, and recommending waste recycling strategies that can contribute to job creation. This chapter describes the exploratory study's research design, research approach, and research methodology. Aspects of the research population, sample size, research instrument used, information sources, and sampling method are all discussed. The data analysis included the validity and reliability of the results, as well as ethical considerations and the study's limitations.

3.2 RESEARCH PARADIGM AND ORIENTATION

The research philosophy dictates how a study should be conducted (Research Philosophies – Importance and Relevance, 2018). A research philosophy, in other words, outlines the process to be followed when generating new knowledge, which aids in the selection of an appropriate research method for the study under consideration. A research philosophy is also defined as a framework that is guided by people's beliefs and feelings about the world - in terms of how it should be studied and understood, (Datt, 2016).

According to Saunders et al., (2015), the three research philosophies commonly used in social research are positivism, interpretivism, and realism, which are briefly discussed below. The positivist school of thought advocates for studies to be founded on pre-existing theories (Saunders et al., 2015). As a result, this philosophy advocates for objectivity in research, and suggests that data be gathered from a large sample size.

The interpretivism philosophy, on the other hand, proposes that the information gathered, be analysed and interpreted from the perspective of the researcher

(Saunders et al., 2015). As a result, an in-depth understanding of the problem is required. As a result, detailed information can be obtained from a small sample size. According to pragmatic philosophy, the choice of research philosophy is primarily determined by the research problem. The applied results are important in this research philosophy (Lancaster, 2005). Alghamdi and Li (2013) argue in another study that pragmatism does not belong to any philosophical system or reality. Researchers have a wide range of options.

Unlike positivism and interpretivism, which are two opposing views on the nature and sources of knowledge, pragmatism is a paradigm that agrees that the research question and research objective are the single most important elements that can determine the underlying research philosophy (Collins & Hussey, 2014).

The research question, according to pragmatism, is the most important determinant of the epistemology, ontology, and axiology you adopt – one may be more appropriate than the other for answering specific questions. Furthermore, if the research question does not clearly indicate that a positivist or interpretivist philosophy is being used, this confirms the pragmatist's view that it is perfectly possible to work with variations in your epistemology, ontology, and axiology (Saunders et al., 2015).

According to Saunders et al., (2015), the philosophy of realism holds that there is a reality that exists apart from the mind. In this regard, realism differs from idealism, which holds that the mind and its contents are the only things that exist. Realism is an epistemological branch that, like positivism, takes a scientific approach to knowledge development. This assumption serves as the foundation for both data collection and data interpretation. According to Saunders et al., (2015), the critical realist viewpoint that the social world is constantly changing is much more in line with the goal of business and management research, which is all too often hard to understand. Realism philosophy is based on the principles of positivist and interpretivist research philosophies. Realistic research philosophy is based on assumptions that are necessary for the perception of subjective nature of the human (Lancaster, 2005).

The philosophy of this study was guided by the researcher's pragmatic research paradigm, which holds that knowledge can be gained through careful observation, and measurement of the objective reality that exists in the world by developing numeric metrics of those observations (Creswell & Creswell, 2018).

3.3 RESEARCH APPROACH

Chetty (2016) has defined the research approach as a plan and procedure, including the broad assumptions, to methods of data collection, analysis, and interpretation. The research study can be conducted through three different approaches - namely quantitative, qualitative, and mixed research approaches (Taušová, 2019). The research conducted in this study will be based on quantitative research approach since the study aims to test the hypothesis “*There is no significant impact of waste recycling on job creation*” and the study uses a deductive approach.

3.3.1 Research Approach to Data Collection

Best and Kahn (2015) define a questionnaire as a form used in survey design that study participants fill out and return to the researcher. They are research instruments that employ written questions or items to which respondents respond individually in writing (Kothari, 2014).

The primary goal of a questionnaire is to elicit facts and opinions about a phenomenon from people who are knowledgeable about the subject (Babbie & Mouton, 2015). Questionnaires are useful in descriptive research, because they allow respondents to express their feelings in writing.

The goal of using a questionnaire is frequently to survey a representative sample of the population, so that generalisations can be made based on the responses of the respondents. (Denzin & Lincoln, 2015).

The questionnaire will be composed of questions developed by the researcher and will be intended to collect quantitative data capable of testing the research hypothesis. The questionnaire will be organised and will employ a 5-point Likert scale.

The questionnaire will allow the researcher to learn about the respondents' perspectives and experiences, on the topic under investigation. A Likert scale questionnaire-based survey will be used to collect data from respondents from the Gauteng province, since the study is quantitative in nature.

3.3.2 Research approach in Data Analysis

According to Babbie (2010), quantitative research focuses on gathering numerical data and generalises it across groups of people, or to explain a particular phenomenon. The main aim of conducting quantitative research goal in conducting quantitative research study is to determine the relationship between or among variables within a population. Determining the association of waste recycling and job creation was deemed a topic where quantitative research tools could be used to conclusively ascertain the existence of association among variables.

The quantitative analysis will be carried out with the help of appropriate descriptive statistical tools - such as standard deviation, mean, mode, median, skewness, and kurtosis. This would assist in describing the data collected.

A correlational research design investigates relationships between variables, without the researcher controlling or manipulating any of them. Correlation analysis in research is a statistical method used to measure the strength of the linear relationship between two variables and compute their association.

Simply put - correlation analysis calculates the level of change in one variable due to the change in the other. A high correlation points to a strong relationship between the two variables, while a low correlation means that the variables are weakly related. (Questionpro, 2022)

Correlation analysis will be used to analyse the data using MS-Excel data analysis tool pack, since it is used to study practical cases. Here the researcher can't manipulate individual variables. Correlation between waste recycling and job creation will be calculated, and the p-value will also be calculated using regression analysis to test the hypothesis. P-values are used in hypothesis testing to help decide whether to reject the null hypothesis. The smaller the p-value, the more likely you are to reject the null hypothesis, (Bevans, 2021).

3.4 THE QUANTITATIVE OR QUALITATIVE STRAND IN RESEARCH APPROACH

According to Babbie (2010), quantitative research is concerned with collecting numerical data, and generalising it across groups of people or explaining a specific phenomenon. The primary goal of a quantitative research study is to determine the relationship between or among variables in a population. The determination of the relationship between waste recycling and job creation, was deemed a topic for which quantitative research tools could be used, to conclusively ascertain the existence of an association between variables.

Hence the research approach for the study will be quantitative - so that the hypothesis may be tested, and the relevant data for testing the hypothesis may be collected from the respondents.

3.4.1 Coverage of the Study

The study is situated in Gauteng province and within the City of Tshwane Metropolitan Municipality. The research population from these areas would be used to collect primary data. The research population is further discussed under the target population section.

3.4.2 Target Population

Research population *“refers to the whole group of people or set of items and events the researcher desires to study”* (Alpaslan et al., 2010). The research population for this study includes recycling players in the Gauteng province - including employees working in the Department of Forestry, Fisheries, and the Environment, Gauteng Department of Agriculture and Rural Development (GDARD), City of Johannesburg Metropolitan Municipality, City of Tshwane Metropolitan Municipality, and private sector companies (service providers, buyers, sellers and processors, waste reclaimers).

3.4.3 Sample Size Calculation

The researcher has two sampling methodologies at his or her disposal. This includes both probability and non-probability sampling methods. The type of sampling chosen is largely determined by the availability of a sampling frame.

3.4.3.1 Probability Sampling

The most common probability sampling techniques are random sampling, systematic sampling, stratified random sampling, quota sampling, and cluster sampling (Chaturvedi, 2016), which are discussed further below.

- **Simple random sampling** – When used correctly, simple random sampling ensures that all elements of the population have equal chances of being included in the study.
- **Systematic sampling** - The method requires that all subjects be arranged in a specific order, and that sampling occurs in a specific defined order, after which participants are selected at clearly defined intervals.

