

RECYCLING SOLID WASTE:

A STUDY ON AN EMERGING RAW MATERIAL INDUSTRY IN NAMIBIA

A DISSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY (GEOGRAPHY)

OF

THE UNIVERSITY OF NAMIBIA

BY

TANDIWE P. MUTEDE

201202222

APRIL 2019

SUPERVISOR: Prof. Dr. F.O. Becker

ABSTRACT

The aim of the study was to assess solid waste recycling as an emerging source of raw material in Namibia. Recycling solid waste has become part of society. In striving to meet the high demand for raw materials and finding solutions to waste management challenges, countries worldwide are turning to recycling of solid waste. In developing countries, recycling is an emerging industry. While there have been numerous studies on recycling processes, very few studies have focused on recycling as an emerging source of raw material industry and little or no research has been conducted on recycling as an emerging source of raw material in Namibia. This study aimed to investigate this emerging industry in Namibia.

This study was a descriptive case study, qualitative in nature employing interviews, document search and observation to collect data to achieve various objectives namely: to investigate the motives and extent of involvement of companies in solid waste recycling in Namibia, examine legislation and policies, guiding waste recovery and recycling in Namibia, establish emerging waste recycling growth trends, assess industry value addition processes and associated benefit chains and examine local and regional operational network linkages in the industry. The study investigated all these issues applying existing waste management concepts and attempted to establish progress of recycling as an emerging raw material industry in Namibia.

The units of analysis comprised fifteen recycling companies in Namibia. Purposive and accidental sampling methods were used to select the companies. The data was analysed manually using content analysis and presented in descriptive narrative with some illustrative tables and figures.

The study showed that recycling industry in Namibia is still in its infancy with most of the activities still concentrated in the recovery, collection and semi processing stage of the recycling loop. Little production of raw materials and products is done locally. Only plastic material formed a complete recycling loop in Namibia. Final processing and subsequent production of new goods for the rest of the materials recycled; paper, glass bottles, cans, scrap metal and electronic waste is done outside the country a situation which may disadvantage the country in terms of industrial and economic growth. Economic and environmental factors were the main forces driving the industry. There was a shift from informal to formal sector dominance in the industry. A host of challenges still hinder the potential success of the industry. There is need to improve on the legal and regulatory environment which controls and governs the industry. Despite these challenges, the industry is a welcome development in the country, as it has become a source of employment as well as a waste reduction measure. Networking within the industry both local and regional facilitates its survival.

The study recommends for an integrated recycling model for Namibia which could assist solid waste management. Such a model could promote a culture of recycling, review of legal and regulatory framework, building technical capacity through the establishment of a Recycling Fund and development of program of action including an establishment of a national database of recyclable waste.

DECLARATIONS

I, Tandiwe P. Mutede, hereby declare that this is a true reflection of my own research and that this work or part thereof has not been submitted for a degree in any other institution of higher learning. No part of this dissertation may be reproduced, stored in any retrieval system, or transmitted in any form, or by any means without the prior permission of the author, or the University of Namibia. I, Tandiwe P. Mutede, grant the University of Namibia the right to reproduce this dissertation in whole or in part, in any manner or format, which the University of Namibia may deem fit, for any person or institution requiring it for study and research; providing that the University of Namibia shall waive this right if the whole dissertation has been or is being published in a manner satisfactory to the University.

..... Date:

Tandiwe P. Mutede

DEDICATION

To my beloved family

ACKNOWLEDGEMENTS

This study would not have been possible without the support and guidance of a number of people and institutions:

- My supervisor Prof. F. O. Becker for your advice, guidance and tireless encouragement;
- Prof. C.T. Nengomasha in the Department of Information and Communication Studies, for your advice, guidance and tireless encouragement.
- The many institutions and companies, involved in recycling, for granting me permission to carry out the research including the individual respondents.
- I give special thanks to my family, especially my dear husband Hillary who against all odds supported me all the way through in many forms and my two loving sons for the moral support and help with house chores during the busy times.
- Above all, I give thanks to my Lord God Almighty, for the strength.

TABLE OF CONTENTS

ABSTRACT.....	i
DECLARATIONS.....	iii
DEDICATION.....	iv
TABLE OF CONTENTS.....	vi
LIST OF TABLES.....	xv
LIST OF FIGURES.....	xvii
LIST OF ABBREVIATIONS AND ACRONYMS.....	xviii
CHAPTER 1.....	1
INTRODUCTION.....	1
1.1. Orientation of the Study.....	1
1.2. Statement of the Problem.....	4
1.3. Objectives of the Study.....	5
1.4. Significance of the Study.....	5
1.5. Limitations of the Study.....	6
1.6. Motivation of Study.....	8
1.7. Study Area.....	9
1.8. Structure of the Report.....	10
CHAPTER 2.....	12
CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW.....	12
2.1. Introduction.....	12
2.2. Conceptual Framework.....	12
2.2.1. Recycling industry: an overview.....	13
2.2.2. Recycling and Sustainability.....	13
2.2.3. Recycling and Waste Management.....	14
2.2.4. Motives for Recycling.....	15
2.2.4.1 Economic reasons.....	16

2.2.4.2	Altruistic reasons	17
2.2.4.3	Legal reasons	17
2.2.4.4	Social reasons.....	19
2.2.5.	Product Life Cycle Model (cradle-grave)	20
2.2.5.1	Avoided burden method of recycling	20
2.2.5.2	Avoided burden end of life recycling model	20
2.2.5.3	Cut-off method.....	21
2.2.5.4	Economic allocation model.....	21
2.2.6.	Nature of Solid Waste Recycling.....	21
2.2.7.	Recycling Chain Process.....	22
2.2.7.1	Solid waste recycling value addition chain.....	24
2.2.7.2	Recycling collection facilities.....	25
2.2.7.3	Material recovery facilities	26
2.2.7.4	Processing facilities	27
2.2.7.5	Manufacturing and selling facilities.....	27
2.2.8.	Benefit chains associated with value addition processes.....	28
2.2.9.	Recycling Network Linkages.....	28
2.3.	Literature Review.....	29
2.3.1.	Actors and trends in the industry	30
2.3.2.	Motives for Recycling.....	35
2.3.3.	Policies and Legislation	36
2.3.4.	Benefits of Recycling.....	38
2.3.5.	Recycling value addition processes	41
2.3.6.	Challenges of Recycling	43
2.4.	Review of Studies in Namibia	44
2.5.	Concluding remarks	48
CHAPTER 3	49

RESEARCH METHODOLOGY.....	49
3.1. Introduction.....	49
3.2. Research Paradigms	49
3.3. The Ontological Orientation of the Research	50
3.4. Epistemology Orientation of the Research	51
3.5. Methodological Assumptions	51
3.6. Research Design.....	52
3.6.1. Case Study	52
3.6.2. Qualitative Research	53
3.7. Research Population.....	53
3.8. Sampling	54
3.9. Data collection techniques	54
3.9.1. Interviews.....	55
3.9.2. Interview guides.....	56
3.9.3. Direct observation.....	57
3.9.4. Observation checklist.....	58
3.9.5. Document search.....	58
3.9.6. Pilot Study.....	59
3.10. Data Collection Procedure	60
3.10.1. Seeking permission from the institutions and individuals	60
3.10.2. The interview process	61
3.10.3. Research ethics (Appendix A)	62
3.11. Data Analysis	62
3.12. Data Presentation	63
3.13. Validity and Reliability.....	64
3.14. Chapter Summary	65
CHAPTER 4	66

PRESENTATION AND INTERPRETATION OF RESULTS.....	66
4.1. Introduction.....	66
4.2. Motives and extent of involvement in solid waste recycling.....	66
4.2.1. Industry players and their roles.....	67
4.2.1.1 Role of players in recycling industry	67
4.2.1.2 Demography of companies	69
4.2.1.3 Distribution of companies and contributory factors	70
4.2.2. Challenges in the industry.....	70
4.2.3. Motives for Recycling.....	72
4.2.4. Extent of Involvement in Recycling Industry	73
4.2.4.1 Extent of involvement regarding processes	74
4.2.4.2 Extent of involvement with regards to type of product materials.....	82
4.2.4.3 Extent of involvement in collection modes and other activities	88
4.3. Policies and legislation guiding waste recycling	94
4.3.1. Policies and guidelines guiding waste recycling	95
4.3.1.1 Government Waste Management Policy	95
4.3.1.2 Public Private Partnership Policy.....	96
4.3.1.3 City of Windhoek Waste Management Policy.....	97
4.3.1.4 Formal–Informal Partnership Policy (Integration Policy)	97
4.3.2. Legislation regulating recycling	97
4.3.2.1 Regulatory Environment.....	98
4.3.2.2 Legislation controlling company operations.....	99
4.3.2.3 Environmental Management Protection Act, 7 of 2007	100
4.3.2.4 The Local Authority Act, 23 of 1992.....	101
4.3.2.5 Solid Waste Management Regulations No. 16 of 2011	102
4.3.2.6 Labour Act, Number 11, of 2007	102
4.3.2.7 Water Resources Management Act, No. 11, of 2013	103

4.3.2.8	Standard Act. No. 18, of 2005	103
4.3.2.9	Affirmative Action (Employment) Act, No. 29, of 1998	104
4.3.2.10	Public and Environmental Health Act No. 1, of 2015	105
4.3.3.	Summary	105
4.4.	Emerging waste recycling growth trends.....	106
4.4.1.	Emerging waste recycling trends	106
4.4.2	Areal Expansion (recycling outside major centres)	107
4.4.3	Growth in the number of companies in the industry.....	107
4.4.4	Trends in prices of products.....	107
4.4.5	Growth in volume of recycled waste	108
4.4.6	Employment trends	112
4.4.7	Growth of total recycling in Namibia	112
4.5.	Value Addition Processes and Benefit Chains.....	113
4.5.1.	Value Addition Processes	113
4.5.1.1	Total recycling in Namibia- value addition processes for plastic.....	114
4.5.1.2	Value Addition for Paper	120
4.5.1.3	Value addition for glass bottles.....	122
4.5.1.4	Value addition for cans	124
4.5.1.5	Value addition for scrap metals	124
4.5.1.6	Value addition for E-Waste	126
4.5.2.	Benefit chains associated with recycling processes.....	127
4.6.	Network Linkages in the Industry.....	129
4.6.1.	Forms of linkages.....	129
4.6.2.	Local Company Linkages	130
4.6.3.	External Linkages	132
4.6.4.	Regional and Local Linkage Nodes.....	133
4.7.	Summary	133

CHAPTER 5	135
DISCUSSION OF RESEARCH FINDINGS	135
5.1. Introduction.....	135
5.2. Motives and extent of involvement in solid waste recycling.....	135
5.2.1. Industry players and their roles.....	135
5.2.2. Challenges in the industry.....	138
5.2.3. Motives for recycling.....	141
5.2.4. Extent of Involvement in Recycling Industry	148
5.3. Policies and legislation guiding recycling in Namibia	150
5.3.1. Policies and guidelines guiding recycling.....	150
5.3.2. Legislation governing the recycling industry in Namibia.....	151
5.4. Emerging waste recycling trends	153
5.4.1.1. Private sector participation	154
5.4.1.2. Recovery of recyclables	155
5.4.1.3 Growth of the industry	159
5.4.1.4 Promotion of Recycling	162
5.4.1.5 Summary	162
5.5. Value addition processes and associated benefit chains	163
5.5.1. Value addition processes in Namibia.....	164
5.5.2. Benefit chains associated with recycling in Namibia	165
5.5.2.1. Economic Benefits	166
5.5.2.2. Environmental benefits	169
5.5.2.3. Social Benefits	172
5.5.3. Summary	173
5.6. Operational network linkages in recycling	173
5.6.1. Local recyclable material linkages.....	174
5.6.2. Total plastic recycling linkages	174

5.6.3.	Non-metal material linkages	176
5.6.4.	Metallic material linkages	176
5.6.5.	E-waste material linkages	177
5.6.6.	Local non-material linkages.....	177
5.6.7.	Regional and international linkages.....	179
5.6.8.	Summary on linkages.....	179
5.7.	Chapter Summary	180
CHAPTER 6		182
PROPOSED RECYCLING MODEL		182
6.1.	Introduction.....	182
6.2.	Integrated Recycling Model for Namibia	184
6.2.1.	Strengthening legal and regulatory framework.....	185
6.2.1.1	Recycling legislation.....	186
6.2.1.2	Recycling policies	187
6.2.2.	Promote culture of recycling.....	187
6.2.3.	Resource requirements	189
6.2.3.1	Labour	189
6.2.3.2	Land Availability	189
6.2.3.3	Infrastructure	190
6.2.3.4	Transport.....	190
6.2.4.	Promote Programme of Action	191
6.2.5.	Recycling Fund	191
6.2.6.	Records Management.....	192
6.3.	Summary	192
CHAPTER 7		194
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....		194
7.1.	Introduction.....	194

7.2.	Summary	194
7.2.1.	Motives of companies in solid waste recycling in Namibia	194
7.2.2.	Extent of involvement of companies in solid waste recycling	195
7.2.3.	Policies guiding waste recovery and recycling	196
7.2.4.	Legislation guiding waste recovery and recycling.....	196
7.2.5.	Emerging waste recycling trends	197
7.2.6.	Recycling value addition processes and products.....	198
7.2.7.	Benefit chains of recycling industry in Namibia	198
7.2.8.	Establishment of operational network linkages in the industry.....	199
7.3.	Conclusion	200
7.3.1.	Motives of companies in solid waste recycling in Namibia	200
7.3.2.	Extent of involvement of companies in solid waste recycling	200
7.4.	Regulatory Framework	201
7.4.1.	Policies guiding waste recovery and recycling.....	201
7.4.2.	Legislation guiding waste recovery and recycling.....	201
7.5.	Emerging waste recycling trends	201
7.6.	Recycling value addition processes and benefit chains	202
7.7.	Benefits of the recycling industry in Namibia	203
7.8.	Establishment of operational network linkages in the industry.....	203
7.9.	Recommendations.....	203
7.10.	Contributions of the study.....	204
7.11.	Areas for further research	205
	List of References	207
	APPENDICES	243
	APPENDIX A: Application for Ethical Clearance Certificate	243
	APPENDIX B: permission letter from the Windhoek City Council	245
	APPENDIX C: UNAM research permission letter.....	246

APPENDIX D: UNAM Ethical Clearance Certificate	247
APPENDIX E: Letter seeking permission to carry out research	248
APPENDIX F: Request to research in the Ministry of Environment and Tourism...	250
APPENDIX G: Request to carry out recycling solid waste research	252
APPENDIX H: Consent letter	254
APPENDIX I: Interview Guide for Companies.....	256
APPENDIX J: Observation Schedule	261

LIST OF TABLES

Table 2.1: Policy instruments under the EPR umbrella	19
Table 4.1: The role of different players in the recycling industry	68
Table 4.2: Demography of participating companies.....	69
Table 4.3: Challenges in recycling industry in Namibia.....	71
Table 4.4: Motives for recycling by companies.....	73
Table 4.5: Extent of involvement with regards to the recycling process.....	75
Table 4.6: Product material handling per Company	83
Table 4.7: Spectrum of recyclables materials in further categories.....	86
Table 4.8: Plastics recycling codes and symbols	87
Table 4.9: Sources of raw materials by company	88
Table 4.10: Collection Modes.....	89
Table 4.11: Modes of collection by company.....	90
Table 4.12: Legislation guiding recycling	100
Table 4.13: Recovery and collection trends in recycling.....	106
Table 4.14: Scrap Metal prices over the years	108
Table 4.15: Percentage of waste recycled in Windhoek	109
Table 4.16: Company E production figures	111
Table 4.17: Company K production figures	111
Table 4.18: Companies contributing to total recycling in Namibia.....	112
Table 4.19: Value addition by Company for Plastics in Namibia	115
Table 4.20: Value addition by Company for Paper in Namibia	121
Table 4.21: Value addition by Company for glass in Namibia.....	123
Table 4.22: Value addition by company for cans in Namibia	124
Table 4.23: Value addition by scrap metal companies in Namibia	125

Table 4.24: Value addition by Company for E-Waste in Namibia.....	126
Table 4.25: Benefits of Recycling	128
Table 4.26: Forms of linkages	130
Table 4.27: Local backward and forward linkages of companies	131
Table 4.28: Forward regional and international linkages	132

LIST OF FIGURES

Figure 1.1: Map of Namibia showing major towns and neighbouring countries	10
Figure 2.1: Waste Management Hierarchy	15
Figure 2.2: Recycling Network Players	22
Figure 2.3: Recycling Loop	23
Figure 2.4: A standardized model for the sustainable value chain	23
Figure 4.1: Communication lines of the players in the industry	67
Figure 4.2 Domestic waste generation and recycling in Windhoek.....	96
Figure 4.3 Trends of recyclables collected at MRF.....	97
Figure 4.4 Processes observed in Namibia total plastic recycling.....	101
Figure 4.5 Benefit chains og recycling solid waste.....	116
Figure 4.6 Local, regional and international material flow linkages network.....	121
Figure 6.1: Integrated recycling model key stakeholders	184
Figure 6.2: Proposed Integrated Recycling Model for Namibia.....	186

LIST OF ABBREVIATIONS AND ACRONYMS

BBCs	Buy-Back Centres
BIR	Bureau Recycling Institute
CBS	Clear Bag System
CoW	City of Windhoek
DBN	Development Bank of Namibia -
EU	European Union
EASAC	European Academies Science Advisory Council
EIF	Environmental Investment Fund Namibia
ELV	End-of-life Vehicles
EMA	Environmental Management Act
EOL	End of Life
EPA	Environmental Protection Agency
EPAT	Environmental Protection Administration Taiwan
EPR	Extended Producer Responsibility
ETP SMR	European Technology Platform on Sustainable Mineral Resources
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HDPE	High Density Polyethylene
IMF	International Monetary Fund
LCA	Life Cycle Analysis
LDPE	Low Density Polyethylene Plastics
MAFWR	Ministry of Agriculture, Forestry and Water Resources
MET	Ministry of Environment and Tourism
MIT	Ministry of Industry and Trade

MOHSS	Ministry of Health and Social Services
MRF	Materials Recovery Facility
MRLGHRD	Ministry of Regional and Local Government, Housing and Rural Development
NBL	Namibia Breweries Limited
NWR	Namibia Wildlife Resorts
PET	Polyethylene Terephthalate
PLDDSI	Partnership for Local Democracy, Development and Social Innovation
PP	Polypropylene Plastics
PPP	Public Private Partnership
PVC	Poly Vinyl Chloride Plastics
RRW	Regulated Recyclable Waste
SAPPI	South Africa Plastic Packaging Institute
SMEs	Small and Medium Enterprises
SWMP	Solid Waste Management Policy
TGRC	the Glass Recycling Company
WEEE	Waste from Electrical and Electronic Equipment
WMH	Waste Management Hierarchy

CHAPTER 1

INTRODUCTION

1.1. Orientation of the Study

Historically, recycling solid waste has always existed in the form of re-use by recovering materials like leather, feathers and textiles and was regarded as a marginal industry (Choi, 2012). Little attention was given to it. Some people partly survived by selling recovered materials. In addition, recovery of recyclable waste had been associated mainly with the poor and disadvantaged people in society (Luitel & Khanal, 2010), a practice still dominant in most developing countries (Ndum, 2013; Swapan, 2009). Factors that push people into waste picking are fundamentally socio-economic with the poor people being forced to make choices between starving or picking waste for a living (Medina, 2008). In this dissertation, wherever the word recycling is used, it means the process of converting used materials to produce new raw materials for the purposes of producing new products for sale.

Over the years, recycling patterns have changed due to growing demand for raw materials, increasing waste and the Extended Producer Responsibility (EPR) policies, which require manufacturers to take responsibility for managing their products after reaching end-of-life period (Choi, 2012). The natural environment has always been the main source of raw materials in the production of goods through mineral extraction, timber logging and oil drilling. However, studies report that rising demand for raw materials has led to shortages and high prices due to competition for the available limited resources (Hilpert & Milder, 2013; European Technology Platform on

Sustainable Mineral Resources, ETP SMR, 2013). This development has contributed to the growth of recycling as a sound approach that promotes sustainability in the 21st Century. For example, the major importers of scrap are Turkey, the USA and the Asian countries: India, China, Korea, Malaysia, Taiwan and Thailand (BIR, 2013 and 2016). To reduce the deficit of metallic raw materials, Japan recycles products, which have reached their end of life, like vehicles. This practice is known as urban mining, according to (Gutberlet, 2015 as cited in Belgiorno & Cesaro, 2017), and is considered as a very useful strategy to regain important raw materials such as metals with benefits of resource conservation, environmental protection and economic advantages as well. In 2008, the EU launched the Raw Materials Initiative (RMI) with recycling as one of its strategy on raw materials. According to Bureau Recycling Institute (2013; 2016), China's demand for steel rose from 512.3 million tonnes in 2008 to 798.8 million tonnes in 2015 of which 72 and 90.1 million tonnes came from scrap. Turkey and the USA's steel manufacturing industries used more than 76% and 71.7% of scrap in 2015, respectively. Therefore, recycling solid waste involving processing of waste material into new products has become an integral part of society today (BIR, 2009).

Recycling is a multi-functional system with dual functions of secondary material production and waste management (Nakatani, 2014). The growth of recycling industry has also been propelled by increased waste generation. Increased waste generation has been linked to high consumption patterns, increases in populations, better living standards and economic development (Hoornweg & Bhada-Tata, 2015; Smith 2012; UN-Habitat, 2010). The need for sustainability in waste management has led to recycling being viewed as a necessity than an option because of the negative impact of

waste on the environment and human health. Smith (2012) emphasizes that the old practice of throwing away rubbish, as was the case some time back, is no longer regarded as the best way of dealing with waste.

In developing countries, recycling solid waste is an emerging industry with benefits emanating from new raw material industries, production processes, products and markets, based on reuse of pre-used and discarded raw materials (Swapan, 2009). In the regional context of southern Africa, dimensions of recycling as an emerging industry have been rarely researched in economic geography. Economic geography's focus is on the production and utilization of raw materials and their manufacture into finished products (Hooder & Roger, 1974). Forbes and Kirsch (2011, as cited in Tunner, 2012) notes that there was still need for further research on the emergence of new industries in the field of economic geography in as far as spatial distribution of the industries, availability of raw materials, location of markets and network industries with other industries are concerned, so as to gain more insight into the activities. Further, Choi (2012) reports a lack of adequate research in the recycling industry, such as in areas of growth of the industry and its spatial patterns with Namibia being no exception.

The structure of the industry in Namibia is a combination of both the formal and informal sectors (Kaakunga & Matongela, 2012) involved in food and drink processing, wood and furniture, engineering and repair activities. Informal sector micro-enterprises are mainly concentrated in the retailing of drinks and cooked food. In Namibia, formal recycling is an industry yet to be understood and researched. Research has highlighted the need for in-depth studies on recycling (Mutumba 2005; Keyter, 2009; Hasheela,

2009; Magen, 2010; Lindell, 2012). This research is the first of its kind that seeks to investigate the issues of formal recycling in Namibia from a geographic point of view.

1.2. Statement of the Problem

The unfolding revolution of sustainability in resource conservation and environmental protection has created an awareness of the importance of recycling worldwide including Namibia (Sukholthaman, 2012). Resource scarcity has led to the exploration of alternative resources and recycling is an area rapidly gaining popularity in this drive. As reported in research studies (Hasheela, 2009; Magen, 2010; Lindell, 2012; Croset, 2014), Namibia is recycling solid waste. Ashipala (2012), reports that recycling solid waste in Namibia is still a fledgling business, which is associated with the production of new materials. In the Namibian context, emerging industries are a newly classified sector of the economy. Bird (2010, Abernathy & Utterback, 1978; Forbes & Kirsch, 2011, as cited in Tanner, 2012) observed that such industries are often difficult to identify during their early development phases until their products appear on the market.

Data about the industry in Namibia is still limited, as not many records have been kept (Recycle Namibia Forum, 2013). This has resulted in the generality of the population having little information about the industry. While previous studies revealed that recycling activities are ongoing in the country, no single comprehensive study has been carried out regarding the industry. Therefore, the lack of a comprehensive assessment of the recycling industry, which may inform planners, policy and decision makers and assist with developing, controlling and regulating the industry, is limiting the growth of this sector. This research is a direct response to that knowledge gap. Urban areas and local authorities struggling with solid waste management could benefit from a broadened

understanding of the industry. In light of such insights; this study investigated the recycling industry in Namibia.

1.3. Objectives of the Study

The main objective of the study was to assess the recycling industry in Namibia, an emerging economic sector involved in the recovery, processing of raw materials, manufacturing and subsequent purchasing of produced goods, so that it may assist in planning, policy and decision making with regards to its development and regulation. Against this background, specific objectives of the study were to:

1. Investigate the motives and extent of involvement of industry players in solid waste recycling in Namibia;
2. Examine the sufficiency of enabling legislation and policies, guiding waste recovery and recycling in Namibia;
3. Establish emerging waste recycling growth trends in the industry;
4. Assess industry value addition processes and associated benefit chains;
5. Establish local and regional operational network linkages in the industry.