3.4.3.2 Non-probability sampling

According to Chaturvedi (2016), the major types of non-probability sampling methods are - purposive, quota, snowball and convenience sampling. These are discussed briefly as under:

- **Purposive sampling** – The respondents are selected from the population based on the purpose of the research. The researcher's subjectivity is the main feature of purposive sampling.
- **Quota sampling** – The elements of the population are divided into mutually exclusive groups, and participants are then chosen subjectively.
- **Snowball sampling** – Snowball sampling is a type of sampling in which the researcher, after gathering information from a subject, asks the subject to make a referral.
- **Convenience** – This is a situation in which subjects for the study are chosen based on how easily they are accessible to the researcher.

The researcher will use the non-probability method of sampling (purposive sampling) to collect data from respondents as a sampling frame is not available, which is the requirement for using probability method of sampling. Raosoft's sample size calculator would be used to calculate the sample size for quantitative data collection. Raosoft is an online sample size calculator to find the appropriate sample size for a research study. It uses the research population to suggest the sample size.

The calculator suggests a sample size of 379 for a large indefinite population, which may be too large, due to time constraints. As a result, a sample size of 100-125 is proposed by the researcher to test the hypothesis by using valid statistical tests.

3.4.4 Research Design

Exploratory, explanatory, descriptive, and causal research designs are the four major types of research designs (Cooper & Schindler, 2013). Cooper and Schindler (2013) further argue that the design of a study has the potential to influence both the sources and types of data collected. The following are the various types of designs:

Exploratory studies –This design is appropriate for conducting research in a new area with unknown variables to aid in the development of an intelligent question (Cooper & Schindler, 2013). In order to gain detailed knowledge, the design seeks to develop a clear review of the problem through a literature review, supplemented by the respondents' views (Saunders et al., 2015). The design is well-known for its adaptability, which can be achieved by slightly altering the research process. (Saunders et al., 2015).

Causal Studies – These designs intend to investigate the relationship between variables, by looking at how variables influence variable change (Cooper & Schindler, 2013). According to Saunders et al. (2015), the goal of business research is to identify relationships between variables, rather than to determine causal factors.

Explanatory Studies– Explanatory designs investigate a problem in order to determine the relationships between variables. Explanatory research is a type of research that attempts to establish causal relationships between variables. The emphasis is on examining a situation or problem to explain the relationships between

variables. (Saunders et al., 2015) These studies rely on previous research and intelligent responses to explain new developments. (Cooper & Schindler ,2013).

Descriptive Studies – This is appropriate for research aimed at producing summaries of people, events, or developments. Cooper and Schindler (2013) emphasise the importance of descriptive studies in answering the "*who, what, when, where, and how*" questions about the subject under study. This could be a continuation or precursor to exploratory or, more commonly, explanatory research.

A descriptive research design will be used to address the research problem. It is important to note that descriptive studies help to provide data answers to the "*who, what, when, where, and how*" questions about the subject under study.

Data from descriptive studies can be used to examine the relationships (correlations) among variables. While the findings from correlational analyses are not evidence of causality, they can help to distinguish variables that may be important in explaining a phenomenon from those that are not. Descriptive research is often used to generate hypotheses that should be tested using more rigorous designs. A variety of data collection methods may be used alone, or in combination, to answer the types of questions guiding descriptive research. Some of the more common methods - include surveys, interviews, observations, case studies, and portfolios. The data collected through these methods can be either quantitative or qualitative. Quantitative data are typically analysed and presenting using descriptive statistics. (Research connections,2018)

Descriptive research would thus assist in assessing the impact of waste recycling on job creation in the selected area of research study.

3.4.5 Sampling Methods

There are two types of sampling methodologies available to the researcher. This includes – probability and non-probability sampling. The selection of the type of sampling depends largely upon the availability of sampling frame.

3.4.5.1 Probability Sampling

The most frequently used probability sampling techniques include random sampling, systematic sampling, stratified random sampling, quota sampling and cluster sampling (Chaturvedi, 2016) and these are discussed below -

- **Simple random sampling** – When applied, simple random sampling ensures that all elements of the population have equal chances of being included to participate in the study.
- **Systematic sampling** - The method necessitates that all subjects be arranged in a specific order, and that sampling take place in a specific defined order, after which participants are chosen at clearly defined intervals.
- **Stratified sampling** – The study population is divided into distinct groups based on predefined criteria, and participants are chosen from each group based on their size.
- **Cluster sampling** – Components from the population are chosen from certain areas and or periods.

3.4.5.2 Non-probability sampling

According to Chaturvedi (2015), the major types of non-probability sampling methods are purposive, quota, snowball and convenience sampling. These are discussed briefly underneath:

- **Purposive sampling** –The respondents are selected from the population based on the purpose of the research. The researcher's subjectivity is the main feature of purposive sampling.
- **Quota sampling** – The elements of the population are divided into mutually exclusive groups, and then participants are chosen subjectively.
- **Snowball sampling** – Snowball sampling is a type of sampling in which the researcher, after gathering information from a subject, asks the subject to make a referral.

- **Convenience** – This is a situation in which subjects for the study are chosen based on how easily they are accessible to the researcher.

The method of non-probability sampling will be used, since a sampling frame will not be available for the entire population. The researcher also intends to use a purposive/judgmental sampling method to collect data.

3.4.6 Data Collection Methods

A survey scale is a collection of answer options—either numeric or verbal—that covers a wide range of opinions on a given topic. It is always asked as part of a closed-ended question (a question that presents respondents with pre-populated answer choices).

A Likert scale survey question is one that employs a 5 or 7-point scale, also known as a satisfaction scale, that ranges from one extreme attitude to another. In most cases, a moderate or neutral option is included in the Likert survey question's scale. Likert scales (named after their creator, American social scientist Rensis Likert) are widely used because they are one of the most dependable methods of measuring opinions, perceptions, and behaviours.

Unlike binary questions, which only have two answer options, Likert-type questions will provide you with more granular feedback on whether your product was *"good enough"* or (hopefully) *"excellent."* Likert scale questions can assist you in determining whether a recent company outing left employees feeling *"very satisfied," "somewhat dissatisfied,"* or *"neutral."* (Survey Monkey, 2015)

Data will be collected using survey-based Likert scale questionnaires, since the research study is quantitative in nature, and Likert scales easily operationalise complex phenomena by breaking down abstract topics into recordable observations. This enables statistical analysis of the data collected.

The research has two basic objectives to analyse the impact of waste recycling on job creation, and to explore solid waste recycling strategies. These are abstract topics which requires a Likert scale questionnaire to record the responses from the respondents. These responses can be analysed using statistical tests. The specific tests are discussed in Chapter 4.

3.4.7 Instrument for Data Collection

As discussed above, the instruments for the study will be structured 5-point Likert Scale based questionnaires. A questionnaire based on 5-point Likert scale uses questions on a scale of 1 to 5. For example – a satisfaction scale may be developed where 1 = Highly Dissatisfied, 2 = Dissatisfied, 3 = Neutral, 4 = Satisfied and 5 = Highly Satisfied. Similarly, a scale of agreement/disagreement or others may be developed.

3.4.8 Pilot Study

In social science research, the term "*pilot study*" is used in two different contexts. It may refer to feasibility studies, which are "*small scale version[s] or trial run[s] done in preparation for the major study*" (Polit et al., 2001). A pilot test can be further described as a small preliminary study that is used to test proposed research study instruments, before they are used on a larger scale (Macmillan & Schumacher, 2014).

One advantage of conducting a pilot study is that it may provide early warning about areas where the main research project may fail, where research protocols may not be followed, or whether proposed methods or instruments are inappropriate or overly complicated.