1.4. Significance of the Study

It is without doubt that Namibia is recycling. The industry is still in its infancy, becoming one among growing economic activities such as mining, fishing, agriculture and tourism. It was evident that not much research in solid waste recycling economy has been conducted to date, except in connection with the logistics of solid waste management (Croset, 2014; Schioldborg, 2014; Jacobsen et al., 2014; Lindell, 2012; Magen, 2010 & Hasheela, 2009). Economic activities are important in development and can shape public policy. Therefore, the findings will serve to close data and knowledge

gaps emphasizing economic aspects. Results may provide fundamental inputs into understanding of the recycling industry, and perhaps formulation of policies for awareness building, operational practices and governance of the industry. Academically, findings are expected to change known perceptions about waste and add knowledge in the discipline of applied economic geography as well as to pave way for further research.

1.5. Limitations of the Study

The research was a descriptive case study, qualitative in nature. Qualitative research by design and data acquisition depends greatly on the willingness of respondents to participate, which came out to be a big challenge as some of them were not willing to do so. Efforts to bring them on board proved difficult, as the researcher was continuously given empty promises by those who tried to be diplomatic compared to some whom out rightly declined. Phone calls to enquire and book appointments were not answered in some instances, resulting in the researcher working with fifteen companies than the twenty targeted which were identified.

In addition, of those who were willing to participate, not all were patient enough to accommodate the 30–45-minute interview with the researcher, as this was deemed a waste of the company's time. The researcher had to adjust accordingly thus compromising the level of detail needed. Moreover, company officials were very cautious in their responses and thus the researcher only managed to get general information leaving without additional information, which was considered confidential.

Data acquisition through document search yielded very little as the researcher failed to have access to company documents. Information was once again considered confidential. The researcher had to work with information given only during interviews, observations and online company information. Triangulation and data saturation were methods the researcher used to ensure quality of data and information provided.

Recycling solid waste as a source of raw material is a relatively new and unique subject that has rarely been researched. Therefore, this was a constraint as relevant literature was scarce both in Africa, Southern Africa and Namibia, resulting in lack of limited critiquing in the literature review and the discussion section.

Financial constraints were another challenge for the researcher, thus the researcher was only able to gather information from places that were reachable and in proximity to the researcher. Namibia is a vast territory, so it was not easy for the researcher to visit the length and breadth of the country to collect data. The researcher only managed to get most of the information from companies in Windhoek, Walvis Bay, Swakopmund, Okahandja and Keetmanshoop.

Another limitation of this study was the focus on Namibia's formal recycling industry only leaving out the informal segment that was also contributing to the recycling chain. As far as this researcher is concerned, a few studies have been conducted on informal recycling of solid waste and future research could look into this area to establish its role and contribution to the industry. The researcher left out this component due to language barrier and safety concerns.

In summary, the major limitation of the study was the unwillingness of the respondents to divulge data on volumes and prices for their merchandise on suspicions and fear of competitors. The researcher, therefore, had to make do with information she managed to gather.

1.6. Motivation of Study

Rationale of the study was based on personal and local scholarly researches.

At personal level, a study done at masters level on a comparative analysis of the quality of service provided by the City Council of Harare in Zimbabwe and the private sector contributed to the selection of this area of research.

Local scholarly researches (Croset, 2014; Lindell, 2012 & Hasheela, 2009) whose focus was on solid waste management at municipal level also contributed to the selection of this area of research. While the studies are commendable, they did not do any studies on recycling as a source of raw materials which this study seeks to achieve.

The impetus to do a research increased, as the researcher had many questions about the whole programme. Some of these questions were:

- I. How is recycling assisting in solid waste management?
- II. How is the private sector involved in the recycling programme?
- III. What are the issues involved in successful recycling?
- IV. What happens to the recovered materials?

These deeper thoughts furthered interest into the issues of recycling solid waste as a source of raw materials and because of these thoughts, the study was undertaken.

1.7. Study Area

Namibia became an independent country in March 1990 after a century of colonial rule. The country was first colonised by Germany from 1884 till 1915 and later became a South African protectorate after the First World War (Croset, 2014). Namibia borders the Atlantic Ocean on the west and shares land borders with Angola and Zambia to the north, Botswana to the east, and South Africa to the south and east. The country has a total land area of 824,292 square kilometres, with a population density of 2.6 people per square kilometre. An estimated 49.7 % of the population lives in urban areas (Geo-Hive, 2013) with 325,858 in the Capital City of Windhoek according to Namibia 2011 Population and Housing Census Main Report. Most of the population thrives on agriculture in the rural areas.

Linked to South Africa, the economy is mainly based on mining, tourism, farming, fishing manufacturing, wholesale and retail trade. The country's Gross Domestic Product (GDP) is estimated at US\$28 billion (IMF Report, 2013) and GDP – per capita (PPP) of about US\$11,500. Namibia is strongly dependent on exports to other countries partly due to its small local market. United Nations Economic Commission for Africa (2015) claims that Namibia has experienced years of economic growth and has made great strides in human development since independence. Namibia is considered as a middle-upper income country. However severe inequalities still exist in the Namibian society (World Bank, 2013 cited in Croset, 2014). The country has a Gini-coefficient of 59.7. Another cause of concern in the country is the high unemployment rate reported at 27.4 percent of the population according to Croset (2014)



Figure 1.1: Locality map of Namibia showing major towns and neighbouring countries

Source: Schioldborg (2014)

1.8. Structure of the Report

The dissertation is organised into seven chapters.

Chapter 1: Introduction

The chapter provides the introduction and background of the study, problem statement, aim and objectives, significance of the study, limitations, motivation of the study and the description of the study area.

Chapter 2: Conceptual Framework and Literature review

The chapter presents conceptual framework and literature review. The conceptual framework covers issues such as overview of recycling, models of recycling, motives, recycling programs as well as benefit chains associated with the industry. The literature review focuses on related studies and their findings.

Chapter 3: Methodology

This chapter outlines the methodology of the study in terms of the research design, study population, sample, data collection techniques, data collections instruments and the data analysis procedures, piloting of the data collection instruments and ethical considerations.

Chapter 4: Presentation and Interpretation of Results

Data are presented in this chapter. Data on motives and extent of involvement of companies in solid waste recycling, legislation and policies governing the industry, network linkages in the industry, value addition and benefit chains of the industry in Namibia are all presented.

Chapter 5: Discussion of Research Findings

The chapter is dedicated to discussing the findings emerging from the data presented in Chapter 4. The findings are discussed in relation to the thematic headings that emerged from the main objectives and compared to findings of related studies.

Chapter 6: Proposed Recycling Model

The chapter highlights the proposed solid waste recycling model, which could assist both solid waste management and recycling in Namibia.

Chapter 7: Summary, Conclusions and Recommendations

The chapter concludes the research by summarising the results, presenting recommendations and suggesting areas for further research.

CHAPTER 2

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1. Introduction

This chapter gives a review of concepts used in the study and reviews various studies concerning solid waste recycling practices around the world. As McGaghie et al. (2001) put it: The conceptual framework “sets the stage” for the presentation of the particular research question that drives the investigation being reported based on the problem statement. The problem statement of a thesis presents the context and the issues that caused the researcher to conduct the study.

Conceptual framework and literature reviewed were derived from journal articles, workshop/conference/seminar reports, empirical study reports and online resources. Most of these sources were accessed through the Internet.

2.2. Conceptual Framework

Conceptual framework is an analytical framework, which offers a logical structure of connected concepts that assist in proving a mental picture of how ideas relate to each other in a research and in the real world. It also gives an opportunity to specify and define concepts related to the problem (Jabareen, 2009). The following are some of the concepts which will guide the study: environmental sustainability, recycling loop, value addition and Extended Producer Responsibility Principle (EPR).

2.2.1. Recycling industry: an overview

The solid waste recycling industry has been in existence for a very long time worldwide. According to Binda (2014), the history of recycling dates to around 400 BC. Choi (2012) reported that the industry back then was regarded as peripheral activity. Little attention was paid to its existence, as it was simply associated with marginalised poor members of society. Choi (2012) and BIR (2009) point out that the industry is becoming part of society for two reasons, namely as a source of raw materials and as a solid waste management strategy.

From a historical perspective, the development of the recycling economy was strongly encouraged following the World Conference on Environment and Sustainable Development held in Rio de Janeiro in 1992, known for taking heed of the 1960-1970s environmental movements' criticism of the practice of disposal-based waste management. Waste produced was thrown away, burnt, or buried, as it was regarded useless mass of material. The view of environmental movements was that solid waste comprised of different materials, which should be handled differently, that is, recycled or composted or reused than simply discarded (Schall, 1992 as cited in Gertsakis & Lewis, 2003). The Rio Earth Summit of 1992 advocated for sustainability in solid waste management as well as resource-efficient 21st Green Economy in order to protect the environment.

2.2.2. Recycling and Sustainability

The need to encourage sustainable activities has become an important theme worldwide, according to Phillips and Pittman (2009), driven by environmental issues such as resource depletion, pollution, climate change and loss of biodiversity. The concept of

sustainable development emerged from the Brundtland Commission (World Commission on Environment and Development) report ‘Our Common Future’ (Gertsakis & Lewis, 2003) with the aim of finding ‘ways of living for current and future generations’ (Stewart, 2011, p. 20). Despite the extraordinary influence of the sustainable development concept, Phillips and Pittman, (2009) claims that no perfect definition of the term has emerged. However, the World Commission on Environment and Development (WCED, 1987, p. 43) definition “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” as cited in (Gertsakis & Lewis, 2003) is the one mostly used. The Rio Summit of 1992 and Agenda 21 emphasized the importance of sustainability in economic development as well as waste management to fulfil human needs as well as building technical capacity.

The argument put forward was that the reduction of waste generated should be given priority and its management including recycling should be up-scaled while maintaining economic development. This followed the realisation that poor solid waste management can create negative environmental and health impacts (Hoornweg & Bhada-Tata, 2015; Nathanson, 2015) which could compromise the gains acquired.

2.2.3. Recycling and Waste Management

While recycling is considered a source of raw materials after processing, it is also seen as a waste management strategy. There are a variety of waste management options that can contribute to waste reduction. Recycling is one among others such as waste avoidance, reduction and reuse, as depicted in Figure 2.1.

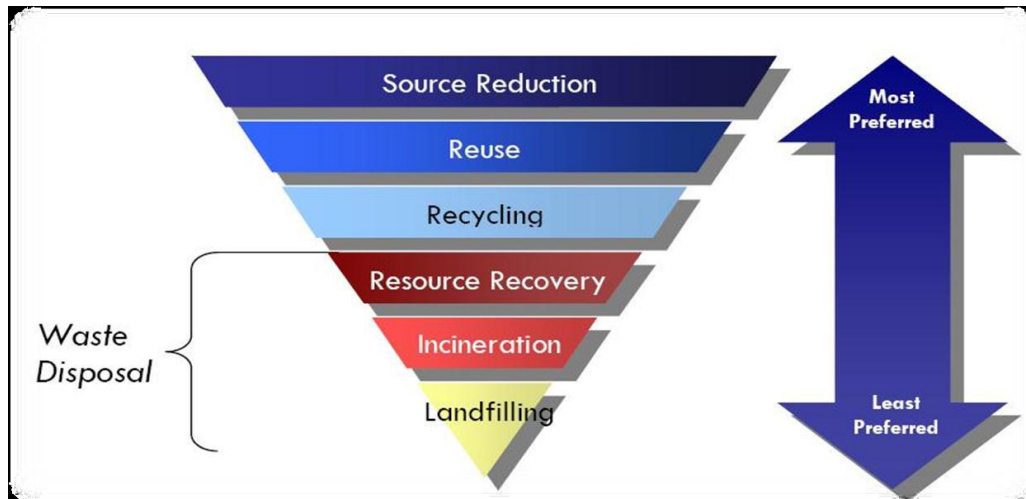


Figure 2.1: Waste Management Hierarchy

Source: Nagabooshnam, 2011

According Figure 2.1, the most preferred options for minimising solid waste are source reduction, re-use, recycling, resource recovery for energy production, incineration and land filling, in that order. The waste management hierarchy, as a concept, encourages waste avoidance before disposal and recycling. The concepts forming part of the waste management hierarchy are now widely used as guiding principles for the formulation and implementation of waste management policies and programmes (Gertsakis & Lewis, 2003).

2.2.4. Motives for Recycling

Drivers for recycling have been identified as environmental, economic, legal and social. Sukholthaman (2012) observes that recycling occurs for three basic reasons: altruistic or environmental, economic and legal. In both developed and developing countries, recycling is being promoted for economic and environmental reasons (Binda, 2014).

2.2.4.1 Economic reasons

Economically, one of the driving forces for solid waste recycling is that it is considered as a cost-cutting measure. In both developed and developing countries, waste management has been observed to consume a lot of money from local authorities. For example, in developing countries, waste collection and treatment highly affect the budgets of local authorities. Waste management is estimated to consume about 30% of the local authorities' budgets in developing countries (Henry et al., 2006 as cited in Lindell, 2012). Waste collection is the costliest activity of waste management, estimated at 60-75 % of the total waste management costs (Nemerow et al., 2009 as cited in Lindell, 2012).

On the other hand, growing demand for raw materials has also influenced the drive towards more recycling discarded products. According to Hilpert and Mildner (2013) emerging economies the likes of Brazil, China, and India have become some of the leading consumers of natural raw materials due to high demand of manufactured products. To meet the deficit, industrial strategies to escape this position include turning to importation of raw materials, stockpiling reserves, technological innovation, as well as recycling of end-of-life products such as cars to get much-needed raw materials like steel. Koehn (2011) also highlights that recycling was becoming one of the solutions to getting secondary raw materials. For example, Koehn (2011) further claims that about 34% of steel production globally emanated from recycling, with 47% coming from Germany. The recovery of secondary raw materials from municipal waste, referred to as urban mining, is becoming a popular concept, as the search for alternative sources for

raw materials expands. In addition, recycled materials are considered cheaper than virgin raw materials (UNEP, 2013).

2.2.4.2 Altruistic reasons

Altruistic reasons include protecting the environment and conserving resources. In addition to the growing scarcity of natural virgin raw materials, increasing volumes of solid waste generation is one of the contributory factors for recycling worldwide, according to Smith (2012). Although the quantity of solid waste is increasing, the composition is also becoming more and more diversified, with serious implications particularly in developing countries where disposal of solid waste is poor and not managed well (UNEP, 2015; UN-Habitat, 2010). Environmental pollution can occur through leaching of dumping sites and landfills, or by air pollution through burning waste. It is also a health hazard to the public and more so for workers and animals that get in direct contact with the waste (Smith, 2012). The need for environmental protection and resource conservation is being promoted at international level to ensure the respect for environmental values for the benefit of humanity now and in the future.

All these highlighted issues point to sustainability in waste management as a necessity than an option in dealing with waste (Chukwunonye & Clive, 2012; Modak, 2011; Williams, 2009). Chukwunonye and Clive (2012) emphasized that recycling will not only benefit the present but the future generations as well.

2.2.4.3 Legal reasons

Over the last decades, environmental concerns have been high on the legal agenda, according to Ruppel (2013), due to growing pressure on the environment on which life

depends and fears are that if this is left unchecked, it can result in more challenges for the future. In response to this, governments are getting involved through a variety of economic and legal measures to encourage recycling. Developed countries have established legal frameworks for their recycling industries. For example, EPR policy principles are mandatory. The concept of EPR originated in Europe and applied to the management of packaging waste in countries such as Sweden, Taiwan and Germany in the late 1980s and early 1990s. EPR is a move towards making the producer of a product liable for its management even after the post-consumer stage. There is a shift in attention from waste to product, as Rodic (2015) states. The policy today also applies to the management of waste electrical and electronic equipment (WEEE) in the EU through the 2002 EU WEEE directive.

In line with the polluter pays principle, EPR shifts the physical and financial responsibility for the environmental impacts (waste) associated with products throughout their lifecycle from society as a whole (and municipalities in particular) towards the generators of waste such as manufacturers, importers, distributors and retailers, and consumers. EPR aims to ensure that the external costs associated with products throughout their lifecycle (including final disposal) are internalised in the costs faced by waste generators and, therefore, to provide incentives to both producers and consumers to change their behaviour in ways that shift waste management up the waste hierarchy. Table 2.1 highlights some of the instruments used to implement the EPR principle.

Table 2.1: Policy instruments under the EPR umbrella

Category	Examples
Regulatory instruments	<ul style="list-style-type: none">• Take-back programmes (mandatory or voluntary), including the provision of infrastructure;• Reuse and recycling targets;• Minimum product standards;• Prohibitions of certain hazardous materials;• Disposal bans;• Mandated recovery/recycling obligations
Economic instruments	<ul style="list-style-type: none">• Product taxes,• Input/material levies,• Virgin material taxes,• Collection and disposal fees,• Deposit-refund schemes,• Subsidies and tax/subsidy combinations
Information instruments	<ul style="list-style-type: none">• Environmental reporting;• Environmental labelling;• Provision of information to consumers, collectors, recyclers, etc.

Source: Nahman, 2009

2.2.4.4 Social reasons

Communities are known to appreciate waste disposal methods such as land-filling, incineration and composting. However, they were found to be aware of some of the environmental challenges they are associated with, For example, modern landfills were found to have the potential to produce negative social impacts. (Asong, 2010). Thus, at the municipal level, recycling and waste reduction programmes are generally influenced by community participation and health-related reasoning. According to research, recycling efforts are still low in developing countries due to low public participation. Possible explanations for this are that people do not separate wastes, infrastructure for waste

separation is not in place, the waste collection system does not correspond to recycling practices, and there are limited recycling technologies (Sukholthaman, 2012).

According to Ezeah *et al.* (2013) recycling provides employment and a livelihood for impoverished, marginalised and vulnerable social groups that survive in a very hostile social and physical environment. Manhart (2011) supports the same idea in a study on informal e-waste management in Lagos, Nigeria, that found that recycling does not require specific skills and is open to poor migrants from rural areas.

2.2.5. Product Life Cycle Model (cradle-grave)

Recycling comes at the end of the useful life of a product. It can take different approaches or models, namely: Avoided Burden Model involving repair and reuse; Avoided Burden End of Life Recycling Model, which includes selling or throwing away; Cut-off Model consisting of recovering material for recycling; and Economic Allocation Model, which market-driven as explained below (Olivetti *et al.*, 2009).

2.2.5.1 Avoided burden method of recycling

Worn out materials are not usually thrown away, but ways of prolonging the lifespan of the item are considered. This involves activities like upholstering or refurbishment of items like sofas to avoid the burden if the product is no longer useful. According to the waste management hierarchy, this form of recycling is termed re-use.

2.2.5.2 Avoided burden end of life recycling model

Products that have reached end of useful life are usually discarded by the initial owner because he/she no longer sees value in them. Such products usually end up being sold or

recovered by waste pickers either at kerbsides or at dumpsites and re-modelled into new products for further use.

2.2.5.3 Cut-off method

Waste recyclers are usually involved. They sort recyclable waste from the general waste before throwing away what is deemed useless. The recyclable waste goes through reprocessing procedures before producing new products.

2.2.5.4 Economic allocation model

If the market is unsaturated, any materials can be destined for the market. However, when the market is saturated or fully developed (Olivetti et al., 2009), the marketers seek for unique recyclable materials with more value to enhance profitability due to increased competition. Such material as scrap metal and e-waste recycling give a competitive edge for the recyclers.

2.2.6. Nature of Solid Waste Recycling

Waste can be any unwanted material that is due for discarding. Technically, waste is considered as a resource in the wrong place, according to (Abdullah, 2011 as cited in Muhammad & Manu, 2013). As earlier on mentioned, recycling is a process that involves processing waste into other useful material. In this study, the working definition of recycling is that it is a chain process of collecting and processing used materials that would otherwise be thrown away as trash and turning them into new raw materials and products (Schultz *et al.*, 1995 as cited in Omran, 2008). The process of recycling usually begins with recovery of materials. Recovery, according to the City of Windhoek Solid Waste Management Policy (2009), is the process of reclaiming waste

materials for purposes of being reused or recycled while excluding them for use for energy generation.

Handling of recyclable waste is associated with both formal and informal sectors in the industry throughout the world, as illustrated in Figure 2.2.

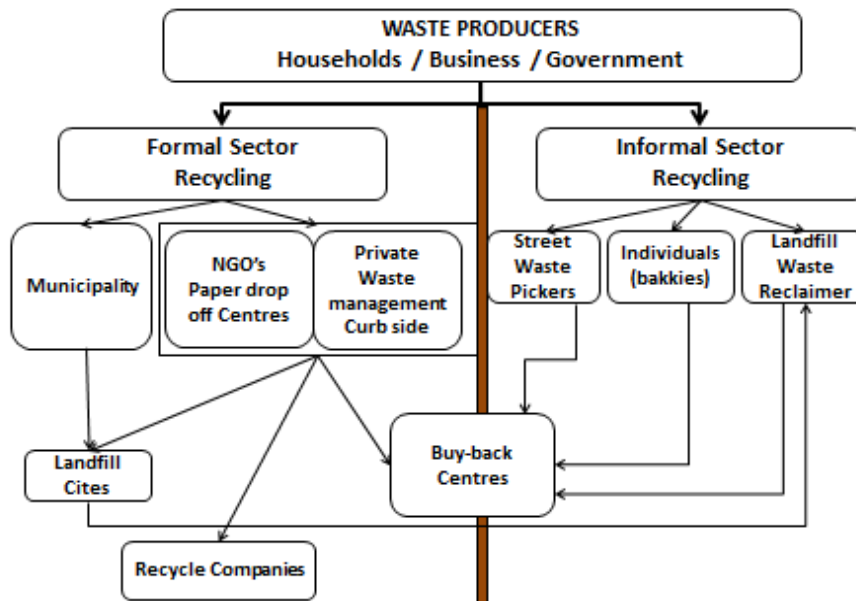


Figure 2.2: Recycling Network Players

Source: Viljoen, Schenck and Blaauw (2012)

2.2.7. Recycling Chain Process

Recycling is represented in three steps depicted by three chasing arrows, as shown in Figure 2.3, called the universal recycling symbol. This was introduced by Anderson in 1970, as a way of raising awareness on environmental issues. Hickman *et al.*, (2009) defines recycling as a process involving three major steps: Step1: collection and processing, Step 2: manufacturing and Step 3: purchasing of recycled products.

Boguski et al. (1994) cited in van Beukering & van den Bergh (2005) identified two main types of recycling processes closed-loop and open-loop. Closed-loop recycling is a process in which the material of a physical product is recycled into the same product, a process that may, in theory, be repeated endlessly. On the other hand, open-loop recycling involves the conversion of material from one or more products into new products involving a change in the inherent properties of the material itself.



Figure 2.3: Recycling Loop

Source: Hickman *et al.*, (2009)

Figure 2.4 shows a more detailed diagram of the recycling process derived from the recycling loop. Whichever process used, close or open recycling loop is represented in the same manner.

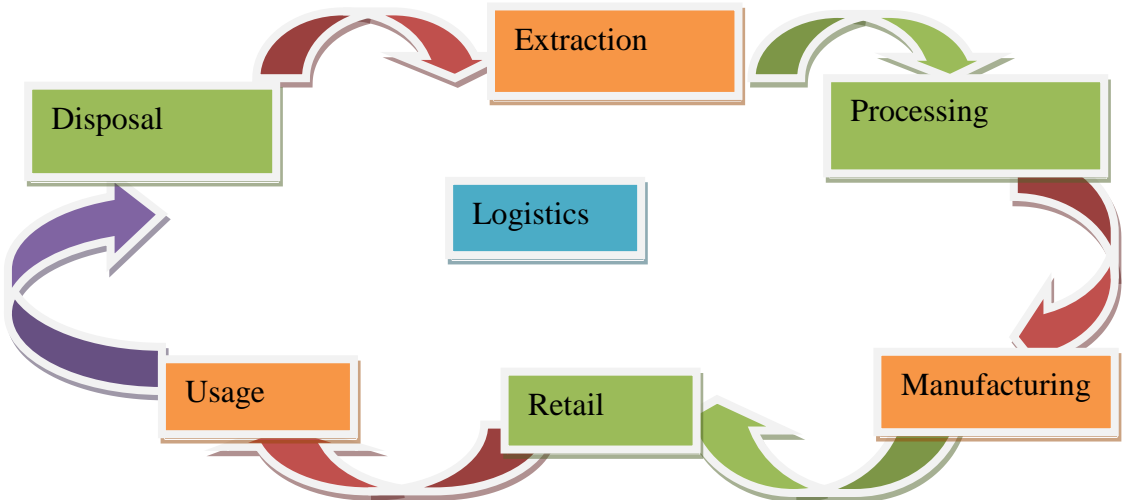


Figure 2.4: A standardized model for the sustainable value chain

Source: WBCSD (2011)

Like any other industry, these processes involve value addition chains carried out within the steps highlighted earlier and associated benefit chains.