The questionnaire will be pilot tested with 12-15 respondents. Their feedback will be incorporated in the questionnaire to make it more comprehensible and relevant.

3.4.9 Validity and Reliability

The collected data will be subjected to reliability testing. The Cronbach's alpha score will be computed to test the reliability. An alpha of 0.6-0.7 indicates an acceptable level of reliability, while an alpha of 0.8 or higher indicates very good reliability, (Hulin et al., 2001).

Validity of the data will be ensured by pilot testing the questionnaire. In addition, subject matter experts including the supervisor, will provide their valuable inputs, so that only valid questions are asked to the respondents.

3.4.10 Administration of Research Instruments

The survey questionnaire will be administered by using Google forms. The survey questionnaires will be forwarded to the selected respondents using Google forms, an online tool. The respondents will be able to receive the questionnaire online, and they may fill the questionnaire online.

It will assist the researcher in saving time and getting the response of the respondents directly in the researcher's mailbox.

3.4.11 Ethical Considerations

The following are important ethical considerations for this research study:

- The dignity and confidentiality of respondents will be respected.
- The anonymity of the individual employees participating in the survey will be respected.
- Consent will be obtained from the relevant department, prior to questionnaires being handed out.
- Data received will be represented in a truthful and transparent manner.
- Findings of primary and secondary data will be unbiased and represented accurately in the findings.
- Copies of the findings will be made available to the respondents.
- The selection of the sample population will be unbiased.

3.4.12 Procedure for Hypotheses Testing

The null hypothesis (H_0): *There is no significant impact of waste recycling on job creation*, will be tested by using a correlation analysis.

The independent variable here is waste recycling, and the dependent variable is job creation. The same is based on the conceptual model proposed by the researcher in Chapter 1.

3.4.13 Measurements

A 5-point Likert Scale will be used in the study to develop questionnaire. The data collected will be analysed using descriptive statistics and correlation analysis.

3.5 CONCLUSION

The chapter elaborated on the research methodology that would be used in the study. The research population and sample size calculation using Raosoft sample size calculator were discussed. The research philosophy in the form of pragmatism was discussed. It was also suggested that a quantitative research approach will be used for the study. A non-probability sampling methodology will be used as a sampling frame is not available.

A 5-point Likert scale questionnaire will be used as the research instrument for data collection. The validity of the data will be ensured by calculating the Cronbach's alpha score, and pilot testing will be used for the reliability. Correlation analysis will be used to test the hypothesis.

CHAPTER 4: DATA ANALYSIS

4.1 INTRODUCTION

The researcher discussed the philosophy and methodology used to collect data in Chapter Three. The research philosophy, research approach, data collection techniques, research strategies, sampling design, data analysis, validity and reliability, study limitations, and ethical considerations were all emphasised in the research design.

There were in total a 100 fully-filled in responses that were collected from the 125 respondents. The respondents were almost equally divided into males and females. The data was collected from five different groups of respondents –

- Group 1- Department of Forestry, Fisheries & Environment;
- Group 2 – Gauteng Department of Agriculture and Rural Development;
- Group 3 – City of Johannesburg Metropolitan Municipality;
- Group 4 - City of Tshwane Metropolitan Municipality;
- Group 5 – Private sector companies.

The data collected is presented in this chapter.

The fourth chapter intends to present the data collected in the form of tables and figures/ charts, and provide statistical analysis of this data using descriptive statistics and correlation. The mean and standard deviation are used to analyse data related to Research Objective 2, Correlation is used to analyse data related to research objectives 1. In addition, reliability test is also conducted using Cronbach's alpha to find the internal consistency of the data.

To find the statistical significance of the correlation, p-value is calculated using regression analysis. Finally, the chapter ends with a conclusion.

4.2 PRESENTATION OF THE DATA

The demographic profile of the respondents including gender, age group and area of work is presented in this section. Pie-charts are used to present the data in the form of figures.

4.2.1 Respondent Profile - Age Group

Figure 3.1 – Age Group

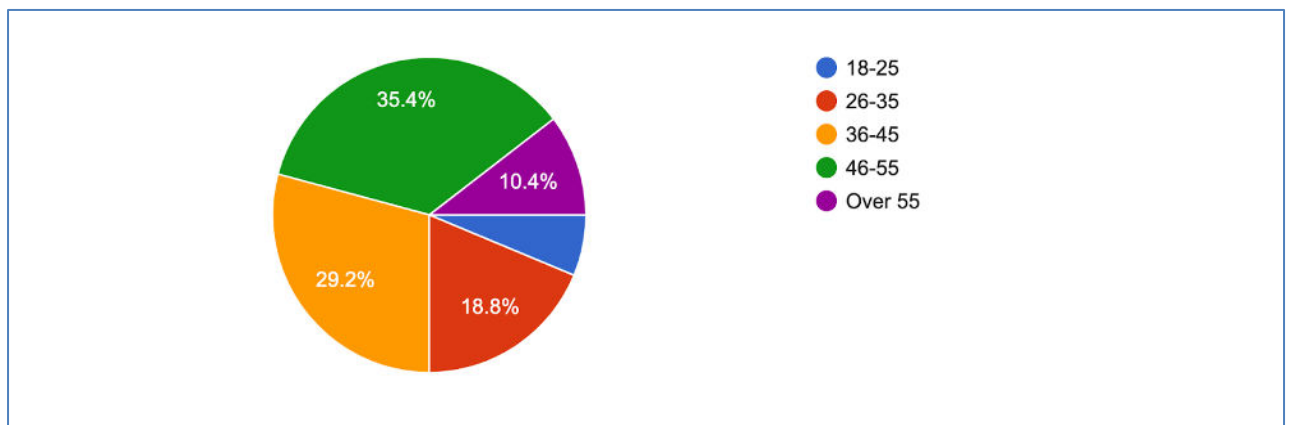


Figure 3.1 indicates that the respondents' age is very well spread out, with most respondents aged between 46-55 years' old and the minimum percentage from the above 55-years age group. There are no respondents from the age group 18-25 years.

4.2.2 Respondent Profile - Area of Work for the Respondents

Figure 3.2 Department of Work for the Respondents

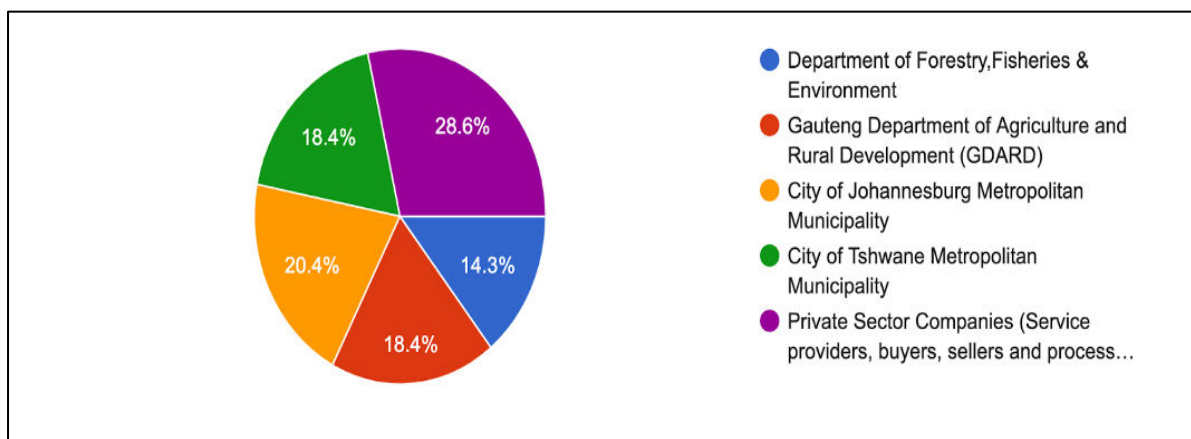


Figure 3.2 indicates that most of the respondents work in private sector companies - including service providers, buyers and sellers and processors, and waste reclaimers. A small percentage (14.3 %) of the respondents work for the Department of Forestry, Fisheries & Environment.