2.2.7.1 Solid waste recycling value addition chain

The value chain concept was introduced by management expert Michael Porter in 1985 (WBCSD, 2011). As a process, value chain refers to all the activities performed on a product from conception until final delivery to the consumer. Such activities may include collection, processing and manufacturing but excludes use by consumer and eventual discard. The idea is getting the product closer to the consumer by improving its presentation, transportation, storage, packaging, labelling, processing as well as marketing.

A variety of materials, such as, plastics, paper, bottles and textiles can be discarded by individuals or entities because they are no longer desired. Solid waste recycling, as a value addition chain, begins with materials collection and ends with usage of recycled product, according to Hickman et al. (2009). Following material discard, comes material collection and storage, which can either be through public or private collectors; processing which involves sorting, cleaning, shredding, crushing, compacting or baling or similar operations to increase the bulk density of secondary materials in order to reduce transport costs in a way that is acceptable to the end-user and finally production of raw material; manufacturing which involves production of new products, depends on material type, such as, recycled cardboard and newspaper are used to make new boxes, papers, and other products such as tissues, paper towels, toilet paper, diapers, egg cartons and recycled plastics used for soft drinks, juices, and peanut butter containers,

etc. After manufacturing, products are distributed to different customers for selling. The recycled raw materials and products are bought and sold just like any other commodity, and their prices change with the market fluctuations.

The following highlights these processes within the facilities generally provided in the recycling process.

2.2.7.2 Recycling collection facilities

Recycling activities begin with material recovery (picking and extraction) and collection after materials are discarded. Without this process, recycling is not feasible (Hickman, et al., 2009). How and where recyclables material can be collected vary from community to community. It can be collected from facilities at residences, schools and businesses through:

i) **Kerbside collection** facilities requiring homeowners to separate recyclables from their garbage is the most common method. Residents set recyclables, sometimes sorted by type, on their kerbs to be picked up by municipal or commercial haulers. Special containers may be provided to collect clean recyclables, while the rest of the undesired garbage is collected in the ordinary containers. Efficient and effective recycling is achieved where secondary raw materials are separated from wastes by the generator. Therefore, design and implementation of source separation must be sensitive to local cultural and socio-economic circumstances.

ii) Drop-off centres also provide another simple means of collecting recyclable material. Used glass bottles, metals, plastics, cans and papers are to be dropped off by people at

designated sites such as supermarkets and parking lots, where there are high traffic volumes. These centres are often sponsored by community organizations.

iii) Buy-back centres are depots where individuals can sell recyclable materials such as metals, glass, plastic and newsprint (Viljoen et al., 2012). At these centres, manufacturers buy their products back from consumers and reuse the used products into new products.

iv) Deposit and refund centres require consumers to pay a deposit on a purchased product in a container, such as bottles. The deposit can be redeemed when the consumer brings the container back to the business or company for reuse or recycling.

2.2.7.3 Material recovery facilities

Materials collected for recycling are usually sent to materials recovery facilities (MRF). These are specialised plants or buildings that receive, separate, and prepare recyclable materials for marketing to end-users (Hickman *et al.*, 2009). There are two types of MRF systems. A “clean” MRF is a facility that accepts source separated recyclable materials. A “dirty” MRF receives a mixture of waste material that requires labour-intensive sorting activities to separate recyclables from the mixed waste. The main function of the MRF is to maximise the quantity of recyclables processed while producing materials that can be transported at low cost to generate the highest possible revenues in the market.

Sorting

This is one of the main processes of value addition of the waste recovered at MRFs. The greater the level of sorting, the greater the value of the material produced. For instance,

if plastic is grouped into one category, its value is lower than when it is further separated into sub-categories of hard and soft, then High Density Polyethylene (HDPE), Polyethylene Terephthalate (PET), and Low Density Polyethylene Plastics (LDPE). Sorting is done according to colour, size, shape and potential use or re-use of the materials so as to meet the end-user requirements.

Volume accumulation

Less volume per unit weight adds value, that is, higher prices per unit volume. If industrial stock feeds are massive in volume, it follows that less storage space is required. Also, the greater the quantity, the better bargaining power the trader has. For example, small quantities have high transaction costs, such as checking quality, arranging transport and paying the seller, hence reducing the profit margin.

2.2.7.4 Processing facilities

Processing includes washing, change in shape by cutting, granulating, compacting and baling. This processing of recyclable materials happens in a variety of ways depending on what is being recycled and what the recycled material becomes. For example, plastic bottles are cleaned, sorted according to type (numbers 1-7), and shredded. The shredded plastic is heated to a specific temperature hot enough that the plastic can be formed into small pellets.

2.2.7.5 Manufacturing and selling facilities

Manufacturing companies purchase the pellets from plastic recyclers to make a myriad of new products from carpets and backpacks to decking and playground equipment (Mills, 2012). These processes follow the same procedure as conventional material.

2.2.8. Benefit chains associated with value addition processes

The benefits of recycling have been explored and highlighted through many scholarly works. A number of researchers agree that recycling has benefit chains that can be categorised into environmental, social and economic (Abdul-Rahman, 2014; Mosia, 2014; Muzenda, 2013; Harris et al., 2011; Nahman, 2009) with further benefits of new raw materials, uses fewer natural resources, preserves landfills, prevents global warming, reduces water pollution, protects wild life, reduces waste, creates jobs, requires less energy and creates new demand for recycled products. However, recycling has also been criticised and has dis-benefits, which will not be discussed in this dissertation.

The benefit chains can easily be associated with a cause effect diagram whereby the main benefit is like the problem and factors contributing to the benefit are like causes of a problem. This can be represented diagrammatically like a ‘fish bone’ cause effect diagram (World Bank 2007).

2.2.9. Recycling Network Linkages

Industrial linkages have been widely studied in economic geography since the 1960s (Marshall, 1987 as cited in Malmberg, 1996). Linkages in Geography denote interdependence among firms or show the interrelationship among various industrial activities (Malmberg, 1996).

Industries depend on each other for survival and growth. This interdependence, therefore, creates some linkages in the network. There are different types of linkages. These include communication linkages, formal linkages, material or work flow linkages,

proximity linkages, and cognitive linkages. Networks are multiplex, that is, actors have more than one type of linkages. Companies create, maintain, dissolve, and possibly reconstitute network linkages due to self-interest, dependency and collective interest.

A network consists of a set of actors (nodes) and the relations (ties) between the actors, such as, individuals or groups of companies (Talarowska & Denana, 2008; Wasserman & Faust, 1994; Håkansson & Ford, 2002 as cited in Haugnes, 2010). Linkages can either be direct or indirect, strong or weak. Strong linkages exist when equally involved business actors and consumers perform many complementing and specialized activities. Weak linkages, on the other hand, involve a few and general activities, the performance of which is dominated by either the business actors or the consumers (Granovetter, 1973; 1982 as cited in Haugnes, 2010).

Solid waste recycling activities also exhibit some linkages of different types. Chaudry (2003) noted that there are backward, forward and side-ways linkages. Scheinberg (2012), and Zikmund and Stanton (1971) pointed out that recycling is a complex process with linkages that need to be understood if recycling is to be a feasible solution to the trash problem. In Hong Kong, for example, recycling of municipal waste is a network of waste pickers, waste collectors, schools, institutions, recyclers or waste dealers and pre-processors (Recovery and Recycling of Municipal Solid Waste in Hong Kong, 2010).

2.3. Literature Review

Literature review enables a researcher to develop a clear understanding of the research topic through what has been researched on the topic and identify gaps, which the

researcher's own study can fill (Bless & Higson-Smith, 1995; Hart, 1998; Sarantakos, 1993).

This literature review unfolds major empirical findings of recycling issues in Africa such as players in the industry, motives of recycling, recycling policies and legislation, recycling behaviour of urban households and benefits of recycling. Global recycling examples are incorporated where necessary.

Related literature in Namibia was limited, hence the many references to other parts of Africa and the world. This is not surprising since the area of recycling is still emerging in Africa, as the continent is still grappling with the management of solid waste. Thus, referenced research issues revealed the dimension of waste management and behavioural attitudes on waste recycling. Specific literature on the recycling industry was limited.

2.3.1. Actors and trends in the industry

Globally, both formal and informal sectors are involved in the industry of recycling (Chandak, 2012; Courtois, 2012; Velis et al., 2012; Gutberlet, 2010). In developed countries, recycling is more organised and the private sector is more entrenched in the industry and most activities are carried out formally e.g. registration and record up keeping. It is the opposite in most developing countries where the informal sector plays a more active role. Despite their importance in the industry as well as in solid waste management, it is noticeable that informal sector recycling activities have been incorporated in very few cities in the world with a few policies developed to encourage the approach. This was also the case at some stage in the past, in what are now developed countries (Velis et al., 2012).

Like any other parts of the developing world, recycling in Africa is still low and not well organised (Tas, & Belon, 2014; Ezeah et al., 2013; Gutberlet, 2010; Mamphitta, 2009; Liebenberg, 2007; Otieno & Taiwo, 2007) attributed to several factors such as financial constraints, low levels of participation and lack of knowledge. For example, in Mozambique, Tas, & Belon, (2014 (2014) estimate that less than 1% of the solid waste generated was being recycled. Recycling activities are limited to a few local companies and some non-governmental organisations. A study by Senzige et al., (2012) on solid waste characterisation in Dar as Salaam found that 98% of solid waste generated per day was not recycled. Fadlalla (2010), in a study on management of PET plastics waste through recycling in Khartoum established that recycling was low as well despite increasing plastic waste generated in that country. Courtois (2012) claims that in Africa the full potential of the recycling industry is still to be realised and pointed out that the private sector can play a significant role in developing the industry in developing countries in order to enjoy more benefits of waste recycling.

Studies have shown that there exists some form of linkage between formal and informal sectors in the recycling industry. Longenhoven and Dyssel (2007) studied the recycling industry and subsistence waste collectors (informal sector) in Mitchell's Plain, South Africa, and found that there was interdependency between subsistence waste collectors and buy-back centres, a similar trend was reflected elsewhere in the world. In Pretoria and Bloemfontein in South Africa, Viljoen et al. (2012) discovered that buy-back centres (BBCs) found in most urban centres linked the informal and formal sector activities in the industry where waste pickers sell recovered materials like cans, scrap metals, plastic and paper. These create formal jobs and informal income-generating opportunities for

the poor and unemployable. According to the study, buy-back centres (BBCs) played a crucial role as market centres for the informal sector participants.

Informal Sector

The informal sector is quite active and dominant in the recycling industry in developing countries and research done attest to this. Gunsilius, Chaturvedi and Scheinberg (2011), in a study on the economics of the informal sector in solid waste management, reveals that the informal sector is more active and more effective in recovering resources than the formal one in low- and middle-income countries. The role of subsistence waste pickers in the recycling industry in South Africa was investigated by Mamphitta (2011) and Dlamini and Simatele (2016). Findings reveal that merchants, recyclers, homeowners and producers of recyclable materials were in agreement that informal waste pickers play an important role in the South African recycling industry. The study revealed also that 84% of recyclable materials recycled are sourced from waste pickers.

Ukoje (2012) and Njoroge et al., (2013) noted that in Zaria (Nigeria) and Nakuru Municipality (Kenya), respectively, waste pickers survived through recovery and selling of recyclable materials. To survive, the majority of the poor are involved in the industry despite the harsh working conditions (Fahmi & Sutton, 2010; Mamphitta, 2009). In Egypt, Fahmi & Sutton (2010) found out that the industry was dominated by the informal sector as well, which has operated for over a decade. Privatisation of municipal solid waste management, however, was threatening the survival of the industry. The study recommends that the informal sector be recognised as stakeholders within the municipality in solid waste management, as they were found to be contributing significantly in reducing waste.

Formal Sector

Despite informal sector dominance in the industry, formal sector participation is slowly making in-roads into the recycling sector in Africa. In Kenya, Rotich et al., (2006) as cited in Marmolejo et al., (2012) reports the growth of recycling at a formal industrial level as an important source of raw materials while in Cameroon, governmental policies and strategies for environmental protection and promotion of conservation of materials were contributory factors to the growth of formal recycling (Manga et al., 2008 as cited in Marmolejo et al., 2012) in that country.

The same was reported in South Africa, where a wide range of organisations are active in the field of recycling with typical examples being Collect-A-Can, the Glass Recycling Company, Mondi Recycling Company (paper), Plastics Federation of South Africa, Nampak Recycling, SAPPI, PETCO, Paper Recycling Association of South Africa, e-Waste Association of South Africa and ROSE Foundation (Taderera, 2010). The government identified plastic, glass, steel cans, paper and tyres as ‘priority wastes’ that needed to be kept away from landfill sites through reduction, re-use and recycling.

Oelofse and Strydom, (2010), in a Paper, *‘The Trigger to recycling in a developing country- in the absence of command – and – control instruments’*, notes that industry involvement is partly driven by financial incentives. On the other hand, households’ participation in recycling is attributed to awareness about the importance of environmental protection as well as easy access of recycling facilities.

Muzenda (2013), in a study of the formal industry in the Gauteng province of South Africa reveals that government, industry and household initiatives were promoting recovery activities in that country. Local government recovery initiatives included drop off centres, collection banks and buy-back centres. The initiative by local authorities was attributed to increased cost of land filling as well as unavailability of landfill space in the province. Drop-off centres are well established in Gauteng cities and larger towns, where waste is separated into glass, paper/cardboard, cans, scrap metal, plastic, garden waste, e-waste and other waste types, and delivered in separate forms by members of the public under the initiative of a private company. However, separation of waste at drop-off centres is not effective, thereby hampering cost-effective recycling. In the case of buy-back centres, they are privately operated. Community members take recyclables of economic value such as bottles and trade them for a small profit, an initiative found to be a source entrepreneurial promotion through source separation.

At industry level, recovery initiatives focus on the recycling of packaging material, plastics, glass bottles, metals, papers, e-waste and waste tyres. Plastics South Africa, an umbrella organisation for the plastics industry in SA that was founded in 1975, is the major force behind plastic recycling. For example, in 2009 about 17.80%, 2010 about 18.40% and 2011 around 18.90% of plastic was recycled (Muzenda, 2013).

The Glass Recycling Company, formed in July 2006, is South Africa's official organisation for promoting glass recycling (Muzenda, 2013). The company works in partnership with national government, glass manufacturers and fillers. The efforts witnessed recycling rates grow from a mere 18% around 2005/6 to 40% in 2011.

Viljoen et al., (2012), in a study on the role of buy-back centres (BBC) in South Africa, concluded that BBCs are an important aspect in the recycling industry, as they form an important link with the informal sector. Most of them are privately owned as revealed in the study. To date, buy-back centres are in all major centres of South Africa. At these centres, subsistence collectors are mostly paid on an ad hoc basis for delivering certain types and grades of recyclables.

2.3.2. Motives for Recycling

According to Fall (2015), in a study ‘Waste and Recycling Programs in Hancock and Houghton, Michigan’, individuals participate in voluntary recycling programmes mainly out of pride for their communities and out of concern for the environment. Communities are aware of some of the environmental challenges associated with some disposal-based systems. For example, modern landfills were found to have the potential to produce negative social and environmental impacts, including the following: i) landfills produce hazardous leachate (liquid formed as waste breaks down and water filters through garbage), ii) despite the well-designed features like landfill liners, groundwater and/or surface water contamination can occur due to landfill liners leakages, iii) landfills release methane gas, which contributes to global climate change which accounts for about 10% of all greenhouse gas emissions from humans activities iv) people prefer not to live near a waste disposal site because of the associated odour, noise, reduced property values and neighbourhood disturbance.

It can be difficult, especially in many urban areas, to find suitable places to site new landfills or expand existing ones. In a study: ‘Bangkok Recycling Program: An Empirical Study of an Incentive-Based Recycling Program’, Sukholthaman (2012)

reveals that many reasons contributed to recycling by municipalities, such as lower budgets for supporting municipal waste management programmes as well as high recycling targets set by governments.

According to Simelane and Mohee (2012), many African cities' recycling efforts are being promoted as one of the strategies to reduce waste. In most cases, these cities are characterised by inefficient collection, management, disposal of municipal solid waste, a situation attributed partly to budgetary pressures and inadequate resources.

2.3.3. Policies and Legislation

Various initiatives are being explored in different countries to promote solid waste recycling, including legislative provision and policy instruments as incentives (Baeyens, Brems & Dewil, 2004).

To date, in countries such as the USA, Europe and Asia, recycling activities have transformed noticeably following the introduction of policies and legislation promoting the industry. Some of the policy directives include EPR, Packaging and Packaging Waste Directive, the End of Life Vehicle Directive, the WEEE Directive, subsidies, Pay-As-You-Throw, take-back obligations, deposit refund schemes (Philippsen, 2015; Priestley, 2011). In Europe, end-of-life vehicles are supposed to be recycled according to law. For example, in the ELV Directive (EC, 2000), it is mandatory for used vehicles to be recycled (Santini, 2012) to minimise the environmental impact.

In Italy, Directive 2000/53/EC and the National enforcement D.lgs. 209/03 compel recycling of vehicles produced. Germany also supports the idea of recycling for resource recovery through the Closed Substance Cycle and Waste Management Act of 1996.

Recycling is supported through this legislation as it is considered a sustainable resource management strategy (Federal Ministry of Economics and Technology, Germany, 2010). In addition, many countries have introduced landfill tax to divert waste stream towards recycling and incineration. Yang and Innes (2007) reaches the same conclusion for common household materials in Taiwan where recycling activities are regulated through the 4-in-1 Recycling Program.

In developing countries, a different scenario prevails regarding policing and legislation for recycling. In a study to assess the impact of EPR for packaging waste in South Africa, Nahman (2009) points out that developing countries have been far slower in implementing EPR policies to promote recycling. Several factors were found attributing to this. Some of these are lack of funding to finance recycling or even adequate waste management, lack of safe and efficient infrastructure for recycling or appropriate waste management and lack of awareness among consumers and collectors of the environmental and health impacts associated with inappropriate waste handling and disposal, and of the benefits of recycling. Despite the fact some countries like South Africa and Botswana have tried it.

South Africa introduced these policies back in 2003, where the government was involved together with private companies in steel, glass and plastic business with less positive results produced. Mandatory government-imposed plastic bag levy was not effective in stimulating recovery in South Africa. As a result, efforts to recycle these materials are still a long way. In Botswana, however, the situation was different as the introduction of plastic levy contributed to a reduction in littering (Bolaane, 2004). However, more still needs to be done, especially in terms of regulation and in promoting

household recycling. The public needs to be made aware of the numerous initiatives already being undertaken, for example, the e-waste and battery recycling collection points.

2.3.4. Benefits of Recycling

Benefits of recycling have been explored and highlighted through many scholarly works. Several researches agree that recycling has some benefits, environmental, social and economic (Chanda, 2014; Abdul-Rahman, 2014; Mosia, 2014; Muzenda, 2013; Nahman, 2009; Harris et al., 2009). However, recycling has also been criticised for having disadvantages as well.

Economic Benefits

In both developed and developing countries, recycling is a means of job creation according to (Scriba, 2015; Mosia, 2014; Muzenda, 2013; Botes, 2012; Ezeah et al., 2013; Fakir, 2009). In South Africa, Nigeria, Zambia and Mozambique the recycling industry employs a number of people. According to Scriba (2015), the recycling industry in Europe employs about 30,000 people while Botes, (2012) found that the industry in South Africa employs around 15,000 people in the formal sector. Muzenda (2013) reports that in South Africa, the industry is also a source of employment requiring various skills and educational background than waste collection and disposal, as a result of this, recycling jobs are fast growing as waste is continuously generated and as the population increases. In a paper “Waste recycling in developing countries in Africa: Barriers to improving reclamation”, Liebenberg (2011) also highlights that recycling industry is an important source of income for many people who cannot find formal employment.

Besides employment creation, recycling is a source of raw materials for manufacturing industries such as automobile, electronic and steel. In South Africa, Mosia (2014) claims that the need to import raw materials is reduced by using recycled secondary raw materials. Through recycling, rare and expensive materials can be recovered (Muzenda, 2013). For example, a variety of rare earth metals such as platinum, gold and copper are recovered despite the presence of some hazardous metals such as mercury and lead (Abdelshafie, 2014; Yamoah, 2014).

Environmental benefits

Apart from economic benefits, recycling is also linked to environmental benefits. One of the indirect benefits is the reduction of energy required during processing of raw materials. It is believed that less pollution occurs due to recycling e.g. carbon emissions that contribute to global warming. The use of less energy during processing of raw material is supported by Mosia (2014) and International Aluminium Institute (2009) that stated that less energy is needed to process scrap aluminium compared to processing virgin aluminium. On the other hand, recycling waste is known to save three times more energy than what is produced by burning it and generating new energy with plastic recycling saves five times as much.

Recycling is also known for saving space by increasing the life span of landfills as well as saving in operational costs as noted by Liebenberg (2011). In Japan, for instance, one of the main reasons for promoting recycling is due to land shortage, particularly for waste disposal.

A study on e-waste issues in Ghana carried by Yamoah (2014) found that recycling activities were impacting negatively on the environment. Some of the activities involve burning of WEEE to recover precious metals. However, this process results in the release of hazardous chemicals like copper, lead and tin. Soils at some waste recycling yards were found with high levels of these toxins, a situation deemed dangerous (Yamoah, 2014). As highlighted at the beginning of this section, this is one of many examples of why recycling has been criticised as a disadvantage.

Social Benefits

Guamba and Tembe (2016) suggest that the industry has some social benefits as well. Waste picking provides opportunities for the poor and marginalized people to be integrated socially.

Global recovery of recyclables has been observed to be a source of livelihood for thousands of people, particularly in developing countries. Botes (2012) points out that the recycling industry in SA employs approximately 440,000 people in the informal sector. At the same time, Ezeah, et al., (2013) reveals that recycling provides employment and a livelihood for impoverished, marginalised and vulnerable social groups that survive in very hostile social and physical environment. Man hart (2011), studied informal e-waste management in Lagos, Nigeria, and found that the first stage of recycling does not require specific skills; hence it is open to poor migrants from rural areas.

E-waste recycling is emerging as a lucrative business in Africa (Oteng-Ababio, 2012; Benedicta, 2012). A study on e-waste recycling in Ghana was found that the industry

was mainly done by the informal sector, but there were no specific laws for e-waste recycling. Activities of the formal sector were still limited due to lack of safe e-waste recycling infrastructure and regulations. Thus, the informal sector dominates the industry. The collectors are mostly youthful employing rudimentary tools in the dismantling processes despite the hazardous nature of e-waste. A similar situation was observed by Hecker (2012), who noted that India's e-waste recycling industry was dominated by the informal sector as well, where tens of thousands of people are estimated to make their living from its recovery. Thus, the collection and separation of recyclables is prevalent as a survival strategy for the unemployed, the marginalised and homeless members of society.

2.3.5. Recycling value addition processes

The subject of value addition has attracted researchers for some time in Africa. A study by Ochieng (2010), 'Effect of value addition on price: a hedonic analysis of peanut in retail supermarkets in Nairobi, Kenya' focusing on the price of peanut butter in the supermarkets, concludes that value addition was found to have effects on the final price of goods. The study established eight different levels of value addition for peanuts, and prices differed significantly across the various levels. Venkatesh (2010) also came up with the same conclusion in a study on the coffee value addition process. Coffee prices varied depending on value addition processes involved. Palander (2015), in a study on economic value chain analysis of Namibian diamonds, found that the Namibian diamond value chain was divided into four stages of processing: (1) rough diamond mining, (2) sorting, valuating and trading of rough diamonds, (3) cutting and polishing of rough diamonds, and (4) jewellery manufacturing and retail. The same can be said about

recycling of solid waste to raw materials and eventually to new products. This is what this research sort to identify.

In a report by the African Development Bank (2014) on global value chains and Africa's industrialisation, findings were that minor value addition was done in Namibia associated with agricultural products although the environment was favourable. It has advanced infrastructure, easy access to South Africa's advanced technology and a good geographic location of the Walvis Bay corridor. To enhance Namibia's competitive advantage, the report recommended a relook into issues such as labour, policy and regulatory environment, which were found to place the country at a disadvantage compared to South Africa and Botswana.

Africa's recyclable material is mainly prepared for export markets. Value addition processes were observed to be limited mainly to collection. For example, in Mozambique, most of the material products are semi processed and exported to South Africa and Asia, as reported by Tas, & Belon, (2014). Value addition to the products is generally very low.

In another study focusing on waste collection, waste pickers in Maputo municipality, Mozambique, Ribeiro (2015) notes that waste collection was hampered by lack of local industries that transformed recyclable materials into recycled products. The same findings were revealed in an earlier study by Fadlalla (2010) on the management of PET plastic waste through recycling in Khartoum, Sudan. Plastics processing simply involved grinding, cleaning and baling before export despite the fact that the collected plastics can be processed into raw materials. In another study, focusing on scrap metal recycling,

Saremo (2015) found that little recycling of scrap metal was taking place in Bulawayo, Zimbabwe, due to limited technical capacity resulting in simply dumping of most of the material posing a threat to the environment and humans.