4.2.3 Respondent Profile - Gender of the Respondents

Figure 3.3 Gender of the Respondents

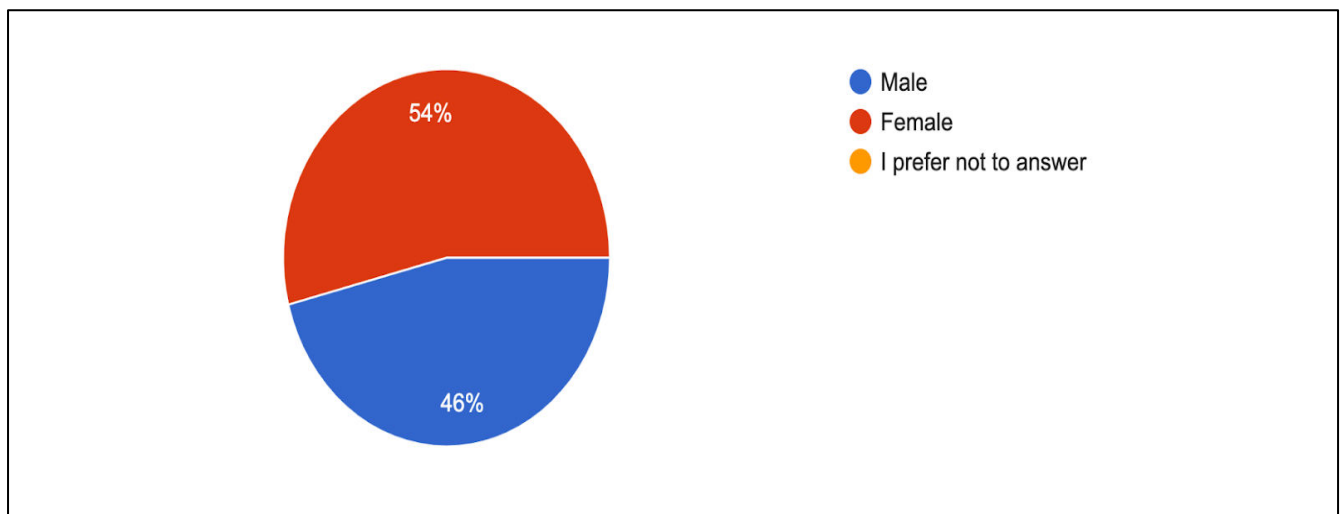


Figure 3.3 indicates that the female and male respondents are almost equal in number. Female respondents are 54 %, whereas the male respondents are only 46 %. Hence there are more female respondents, compared to the male respondents.

4.3 ANALYSIS OF THE DATA ACCORDING TO EACH RESEARCH OBJECTIVE

4.3.1 RESEARCH OBJECTIVE 1

To analyse the impact of waste recycling on job creation. The data collected for the objective is analysed by using correlation. Correlation analysis by using data analysis pack of MS Excel is used to analyse the relationship between waste recycling and its

impact on job creation. All the dimensions of the “*impact on job creation*” construct are used to calculate the correlation value.

Correlation between the following variables is calculated using MS Excel:

- Recycling intensity and direct job creation.
- Recycling intensity and indirect job creation.
- Waste reduction and direct job creation.
- Waste reduction and indirect job creation.
- Reuse and direct job creation.
- Reuse and indirect job creation.
- Informal recycling and direct job creation.
- Informal recycling and indirect job creation.

4.3.1.1 Recycling Intensity - Direct Job Creation

Table 4.1 – Correlation between Recycling intensity and Direct job creation

	<i>Recycling Intensity</i>	<i>Direct Job Creation</i>
Recycling Intensity	1	
Direct Job Creation	0.656941415	1

A correlation of above $\pm .29$ is considered as significant, (Statistics Solutions, 2021) hence there tends to be a significant relationship between recycling intensity and direct job creation.

The Pearson’s correlation value, as per the data analysis, lies between ± 0.50 and ± 1 , which indicates a strong correlation.

However, the statistical significance of the correlation was found using the p-value.

4.3.1.2 Significance Test for Correlation between Recycling Intensity and Direct Job Creation

Table 4.2 - Significance Test for Correlation between Recycling Intensity and Direct Job Creation

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.656							
R Square	0.431							
Adjusted R Square	0.425							
Standard Error	0.656							
Observations	100							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	32.039	32.039	74.405307	1.151			
Residual	98	42.200	0.430					
Total	99	74.24						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1.810	0.289	6.258	1.028	1.236	2.384	1.236	2.384
Recycling Intensity	0.610	0.070	8.625	1.151	0.470	0.750	0.470	0.750

The P – Value is 1.151, which is too high, as compared to the standard of .05 or less. This indicates that a correlation between recycling intensity and direct job creation may be due to chance. Hence, if recycling intensity increases, then direct job creation may not increase.

4.3.1.3 Correlation between Recycling Intensity and Indirect Job Creation

Table 4.3 – Correlation between Recycling Intensity and Direct Job Creation

	<i>Recycling intensity</i>	<i>indirect job creation</i>
Recycling intensity	1	
indirect job creation	0.317714781	1

A correlation of above $\pm .29$ is considered as significant (Statistics Solutions, 2021), hence there tends to be a significant relationship between recycling intensity and indirect job creation.

The Pearson's correlation value, as per the data analysis, does not lie between ± 0.50 and ± 1 , which indicates a weak correlation. However, the statistical significance of the correlation is found using the p-value.

4.3.1.4 Significance Test for Correlation between Recycling Intensity and Indirect Job Creation

Table 4.4 - Significance Test for Correlation between Recycling Intensity and Indirect Job Creation

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.3177147							
R Square	0.1009426							
Adjusted R Square	0.0917686							
Standard Error	0.7309561							
Observations	100							
<i>ANOVA</i>								
	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	5.878	5.878	11.003	0.001			
Residual	98	52.361	0.534					
Total	99	58.24						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	2.937	0.399	7.355	5.845	2.145	3.730	2.145	3.730
Recycling intensity	0.261	0.078	3.317	0.001	0.105	0.417	0.105	0.417

The P – Value is 0.001, which is within the standard of .05 or less. This indicates that the correlation (though weak) between recycling intensity and in-direct job creation is not due to chance. Hence, if recycling intensity increases, then indirect job creation may also increase.

4.3.1.5 Waste Reduction - Direct Job Creation

Table 4.5 – Correlation between Waste Reduction and Direct Job Creation

	<i>Direct Job Creation</i>	<i>Waste Reduction</i>
Direct Job Creation	1	
Waste Reduction	0.656941415	1

A correlation of above $\pm .29$ is considered as significant, (Statistics Solutions, 2021) hence there tends to be a significant relationship between waste reduction and direct job creation.

4.3.1.6 Significance Test for Correlation between Waste Reduction and Direct Job Creation

Table 4.6 - Significance Test for Correlation between Waste Reduction and Direct Job Creation

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.6569414							
R Square	0.4315720							
Adjusted R Square	0.4257717							
Standard Error	0.6562112							
Observations	100							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	32.039906	32.03	74.405307	1.151			
Residual	98	42.200093	0.430					
Total	99	74.24						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.5891112	0.4283064	1.375	0.172	-0.260	1.43	-0.260	1.43
Waste Reduction	0.6105165	0.0707775	8.625	1.151	0.470	0.750	0.470	0.754

The P – Value is 1.151, which is outside the standard of .05 or less. This indicates that the correlation between waste reduction and direct job creation is due to chance. Hence, if waste reduction increases, then direct job creation may not increase.

4.3.1.7 Correlation between Waste Reduction and Indirect Job Creation

Table 4.7 – Correlation between Waste Reduction and Indirect Job Creation

	<i>Indirect Job Creation</i>	<i>Waste Reduction</i>
Indirect Job Creation	1	
Waste Reduction	0.317714781	1

A correlation of above $\pm .29$ is considered as significant, hence there tend to be a significant relationship between waste reduction and indirect job creation.

4.3.1.8 Significance Test for Correlation between Waste Reduction and Indirect Job Creation

Table 4.8 - Significance Test for Correlation between Waste Reduction and Indirect Job Creation

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.317							
R Square	0.100							
Adjusted R Square	0.091							
Standard Error	0.730							
Observations	100							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	5.878901	5.878901	11.0030614	0.001			
Residual	98	52.36109	0.534296					
Total	99	58.24						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	2.414611	0.555132	4.349615	3.343	1.312	3.516253	1.312969	3.516253
Waste Reduction	0.261516	0.078839	3.317086	0.001	0.105	0.417971	0.105062	0.417971

The P – Value is 0.001, which is within the standard of .05 or less. This indicates that the correlation between waste reduction and indirect job creation is not due to chance. Hence, if waste reduction increases, then indirect job creation may also increase.

4.3.1.9 Correlation between Reuse - Direct Job Creation

Table 4.9 – Correlation between Reuse and Direct Job Creation

	<i>Direct Job Creation</i>	<i>Reuse</i>
Direct Job Creation	1	
Reuse	0.766878981	1

A correlation of above $\pm .29$ is considered as significant, (Statistics Solutions, 2021) hence there tends to be a significant relationship between reuse and direct job creation.

4.3.1.10 Significance Test for Correlation between Reuse and Direct Job Creation

Table 4.10 - Significance Test for Correlation between Reuse and Direct Job Creation

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.76687							
R Square	0.58810							
Adjusted R Square	0.583900							
Standard Error	0.55859							
Observations	100							
ANOVA								
	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	43.6607943	43.6607943	139.923773	1.387			
Residual	98	30.5792057	0.31203271					
Total	99	74.24						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1.40651	0.2459654	5.71834466	1.165	0.918404	1.89462529	0.91840461	1.89462529
Reuse	0.69790	0.05899961	11.82893	1.387	0.580819	0.81498553	0.58081992	0.81498553

The P – Value is 1.387, which is outside the standard of .05 or less. This indicates that a correlation between reuse and direct job creation is due to chance. Hence, if reuse increases, then direct job creation may not increase.

4.3.1.11 Correlation between Reuse - Indirect Job Creation

Table 4.11 – Correlation between Reuse and Direct Job Creation

	<i>Indirect Job Creation</i>	<i>Reuse</i>
Indirect Job Creation	1	
Reuse	0.708201733	1

A correlation of above $\pm .29$ is considered as significant, (Statistics Solutions, 2021) hence there tends to be a significant relationship between reuse and indirect job creation.

4.3.1.12 Significance Test for Correlation between Reuse and Indirect Job Creation

Table 4.12 - Significance Test for Correlation between Reuse and Indirect Job Creation

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.7082017							
R Square	0.5015496							
Adjusted R Square	0.4964634							
Standard Error	0.5442627							
Observations	100							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	29.210254	29.210	98.609	1.715			
Residual	98	29.029745	0.296					
Total	99	58.24						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1.738777718	0.2576928	6.747	1.06	1.227	2.250	1.227	2.250
Reuse	0.62844781	0.0632863	9.930	1.715	0.502	0.754	0.502	0.754

The P – Value is 1.715, which is outside the standard of .05 or less. This indicates that a correlation between reuse and indirect job creation is due to chance. Hence, if reuse increases, then indirect job creation may not increase.

4.3.1.13 Correlation between Informal Recycling - Direct Job Creation

Table 4.13 – Correlation between Reuse and Direct Job Creation

	<i>Direct Job Creation</i>	<i>Informal Recycling</i>
Direct Job Creation	1	
Informal Recycling	0.489286182	1

A correlation of above $\pm .29$ is considered as significant, (Statistics Solutions, 2021) hence there tends to be a significant relationship between informal recycling and direct job creation.

4.3.1.14 Significance Test for Correlation between Informal Recycling and Direct Job Creation

Table 4.14 - Significance Test for Correlation between Informal Recycling and Direct Job Creation

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.4892861							
R Square	0.2394009							
Adjusted R Square	0.2316397							
Standard Error	0.7590734							
Observations	100							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	17.77312	17.77312	30.84581221	2.395			
Residual	98	56.466	0.5761					
Total	99	74.24						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	2.6016949	0.3045	8.5415	1.7496	1.9972404	3.2061	1.997	3.206
Informal Recycling	0.413713405	0.074490	5.553900	2.395	0.265889229	0.561537	0.265	0.561

The P – Value is 2.395, which is outside the standard of .05 or less. This indicates that a correlation between informal recycling and direct job creation is due to chance. Hence, if informal recycling increases, then direct job creation may not increase.

4.3.1.15 Correlation between Informal Recycling - Indirect Job Creation

Table 4.15 – Correlation between Informal Recycling and Indirect Job Creation

	<i>Indirect Job Creation</i>	<i>Informal Recycling</i>
Indirect Job Creation	1	
Informal Recycling	0.493819357	1

A correlation of above $\pm .29$ is considered as significant. Hence, there tends to be a significant relationship between informal recycling and indirect job creation.

4.3.1.16 Significance Test for Correlation between Informal Recycling and Indirect Job Creation

Table 4.16 - Significance Test for Correlation between Informal Recycling and Indirect Job Creation

SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.493							
R Square	0.243							
Adjusted R Square	0.23614							
Standard Error	0.6703466							
Observations	100							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	14.202264	14.20226415	31.60520994	1.781			
Residual	98	44.0377	0.44936					
Total	99	58.24						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	2.391	0.33556	7.12674	1.755	1.725584	3.0574339	1.72558496	3.05743391
Informal Recycling	0.457547	0.0813	5.621851	1.780	0.29603676	0.6190575	0.29603676	0.61905758

The P – Value is 1.780, which is outside the standard of .05 or less. This indicates that a correlation between informal recycling and indirect job creation is due to chance. Hence, if informal recycling increases, then indirect job creation may not increase.

4.3.2 RESEARCH OBJECTIVE 2

To explore solid waste recycling strategies. The data collected for the objective is analysed by using descriptive statistics.

4.3.2.1 Source Segregation Increases the Quality of Waste Input

Table 4.17: Source Segregation Increases the Quality of Waste Input

<i>Source segregation increases the quality of waste input</i>	
Mean	4.08
Standard Error	0.077433582
Median	4
Mode	4
Standard Deviation	0.774335818
Sample Variance	0.59959596
Kurtosis	3.447189659
Skewness	-1.205400361
Range	4
Minimum	1
Maximum	5
Sum	408
Count	100

The data analysed above indicates that the distribution is normal as the mean mode and median are almost equal.

A mean of 4.08, indicates that the majority of the respondents are in agreement that source segregation increases the quality of waste input.

A standard deviation of 0.77 indicates a scatter in the units of data collected, which indicates a difference in the responses of the respondents.

4.3.2.2 Optimising Access to Waste Increases the Quality of Waste Input

Table 4.18 - Optimising Access to Waste Increases the Quality of Waste Input

<i>Optimising access to waste increases the quality of waste input</i>	
Mean	4.22
Standard Error	0.067539738
Median	4
Mode	4
Standard Deviation	0.675397376
Sample Variance	0.456161616
Kurtosis	-0.800155819
Skewness	-0.29675895
Range	2
Minimum	3
Maximum	5
Sum	422
Count	100

The data analysed above indicates that the distribution is not normal, it is skewed since the mean mode and median are not equal.