To tackle some of the country's developmental challenges of unemployment, inequality and poverty, Mugano (2016), in a study "The New Growth Path", concluded that one way out of poverty rests on the idea of value addition, a concept still limited in most African countries. No studies on value addition in the recycling industry in Namibia have been done so far and thus an area for study.

2.3.6. Challenges of Recycling

Participation in recycling has been studied in different parts of the world and several factors were found to be affecting recycling activities by different stakeholders, among them are behaviour, attitudes, perceptions and awareness. According to Siddique et al. (2010), recycling behaviour is a function of internal and external factors that include education level, gender, and infrastructure availability, public education and information campaigns as effective approaches to change behaviour, attitudes, perceptions and increase awareness, hence promoting recycling.

Omran (2008) and Anderson et al. (2013) reveal that governments are promoting recycling through several initiatives. However, progress was hampered by low participation levels and unresponsive attitudes by households. In Botswana, a study conducted by Bolaane (2004) reveals that the major constraints to organised recycling were low public awareness about recycling initiatives and lack of support from governing authorities despite the potential value of waste. There remain barriers to

consumers' commitment to fully support action required for recycling in the absence of appropriate incentives and structures to deal with people's apathy and ignorance. Kotze (2015), studying perceptions and attitudes of women towards recycling in South Africa, found that women were ignorant and lacked knowledge to implement effective recycling practices.

In Uganda, Banga (2011) explored household awareness, attitudes and practices on recycling of solid waste in Kampala and concluded that households did not fully participate in recycling activities, although the people are aware of solid waste recycling practices, due to lack of awareness of recycling activities in their area. Some of the recommendations were that recycling facilities be made easily accessible to the public and incentives be introduced to motivate the public to participate in recycling more. These factors were found in other studies done elsewhere.

Anderson et al. (2013) looked at the effect of demographic factors, socio-economic status on recycling by urban South African households. The study found that educational level, gender factors and household income affected views and attitudes on recycling. For example, it was found that respondents with low level of education recycled less than the educated ones.

2.4. Review of Studies in Namibia

Researches related to this study have been conducted earlier focusing on solid waste management (Hasheela, 2009; Magen, 2010; Lindell, 2012; Westphal & Pfeffer, 2013; Croset, 2014; Jacobsen et al., 2014; Mughal et al., 2014). The studies found that solid waste management was a challenge in Namibia, especially in most urban areas, just like

reported in other parts of the world. Thus, the status of waste management in some small urban centres in the country needed improvement, as confirmed by the Audit Report of the Auditor-General of 2013. Improper waste collection, removal and maintenance of dumpsites were found to be problematic partly due to lack of sufficient and appropriate waste collection equipment and vehicles and lack of cooperation from the relevant stakeholders, among other issues.

In Tsumeb town, some 500km north of Windhoek, Croset (2014) found that some recycling was already happening with formal and informal sectors participating and an informal network existed among the players. The main players involved were waste pickers (at the bottom of the hierarchy), scrap yard dealers, intermediate buyers and other buyers outside the town. A small community of waste pickers was found to be surviving by recovering materials such as glass, bottles, cardboard boxes and cans from dumpsites and other disposal points. The development of recycling in Tsumeb was found to be facing some challenges of long distance to recycling depots in Windhoek and financial constraints despite its potential. The study concluded that more awareness and education about the benefits of recycling and importance of efficient waste management in general was needed. The same conclusion was reached by Magen (2010) in a study on waste management and recycling in Keetmanshoop and Ondangwa, in Namibia.

A study by Mughal et al., (2014) to establish the status of waste management in the three northern Namibia towns of Ondangwa, Oshakati and Ongwediva found that there was a need to improve the existing status quo regarding waste management. Improvements in regulatory frameworks, financial support, public education and awareness, among

others, were cited as the challenges that Ondangwa, Oshakati and Ongwediva towns were facing in the management solid waste. The culture of reuse was found absent among most of the people, as most recyclables like bottles and plastic carrier bags were simply thrown away causing a lot of litter all over ending up posing danger to both humans and animals. The study recommended the need for more education and awareness about the benefits of recycling, as well as putting in place effective by-laws.

According to Jacobsen et al. (2014) inefficient recycling practices together with unemployment were major problems facing Namibia. In a study on how informal waste collectors could be integrated into the formal collection system, Jacobsen et al. (2014) found that there was a likelihood of betterment of people's lives through promoting recycling. However, inefficient collection of recyclables was partly found to be a result of transport problems in some areas, particularly those in low-income areas where inaccessibility is hampered by inadequate road networks. In the same study, Jacobsen et al. (2014) pointed out that the feasibility of using bicycle-driven carts to collect and transport recyclables could be a way to generate employment in Windhoek since unemployment and inefficient recycling practices were a significant problem in Namibia. If successful, the bicycle model could be expanded to other towns as well.

Westphal and Pfeffer (2013) studied the role of small- and medium-sized enterprises (SMEs) in cleaning and provision of waste collection services in the City of Windhoek. The study found out that the sector assisted the Windhoek municipality in waste management as well as providing a means of survival to men, women and young people, who found it difficult to get employment in the formal job market.

Lindell (2013), focusing on identifying different concepts for improving waste management in developing countries, particularly the Kavango region of Namibia, found that four different concepts, namely integrated solid waste management, integration of the informal sector, private public partnerships (PPP) and decentralisation could be implemented to improve waste management in the region.

Magen (2010) conducted a study to get more understanding about the different waste management and recycling practices and the social aspects that contribute and affect them in the municipalities of Windhoek, Keetmanshoop and Ondangwa. The study established that there was no national waste management policy, thus each local municipality had its own laws and regulations, a system which was found to compromise waste management operations such as enforcement of practices like recycling. On the other hand, recycling had not received enough attention from all stakeholders, a situation which compromised its success. For example, poor public participation from the public was one of the constraints to successful recycling despite efforts that the business communities and recyclers were making in promoting recycling.

Hasheela (2009) investigated waste management practices at municipal level in Namibia, with reference to Windhoek. The study found that waste management practices in the city were running well compared to other centres, thus this earned Windhoek 'the cleanest city in Africa' tag. The study recommended that the system of waste management in use be used as a model for the entire Namibia and that recycling be studied in detail to establish how it can contribute to this endeavour. While appreciating the importance of waste recycling as a waste minimisation strategy, Keyter (2009) emphasized the need to introduce the PPP concept, an approach that has now been

embraced in recycling initiatives in Namibia, as will be presented in detail in this research.

2.5. Concluding remarks

Recycling concepts and literature review were covered in this chapter. Recycling is a process that involves the production of new raw materials and goods. Various models explain this process e.g. Ollivet's recycling models and Hickman's recycling loop model. Ollivet's recycling models emphasis reuse, refurbishment and production of new goods. Whereas the recycling loop stipulates that recycling is incomplete in the absence of production and selling of new produced goods. Hickman's recycling loop model informed the study.

In Namibia, literature on the industry was limited. Literature review revealed that the industry is run by both formal and informal sectors globally, with the informal sector dominating in developing countries. The next chapter covers the methodology of the study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Introduction

This chapter describes the research methodology of the study, whose focus was to assess the country's recycling industry that is an emerging economic sector. Philosophical assumptions that informed the study are presented as well. Research methodology focuses on data collection and analysis procedures used to address the research problem (Walter, 2013; Creswell, 2009; Mouton, 1996).

3.2. Research Paradigms

Research is usually guided by certain beliefs, as highlighted by Saunders (2013), which are known as research paradigms. These are considered as the starting point of any research. Despite the fact that they are often taken for granted. The search for reality is, therefore, influenced by a set of assumptions that the research may have. The term paradigm was first used by Thomas Kuhn in his 1972 while referring to overall theoretical research framework (Saunders, 2013). Positivism and interpretivism are considered to be the broad frameworks of paradigms in which research is conducted.

The positivist paradigm is mainly associated with natural sciences (Neuman, 2014), whose emphasis is on scientific methods. The main assumption of this paradigm is that the nature of reality can be observed through scientific (measurements and testing) and statistical analysis methods. Reality is considered 'out there', independent of human consciousness; is objective, rests on order, is governed by strict natural and unchangeable laws, and can be realised through experience (Sarantakos, 2005).

Despite its relevance, positivist paradigm has been criticised. This gave birth to constructivism or interpretivism ideologies. Interpretivism is concerned with text interpretation and understanding of social life (Neuman, 2014; Sarantakos, 2005). The fundamental assumption of this paradigm is that social reality depends on people's views and interpretations. The same idea is supported by Saunders (2013). The world in social phenomena has different meaning; as a result, different researches can have different conclusions for one observation. There are three assumptions in research: ontological, epistemological and methodological.

3.3. The Ontological Orientation of the Research

Ontology is concerned with the nature of reality (Neuman, 2014). There are different assumptions to see the world, as outside individuals. One of the assumptions of ontology is based on the notion that knowledge is derived from observation and measurement of objects that exist out there, as claimed by realists (Neuman 2014; Creswell, 2009). Reality is considered independently of humans and their interpretations. The nominalist, on the other hand, claims that knowledge is subjective, based on human influences and interpretations. The world in social phenomena has different meanings; as a result, different researches can have different conclusions for one observation.

Nominalist assumptions informed this study. To gain an in-depth understanding of the nature of the recycling industry in Namibia, the researcher relied on views of different actors of the industry, who were identified, namely local authorities, government ministries and recycling companies.

3.4. Epistemology Orientation of the Research

Epistemology is concerned with ways of acquiring knowledge or how people know the world around them (Neuman 2014; Bryman, 2001). In natural sciences, new knowledge is produced through deductive thinking, whereas, in social sciences, it is produced through induction reasoning, according to Neuman (2014). Through, interpretivism assumptions when investigating a social phenomenon can result in many interpretations.

Based on interpretive ontological and epistemological assumptions, the study was guided by the interpretive paradigm of research. Information was gathered through different respondents for the researcher to gain an understanding of why companies were recycling, policies and legislation guiding the operations of the industry, networks, trends and benefits of the industry through interpretation of the responses.

3.5. Methodological Assumptions

Quantitative and qualitative research methods are the main techniques used in research. Methodological assumption focuses on analysis of the methods used for gaining the data. Quantitative approach relies on the use of scientific methods to produce new knowledge (Bryman, 1989). In this case, measurements, calculations and testing of hypotheses are done. In contrast, the qualitative approach concentrates on the use of words and observations to express reality (Creswell, 2009). As a result, the findings can be open to many interpretations. In order to understand the recycling industry in Namibia, the researcher made use of interviews, observations as well as document searches.

3.6. Research Design

Research design is a plan that guides the investigator in the process of data collection and analysis (Yin, 2009). The study was a descriptive case study design, which was qualitative in nature.

3.6.1. Case Study

A case study is the study of ‘an instance in action’, according to Adelman et al., 1980 as cited in Cohen, Manion & Morrison, 2005). Case study was chosen for the study due to its versatile nature, as a research method (Hancock, 1998). By using case studies, a researcher can employ any research method in gathering data. In this study, semi-structured interviews, observations and document searches were used to gather data on the investigations of the recycling industry. In addition, case studies allow greater in-depth studies of situations, cases or phenomena in their natural or real settings (Creswell 2002) enabling the researcher to understand “ideas more clearly than simply by presenting them with abstract theories or principles” (Cohen, 2005 p.253), as the researcher is “able to penetrate situations in ways that are not always susceptible to numerical analysis”. Hancock (1998) further emphasizes the idea that a case study provides in-depth of information not usually offered by other methods. Case studies also enable the study of the causes and effects of situations in real contexts. According to Bell (1993), one of the greatest strengths of the case study method is that it allows the researcher to concentrate on a specific instance or attempt to identify the various interactive processes at work. Through interviews and observations, the researcher was able to get first-hand information on how recycling companies were operating. At some

companies, the researcher witnessed the production processes that were involved in the manufacturing of goods such as plastics.

However, case studies are not without their own weaknesses. According to Hancock (2003, p.7), one of the weaknesses of a case study approach is that “the case under study is not necessarily representative of similar cases and therefore the results of the research cannot be generalised”. The other disadvantage of case studies is that they may be biased and subjective, as the researcher may both be the participant and observer. It is not easy to cross check for such incidences noted Cohen (2005).

3.6.2. Qualitative Research

Qualitative research was used in this study due to its advantages over quantitative research. It allows for the research to be carried out in a natural setting or field where phenomena are described as they occur. Researchers do not bring participants into a laboratory (a contrived situation) as Creswell (2009, p.175) put it. The advantage is that no attempt is made to manipulate the situation under study (Hancock, 1998). In addition, qualitative data are collected through direct encounters with individuals, through one-on-one interview, by observation or through examining documents rather than relying on a single data source. Out of 20 recycling companies identified, 15 companies were investigated to gain an in-depth understanding of the recycling industry in Namibia.