A mean of 4.22 indicates that majority of the respondents are in agreement that optimising access to waste increases the quality of waste input.

A standard deviation of 0.67 indicates a scatter in the units of data collected, which indicates a difference in the responses of the respondents.

4.3.2.3 Access to Finance assists in Increasing the Quality of Waste Input

Table 4.19 - Access to Finance assists in Increasing the Quality of Waste Input

<i>Access to finance assists in increasing the quality of waste input</i>	
Mean	4.02
Standard Error	0.073827536
Median	4
Mode	4
Standard Deviation	0.738275359
Sample Variance	0.545050505
Kurtosis	-1.143417512
Skewness	-0.031720831
Range	2
Minimum	3
Maximum	5
Sum	402
Count	100

The data analysed in Table 4.19 indicates that the distribution is normal, since the mean mode and median are almost equal.

A mean of 4.02 indicates that the majority of the respondents are in agreement that access to finance assists in increasing the quality of waste input.

A standard deviation of 0.73 indicates a scatter in the units of data collected, which indicates a difference in the responses of the respondents.

4.3.2.4 Access to Technical Knowledge helps in Increasing the Quality of Waste Input

Table 4.20 Access to Technical Knowledge helps in Increasing the Quality of Waste Input

<i>Access to technical knowledge helps in increasing the quality of waste input</i>	
Mean	4.22
Standard Error	0.081128406
Median	4
Mode	4
Standard Deviation	0.811284055
Sample Variance	0.658181818
Kurtosis	4.117758831
Skewness	-1.58418704
Range	4
Minimum	1
Maximum	5
Sum	422
Count	100

The data analysed in Table 4.20 indicates that the distribution is skewed, since the mean mode and median are not equal.

A mean of 4.22 indicates that the majority of the respondents are in agreement that access to technical knowledge helps in increasing the quality of waste input.

A standard deviation of 0.81 indicates a scatter in the units of data collected, which indicates a difference in the responses of the respondents.

4.3.2.5 Access to Training Helps Reclaimers in Increasing the Quality of Waste Input

Table 4.21 - Access to Training Helps Reclaimers in Increasing the Quality of Waste Input

<i>Access to training helps reclaimers in increasing the quality of waste input</i>	
Mean	3.96
Standard Error	0.106287204
Median	4
Mode	4
Standard Deviation	1.062872038
Sample Variance	1.12969697
Kurtosis	0.702179517
Skewness	-1.052179633
Range	4
Minimum	1
Maximum	5
Sum	396
Count	100

The data analysed in Table 4.21 indicates that the distribution is normal, since the mean, mode and median are almost equal.

A mean of 3.96 indicates that the majority of the respondents are in agreement that access to training helps reclaimers in increasing the quality of waste input.

A standard deviation of 1.06 indicates a large scatter in the units of data collected, which indicates a high degree of difference in the responses of the respondents.

4.3.2.6 Recognising Reclaimers as part of Reverse Logistics will Create a Sustainable Pool of Reclaimers

Table 4.22 - Recognising Reclaimers as part of Reverse Logistics will Create a Sustainable Pool of Reclaimers

<i>Recognising reclaimers as part of reverse logistics will create a sustainable pool of reclaimers</i>	
Mean	4.14
Standard Error	0.092135
Median	4
Mode	5
Standard Deviation	0.921351
Sample Variance	0.848888
Kurtosis	1.222316
Skewness	-1.07497
Range	4
Minimum	1
Maximum	5
Sum	414
Count	100

The data analysed in Table 4.22 indicates that the distribution is skewed, since the mean mode and median are not equal.

A mean of 4.14 indicates that the majority of the respondents are in agreement that recognising reclaimers as part of reverse logistics would create a sustainable pool of reclaimers.

A standard deviation of 0.92 indicates a large scatter in the units of data collected, which indicates a high degree of difference in the responses of the respondents.

4.3.2.7 Reverse Logistics Helps in Increasing the Revenues of the Organisation

Table 4.23 - Reverse Logistics Helps in Increasing the Revenues of the Organisation

<i>Reverse logistics helps in increasing the revenues of the organisation</i>	
Mean	4.06
Standard Error	0.08387099
Median	4
Mode	4
Standard Deviation	0.83870993
Sample Variance	0.70343434
Kurtosis	-0.4073806
Skewness	-0.5338402
Range	3
Minimum	2
Maximum	5
Sum	406
Count	100

The data analysed in Table 4.23 indicates that the distribution is normal, since the mean, mode and median are almost equal.

A mean of 4.06 indicates that the majority of the respondents are in agreement that reverse logistics helps in increasing the revenues of the organisation.

A standard deviation of .83 indicates a scatter in the units of data collected, which indicates a difference in the responses of the respondents.

4.3.2.8 Circular Supply Chain where Waste is used as a Raw Material Helps in Increasing the Revenues of the Organisation

Table 4.24 - Circular Supply Chain where Waste is used as a Raw Material helps in Increasing the Revenues of the Organisation

<i>Circular supply chain where waste is used as a raw material helps in increasing the revenues of the organisation</i>	
Mean	4.12
Standard Error	0.0794933
Median	4
Mode	4
Standard Deviation	0.7949334
Sample Variance	0.6319191
Kurtosis	-0.5810657
Skewness	-0.4656559
Range	3
Minimum	2
Maximum	5
Sum	412
Count	100

The data analysed in Table 4.24 indicates that the distribution is skewed, since the mean mode and median are not equal.

A mean of 4.12, indicates that the majority of the respondents are in agreement that a circular supply chain where waste is used as a raw material helps in increasing the revenues of the organisation.

A standard deviation of 0.79 indicates a scatter in the units of data collected, which indicates a difference in the responses of the respondents.

4.3.2.9 Circular Supply Chain is the most exciting Sustainable Solid Waste Recycling Strategy

Table 4.25 - Circular Supply Chain is the most exciting Sustainable Solid Waste Recycling Strategy

<i>Circular supply chain is the most exciting sustainable solid waste recycling strategy</i>	
Mean	4
Standard Error	0.087617165
Median	4
Mode	4
Standard Deviation	0.876171654
Sample Variance	0.767676768
Kurtosis	1.350362186
Skewness	-0.91943786
Range	4
Minimum	1
Maximum	5
Sum	400
Count	100

The data analysed in Table 4.25 indicates that the distribution is normal, since the mean, mode and median are equal.

A mean of 4 indicates that the majority of the respondents are in agreement that a circular supply chain is the most exciting sustainable solid waste recycling strategy

A standard deviation of .87 indicates a scatter in the units of data collected, which indicates a difference in the responses of the respondents.

4.3.2.10 Circular Supply Chain will Boost the Economic Growth of Countries like South Africa

Table 4.26 - Circular Supply Chain will Boost The Economic Growth of Countries like South Africa

<i>Circular supply chain will boost the economic growth of countries like South Africa</i>	
Mean	4.18
Standard Error	0.086899454
Median	4
Mode	4
Standard Deviation	0.868994543
Sample Variance	0.755151515
Kurtosis	2.385189171
Skewness	-1.30293521
Range	4
Minimum	1
Maximum	5
Sum	418
Count	100

The data analysed in Table 4.26 indicates that the distribution is skewed, since the mean mode and median are not equal.

A mean of 4.18 indicates that the majority of the respondents are in agreement that a circular supply chain will boost the economic growth of countries like South Africa.

A standard deviation of 0.86 indicates a scatter in the units of data collected, which indicates a difference in the responses of the respondents.

4.4 RELIABILITY OF THE DATA

The reliability and internal consistency of the measuring scale were tested, using Cronbach's Alpha Reliability score.

The Cronbach's Alpha results are presented below in the Table 4.27.

TABLE 4.27 – Cronbach's Alpha Score

Measure/Statement	Cronbach's Alpha Score	Internal Consistency
Impact of waste recycling on job creation	0.92	Very good
Solid waste recycling strategies	0.90	Very good

Impact of Waste Recycling On Job Creation

Cronbach's Alpha	0.92781157
Split-Half (odd-even) Correlation	0.78148529
Split-Half with Spearman-Brown Adjustment	0.87734128
Mean for Test	40.88
Standard Deviation for Test	6.84292335
KR21 (use only 0 and 1 to enter data for this)	4.10656279
KR20 (use only 0 and 1 to enter data for this)	4.10935708

Solid Waste Recycling Strategies

Cronbach's Alpha	0.9057076
Split-Half (odd-even) Correlation	0.7597813
Split-Half with Spearman-Brown Adjustment	0.86349514
Mean for Test	41
Standard Deviation for Test	6.164414
KR21 (use only 0 and 1 to enter data for this)	4.82748538
KR20 (use only 0 and 1 to enter data for this)	4.82968421

A general accepted rule is that an alpha of 0.6-0.7 indicates an acceptable level of reliability, and an alpha of 0.8 or greater indicates a very good level of reliability (Hulin et al., 2001). Hence, it can be reasonably argued that the data collected is reliable.

4.5 CONCLUSION

The chapter presented the data collected by using pie charts and bar graphs. The data collected was analysed with descriptive statistics and correlation analysis. The first research objective regarding the impact of waste recycling on job creation was analysed and revealed that waste recycling has a strong correlation with job creation. However, the job creation may be due to chance, as analysed by calculating the p-value through regression analysis.

Only two correlations - *Recycling Intensity- Indirect Job Creation* and *Waste Reduction – Indirect Job Creation*, were found to be statistically significant. This suggests that a correlation between other variables may be strong, but that this correlation may be due to chance.

The second research objective with regards to waste recycling strategies was analysed using descriptive statistics. The respondents agreed to all the 10 statements indicating that these strategies may be very useful in recycling. The mean for all the statements was above average, indicating a high degree of agreement for the suggested strategies.

Finally, the reliability of data collected for - *Impact of Waste Recycling On Job Creation*; and *Solid Waste Recycling Strategies* was calculated using Cronbach's alpha score. Both the scores were above .90, indicating the data to be reliable.

The next chapter is on the discussion of results indicated in this chapter. The research objectives, findings from the literature review and research findings are triangulated to assess how are these inter-related to each other, and to assess the consistency or inconsistency, between findings from literature review and research findings.

CHAPTER 5: DISCUSSION OF RESULTS

5.1 INTRODUCTION

The research questions/ objectives are restated in this chapter for the purpose of data triangulation. The research questions/ objectives, findings from the review of literature, and findings from the analysis of primary data are triangulated. The data is triangulated to ensure that the research objectives are met, and there is some degree of consistency or inconsistency between what other researchers found on similar research problems and research objectives.

The triangulation is followed by a discussion of the findings' consistency. If the study's findings are not found to be consistent with the findings of the reviewed literature, a justification is provided. However, the study's findings must be consistent with the research questions/ objectives and provide answers to these research questions/ objectives. A conclusion is provided at the end of the chapter.

5.2 TRIANGULATION

5.2.1 Research Objective 1

To analyse the Impact of Waste Recycling On Job Creation

5.2.1.1 Summary of Literature

Godfrey (2021), conducted a study to quantify the economic activity in the informal recycling sector in South Africa. The analysis from data of tonnages and price data shows that the mean estimate of money paid by the private sector to the informal waste sector through the purchase of recyclables at intermediaries, such as buy-back centres, was ZAR625 million in 2012, increasing to ZAR872 million in 2017. This private sector '*investment*' in the local recycling economy has led to direct and indirect

job creation and improved livelihoods, particularly for a large, well-established, and effective informal waste sector, and has indirectly funded municipal waste diversion strategies, saving municipalities in both the collection and disposal of waste (Godfrey, 2021).

In another research by Majeed, et al., (2016) it was found that the recovery activity is profitable for key stakeholders involved and generates a revenue of approximately 6.05 billion Rupees or 6 million USD/ year. The study further suggested that the informal waste management sector is proficiently involved in waste recovery activities and its integration with formal sector can work optimally at both ends (Majeed, 2016). Viljoen et al., (2019) also investigated the entrepreneurial opportunities and value-adding activities of buy-back centres in the recycling industry by collecting information from 67 buy-back centres across South Africa. It was concluded from this study that recycling model that increases the volumes of recyclables recovered by buy-back centres through informal sector activities is required.

Hence, it can be reasonably argued that the literature reviewed does not provide conclusive information and data on the impact of waste recycling on job creation.

5.2.1.2 Summary of Research Findings

According to the analysis of the data collected from respondents, there is a strong correlation between different constructs of waste recycling and job creation. There is a strong correlation between - *Recycling intensity and direct job creation; Recycling intensity and indirect job creation; Waste reduction and direct job creation; Waste reduction and indirect job creation; Reuse and direct job creation; Reuse and indirect job creation; Informal recycling and direct job creation; and Informal recycling and indirect job creation.*

However, the significance of this correlation was found only for recycling intensity and indirect job-creation, waste reduction and indirect job creation. Hence, the strong correlation between other constructs may be due to chance.

5.2.1.3 Discussion

The findings of the study are consistent with the findings of the literature reviewed - in the sense that the literature indicated private sector *'investment'* in the local recycling economy has led to direct and indirect job creation and improved livelihoods, particularly for a large, well-established, and effective informal waste sector.

Similarly, the findings of the study also found a strong correlation between waste recycling and direct/ indirect job creation - though only two correlations are found to be statistically significant. However, a strong correlation suggests a strong impact of waste recycling on job-creation - both direct and indirect job creation.

5.2.2 Research Objective 2

This research objective is to explore solid waste recycling strategies.

5.2.2.1 Summary of Literature

In a research study, it was suggested that for effective waste management across the supply chain, firms within the chain can take either a proactive (associated with Reduce), or a reactive (associated with Reuse and/or Recycle) approach. Individual firms can benefit from the reactive approach, which focuses on extending product life. This could be, for example, through offering both new and remanufactured products in the market and profiting from recycling efforts.

More supply chain firms are discovering reverse supply chains to be a profitable proposition - in terms of reuse and/or recycling. Firms are seizing the opportunity to introduce remanufactured products into the market alongside new products, attempting to reuse and recycle components salvaged from the products. (Mahajan & Vakharia, 2016).

In other research studies on circular economy as a strategy, it is argued that the Circular Economy (CE) is gaining traction among academics, businesses, and

policymakers as a promising strategy for promoting both sustainability and competitiveness (Murray et al., 2017). China, Japan, the United States, and the European Union, amongst others, have issued policies encouraging the use of CE (Winans et al., 2017).

It is also argued that the entire field of reverse supply chain research is motivated by the observation that it is possible to reduce landfill waste, by reusing, remanufacturing, and recycling used products/components (Blackburn et al., 2004).

Hence, it is evident that there are diverse strategies suggested for solid waste recycling. However, these strategies have been suggested in different contexts and needs to be channelized, so that a focused set of strategies may be suggested.

5.2.2.2 Summary of research findings

The data collected from respondents, and analysed using descriptive statistics, suggests a comprehensive set of activities that can be suggested as waste recycling strategies.

It includes:

- Source segregation,
- Optimising access to waste,
- Access to finance,
- Access to technical knowledge,
- Access to training for reclaimers,
- Recognising reclaimers as part of reverse logistics,
- Reverse logistics,
- Circular supply chain where waste is used as a raw material,
- Circular supply chain.

These are the most exciting sustainable solid waste recycling strategies, which can boost the economic growth of countries like South Africa

5.2.2.3 Discussion

The findings of the study are consistent with the findings of the literature reviewed, in the sense that the literature indicated strategies - including remanufactured products to be introduced into the market alongside new products, attempting to reuse and recycle components. This is consistent with the strategies suggested, using the responses from the respondents, which includes a circular supply chain where waste is used as a raw material.

Similarly, strategies of reverse supply chain and circular economy are suggested by literature review and by the analysis of the primary data collected. Hence, the findings of the study are totally consistent with the findings of the literature review.

5.3 CONCLUSION

The research objectives, findings from the literature review, and findings from the research study were triangulated in the chapter. The majority of the research study findings are consistent with the literature findings. However, while conducting the research, additional findings were discovered.

The research and literature findings are consistent in terms of direct and indirect job creation in the informal sector, as well as strategies of circular economy and reverse supply chain.

The findings of the study very clearly meet the research objectives and are able to provide clear answers to all the three research objectives of the study.

CHAPTER 6: SUMMARY AND RECOMMENDATIONS

6.1 INTRODUCTION

The identified research objectives for this research study were investigated by using a survey based on a Likert scale questionnaire. The questionnaire was developed by the researcher, pilot tested, and the suggestions from subject matter experts were incorporated to ensure the validity of the questionnaire. It was administered using Google forms.

The research population for this study includes recycling players in the Gauteng province - including employees working in the Department of Forestry, Fisheries, and the Environment, Gauteng Department of Agriculture and Rural Development (GDARD), City of Johannesburg Metropolitan Municipality, City of Tshwane Metropolitan Municipality, and private sector companies (service providers, buyers, sellers and processors, waste reclaimers). A sample size of 100 was used to collect the data. The data collected was analysed using descriptive statistics, correlation, and a regression analysis.

Based on the findings from the research study, the researcher wishes to suggest and recommend waste recycling strategies. The recommendations are also made regarding future research, since the sample size was limited and there is a lot of scope of future research before deciding the implementation of waste recycling strategy in the country. The chapter ends with a conclusion.

6.2 SUMMARY OF THE FINDINGS

The findings of the study, based on the analysis of the data collected from 100 respondents are presented below:

The first research objective regarding the impact of waste recycling on job creation

was analysed using correlation and regression analysis. It revealed a strong correlation between waste recycling and direct/ indirect job creation. However, only the correlation between recycling intensity and indirect job creation, and waste reduction and indirect job creation were found to be statistically significant. This suggests that a correlation between other variables may be strong, but that correlation may be due to chance.

The second research objective with regards to solid waste recycling strategies suggested 10 diverse strategies related to various constructs of waste recycling. These strategies are discussed in detail in Chapter Five.

6.3 RECOMMENDATIONS

The intensity of waste recycling by different industries needs to be increased exponentially, which will have a positive impact on indirect job-creation in South Africa. New industries, SMEs, and waste reclaimers can largely benefit from such a surge in the intensity of waste recycling. Further waste recycling would mean an increase in business opportunities, and more recognition for waste reclaimers.

The waste reduction by industries needs to be promoted, and the government needs to make policies to encourage waste reduction by industries. These policies should be aimed at encouraging waste reduction - rather than a punitive action. This will lead to a business environment where industry and government can partner together, to reduce waste, which will indirectly lead to job creation. The waste generated may be reused as a raw material for other products.

Hence, a circular economy would be promoted, wherein the waste of one industry may be used as a raw material for another industry.

A provision of training for waste recycling, easy access to finance for waste recycling and the technical know-how of waste recycling needs to be promoted. This initiative needs to be driven by government taking the industry into confidence. These initiatives would assist SMEs and other industries to consider waste recycling seriously.

A further recommendation by the researcher is about the scope of future research. The sample size was limited due to limitations of the study. However, a more comprehensive study including a larger sample size and research population - including respondents from various industries and geographical areas, is recommended. This would assist in generalising the findings of the study, and developing strategies that have a wide scope of implementation for the country, as whole.

6.4 MY CONTRIBUTIONS TO KNOWLEDGE

The literature review suggested various strategies of waste recycling and the impact of waste recycling on job creation in different contexts. The literature is spread in different contexts and needs to be structured to suit the needs of the business environment of South Africa and its specific requirements.

The research study, though limited to a small sample size, suggests specific strategies and a significant correlation between waste recycling and indirect job creation in the South African context. This is a new contribution to knowledge and opens a wide scope of future research in a similar area with a more comprehensive research population.

The recommendations are specific and based on findings of the study. These recommendations are South Africa-specific and based on current data collected in the year 2022. There was no literature available suggesting strategies for waste recycling, specific to South Africa.

An attempt has been made in this research for a South Africa specific study on waste recycling.

6.5 CONCLUSION

The study's three research objectives were used to discuss the study's findings. The findings suggested a correlation between waste recycling and indirect job creation, and a strong correlation between waste reduction and indirect job creation. Similarly,

the ten diverse strategies found through data analysis are used as a source to suggest and recommend strategies for waste recycling.

Recommendations are made based on the findings related to Research Objective One and Two. It is discussed how waste recycling and waste reduction should be promoted in the country. In addition, it is also recommended that a provision of training for waste recycling, easy access to finance for waste recycling and the technical know-how of waste recycling needs to be promoted. The scope of future research is also recommended.

The research problem stated waste recycling and employment creation are pressing challenges for the South African economy. The findings and the recommendations suggest strategies for waste recycling, which can act as a catalyst of indirect job-creation. Hence, the research problem is addressed by the research study.

Finally, the study's contribution to knowledge is also discussed to end the chapter.

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APPENDIX A – QUESTIONNAIRE

SECTION 1: Respondent Profile

This section includes some general and biographical questions. Please indicate your answer by marking (X) where appropriate.

1. Please indicate your age range

1	18-25	
2	26-35	
3	36-45	
4	46-55	
5	Over 55	

2. In which of these areas/department do you work?

1	Department of Forestry, Fisheries & Environment	
2	Gauteng Department of Agriculture and Rural Development (GDARD)	
3	City of Johannesburg Metropolitan Municipality	
4	City of Tshwane Metropolitan Municipality	
5	Private Sector Companies (Service providers, buyers, sellers and processors, Waste reclaimers).	

3. Gender (please mark X on the corresponding line)

1	Male	
2	Female	
3	I prefer not to answer	

SECTION 2 - the impact of waste recycling on job creation

Please note –

- Direct job creation here refers to employment in an organisation.
- Indirect job creation here refers to waste reclaimers and other people who are not employed in an organization but still make money by being part of waste recycling process.

- Please indicate your answer by marking (X) where appropriate.

		Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
1	Recycling intensity is positively related to direct job creation					
2	Recycling intensity is positively related to indirect job creation					
3	Waste reduction is positively related to direct job creation					
4	Waste reduction is positively related to indirect job creation					
5	Reuse is positively related to direct job creation					
6	Reuse is positively related to indirect job creation					
7	Recycling is positively related to direct job creation					
8	Recycling is positively related to indirect job creation					
9	Informal Recycling is positively related to direct job creation					

10	Informal Recycling is positively related to indirect job creation					
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SECTION 3 - Solid waste recycling strategies

- Please indicate your answer by marking (X) where appropriate.
- *Please note that Reverse logistics is a type of supply chain management that moves goods from customers back to the sellers or manufacturers. Once a customer receives a product, processes such as returns or recycling require reverse logistics.

		Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
1	Source segregation increases the quality of waste input					
2	Optimising access to waste increases the quality of waste input					
3	Access to finance assists in increasing the quality of waste input					
4	Access to technical knowledge helps in increasing the quality of waste input					
5	Reverse logistics * helps in increasing the revenues of the organisation					
6	Circular supply chain where waste is used as a raw					

	material helps in increasing the revenues of the organisation					
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