3.7. Research Population

In this study, the population comprised of companies which were involved in solid waste recycling in Namibia. Babbie (2004, p.190) defined a study population as an aggregate

of elements from which a sample is selected, while Bryman (2001) defined a population as a universe of units from which a sample is selected.

3.8. Sampling

For this study, all the 20 identified companies were selected for the study and considered the target sample population. However, not every company was willing to engage the researcher and some of the companies were no longer operational. Eventually, through accidental sampling, 15 companies were interviewed; hence the sample size was 15 companies. Accidental sampling refers to the process of picking those participants who are available and willing to participate in the study (Hoyle, Harris and Judd, 2002).

Johnson and Christensen (2004) define a sample as a representative group of individuals, items, or events that participate in the study. At times, it is not possible to study an entire population or “everything we are interested in” (Becker, 2009 p. 67 as cited in Neuman, 2014) due to time or budget constraints, as Saunders (2009) pointed out. Thus, sampling is used. According to Patton (2002), no rules exist for sample size in qualitative inquiry. It depends on the “purpose of the study and the nature of the population under scrutiny” (Cohen et al., 2005, p. 101). Qualitative studies have been carried out with as many as 50 cases and as few as one (Patton, 2002; Yin, 2003).

3.9. Data collection techniques

This section describes the data collection techniques and the instruments used for this study. Data collection techniques used comprised interviews, direct observation and document search. Multi-methods or triangulation is encouraged in empirical studies (Creswell, 1994; Denzin, 1978; Patton, 2002; Yin, 2003). A variety of sources and

resources are important to assist the researcher build on the strengths of each type of data collection method. This minimises the weaknesses of any single approach (Patton, 2002).

3.9.1. Interviews

Interviews involve an exchange of views between two or more people on a topic of mutual interest (Kvale, 1996 as cited in Cohen et al., 2005). An interview entails collection of data from individuals through conversations (Koshy, 2010).

There are different types of interviews. Patton (1980, as cited in Cohen et al., 2005) identifies four types of interviews, namely informal conversational interviews, interview guide approaches, standardised open-ended interviews and closed-ended interviews. The study used semi-structured open-ended questions, which were a combination of interview guide approaches and standardised open-ended interviews. Interviews were conducted with company directors, managers, supervisors and any other officials that were available to the researcher since there was no control of who to choose to interview.

Interviews are known to have some advantages as research methods. Interviews allow for more information through in-depth discussion, follow-up questions which may not be possible in a group context (Chiromo, 2009). Additional information may be acquired through facial, bodily expressions, tone of voice as well as gestures of respondents. During the interviews, the open-ended questions allowed respondents room to air varied views unlike structured closed-ended interviews, where the respondents sometimes are limited to a range of responses, previously developed by the researcher. Even though certain questions were asked, the respondents were given freedom to talk about the topic

and give their views in their own time. Besides the flexibility of the method, the researcher was able to follow up areas of interest during and after the interviews. The participants were also able to give a broader picture on the situation on the ground.

However, interviews have shortcomings, which included distortions due to several factors such as bias, emotional state of the interviewee at the time of the interview and lack of awareness (Patton, 2002). Face-to-face interviews are also time consuming. Thus, the interviewer needs to be well prepared and organised in conducting the sessions. The researcher overcame these shortcomings by making sure that interviews were conducted when the time was convenient to the interviewees.

3.9.2. Interview guides

In conducting the interviews, the researcher made use of interview guides. Questions were prepared in advance taking heed of Patton (2002)'s idea that an interview guide lists the questions or issues that are to be explored during an interview. The use of an interview guide has advantages, as it ensures efficient use of interview time, makes interviewing systematic and comprehensive by deciding in advance the issues to be explored while maintaining the interactions focused. Cohen et al. (2005) also points that interview guides enable data collection to be systematic.

The interview guides were designed in such a way that they addressed the key issues, which needed to be answered as far as an understanding of the recycling industry was concerned. Issues such as companies motives and extent of involvement in recycling, policies and legislation for recycling, recycling products, recycling networks, benefit chains, value addition processes, awareness of recycling and challenges of the industry

were covered in the guide. Through interviews, the following data were generated: recycling products, challenges the industry faced, three main motives for recycling were highlighted, namely, environmental, economic and social, the extent of involvement companies were involved in, how the industry was regulated, recycling trends, recycling trends, value addition processes, benefit chains and linkage networks of the industry.

Data gathered answered the main objectives of the study. Appendix I give details of the general structure of the interview guides with some omissions or additions in the different guides depending on the areas of focus.

3.9.3. Direct observation

Observation, as a research process, offers the researcher the opportunity to “look directly at what is taking place *in situ* rather than relying on second-hand accounts” (Cohen et al., 2005, p. 415). Data is gathered from naturally occurring social situations. Rugg and Petre (2007, p. 110) remark that “one strong point of observation is that it shows you something, without the filtering effect of language”. Observations, according to Morrison (1993, as cited in Cohen et al., 2005, p.397) enable the researcher to gather data on physical, human, interactional and the programme settings. The researcher carried out direct observations during company visits. These were done to confirm data collected during interviews and documentation. The observation process commenced with company officials briefing the researcher about the company business, challenges faced and how they managed them. After company briefings, the researcher was taken on the tour. Through observations, the researcher collected data on activities and processes carried out by the different recycling companies. The following data were generated during this method: materials handled, machinery used, manpower, work and

storage space, operational activities, manufacturing processes, products produced, packaging, storage and dispatching of goods to markets. The researcher was able to observe recovery, pre-processing and manufacturing activities that took place at companies A, B, C, D, E, K, F and N. Manufacturing of plastic packaging and plastic pipes at companies B and D was captured during observations, confirming what was said during the interviews.

While the method is credited for providing first-hand information, several limitations have been recorded. Kothari (2004) identifies the following shortcomings:

1. It is an expensive method.
2. The information provided by this method is very limited.
3. Sometimes unforeseen factors may interfere with the observational task.

3.9.4. Observation checklist

Observations were recorded using an observation checklist. For systematic data collection, the use of checklists is encouraged as noted by Rugg and Petre (2007). The researcher kept a list of activities to be observed in diaries to record answers on a specific observation. Appendix J shows the checklist used during the research.

3.9.5. Document search

Apart from primary sources of data collection, the researcher also used documents from companies and Internet archives. Documents comprised of written material and other documents from the cases under investigation (Patton, 2002). Document search was important because it gave the researcher a general background and operation issues on the subject that was being studied. The researcher collected official documents in hard

and soft copy such as the waste management policies, regulations and reports on waste reduction measures and waste audit plus other related documents from Company (O) while company (M) documents were a report and pamphlet about the recycling industry. Document search gave the researcher an insight into the activities taking place within the organisation, for example, company (M) documents helped the researcher to verify what was happening in the recycling industry in Namibia, as some of the issues raised, like challenges of the industry, were well documented. Unlike respondents, who are aware of being studied, documents have the advantage of “unobtrusive and non-reactive measures” (Hoyle et al., 2002, p. 361). However, not all companies provided this information. Therefore, information such as general policies and legislation governing the industry was obtained from the Internet. As with other data collection methods, documents have limitations. They may be incomplete and, in some instances, inaccurate.

3.9.6. Pilot Study

A pilot study is a “small scale replica and a rehearsal of the main study” (Sarantakos, 1993, p. 277). The purpose of the exercise is to check the effectiveness of the research instruments e.g. checking respondents’ comprehension of questions or checking on cases of ambiguity (Bless & Higson-Bless, 1995; Powell, 1997; Sarantakos, 1993; Yin, 2003). Sarantakos (1993, p. 277) states that with “case studies, piloting can establish availability of respondents, accessibility of the research environment and effectiveness of the data collection technique, whether it will collect too much or too little information”. Following this argument, the researcher decided to carry out a pilot study. Piloting was carried out in March 2015 with one of the largest recycling companies in the country. It came out during the interview that questions had to be short, as long

questions ended up with part of them not addressed. Some adjustments were later made to the interview guide. Through piloting, it was possible to clarify as well as identify other issues pertinent to the study, which were then included in the inquiry. Piloting established that the time required to complete the interview guides was too long and that some of the questions were unintentionally repetitive and ambiguous. The interview guides were then adjusted accordingly.

3.10. Data Collection Procedure

This section describes the process the researcher went through to collect data from the different companies e.g. from seeking authority to conduct the study, arrangement for interviews, up to the collection of the data.

3.10.1. Seeking permission from the institutions and individuals

Before conducting research on an institution, approval to conduct the research should be obtained from the institution (Bell, 1999). At the beginning of the research, the researcher physically visited the City of Windhoek municipal officials since the researcher had no idea who to talk to. After getting contact numbers, the researcher phoned all companies that were identified to seek permission to conduct the research in their organisations. This was a lengthy and frustrating process as very few responded in an amicable way. Having explained the purpose, the researcher then sent letters to all institutions seeking permission to conduct the research in their companies as per request (Appendix G). Some of the companies did not respond despite endless efforts by the researcher to get feedback. In some instances, the researcher had to wait for up to three

weeks to get responses. Of the 20 companies identified, 15 gave the researcher permission to conduct the study. Data collection started in May 2015.

After getting permission to conduct the research in the organisations, the next step was to arrange interview appointments another lengthy process. Setting up interviews with the research participants was not an easy task with some of the participants. They would cancel appointments or request to be interviewed at short notice or simply dodged the interview after indicating the date and time of the interview.

3.10.2. The interview process

The researcher conducted all interviews personally. Before the interview commenced, a consent letter (Appendix H) had to be signed for agreement to be interviewed and audio recorded. All participants agreed to be interviewed and audio recorded. However, in all instances, the researcher was only able to use the voice recorder on two participants, as the voice recorder malfunctioned in some instances and the researcher had no back-up plan except to take down notes as the interview progressed. Information sought from the companies was to do with motives, extent of involvement in recycling activities, policies and legislation governing their operations, value addition, linkages and benefits of the industry as well as constraints they faced in their operations and how they managed them. Where given permission, photographs were taken during observations. The researcher reviewed notes at the end of each day for any insight on issues relevant to pursue in subsequent interviews. This is what Patton (2002, p. 383) refers to as the “emergent nature of qualitative research”.

3.10.3. Research ethics (Appendix A)

Issues of informed consent, confidentiality and integrity during the research are important (Patton, 2009). Ethics consider the good and bad or right and wrong with moral duty and obligations.

Observations of ethics were of great significance to the study. The researcher firstly debriefed the participants before carrying out the interviews. This was done by explaining the whole purpose and process of the study before highlighting the importance of the research. In this research, the participants were given assurance of confidentiality, and by so doing they were assured of no disclosure of information such as names of companies or respondents as such information obtained would be considered personal and private and was going to be used for academic purposes only.

Creswell (2003) advised on the importance of maintaining privacy and confidentiality during a research. The researcher used codes for companies to protect their identities and no participants were coerced to take part. During and after the study, the identity of the respondents will remain confidential. Research information from interviews and discussions were coded and kept in a safe place with confidentiality.

3.11. Data Analysis

Data analysis and presentation follows data collection. It involves making sense of data in terms of 'the participants' definitions of the situation, noting patterns, themes, categories and regularities' (Cohen, et al., p.458). Data analysis is important in order to generate findings from the raw data. It is the process of organising the mass of collected data (Creswell, 2014). The process is not left until the end, as Walter (2013) points out.

In fact, data collection and analysis take place simultaneously with qualitative research. The study applied content analysis procedure. Content analysis refers to the systematic set of procedures for the rigorous analysis, examination and verification of the contents of written data (Flick 1998: 192; Mayring 2004: 266 as cited in Cohen et al., 2005, p. 475). Desired information from a text is extracted during this procedure. Content was extracted from the interview transcripts, documents and observation notes. As the first step, transcripts of interviews were analysed by reading them. Information from the transcripts was then broken down into categories resulting in the emergence of different themes. According to Trace (2001 as cited in Nengomasha, 2009) when analysing the data, themes should be allowed to emerge rather than attempting to impose preconceived sets of themes on the data. Using the deductive approach, the researcher thematically analysed the transcript data first and then analysed these themes in light of the research questions.

Data were analysed manually although there were computer software packages that could be used to analyse qualitative data such as Atlas/ti and Hyper Qual. Mayring (2000) and Rourke et al., 2001 as cited in Nengomasha, (2009) reports that these software packages have proved their worth. Hoyle et al. (2002; p. 399) argues that computerised content analysis can analyse large amounts of data very quickly but cannot handle “verbal subtleties such as sarcasm”. The researcher considered the data collected as not being large enough to warrant the use of software.

3.12. **Data Presentation**

Data presentation differs depending on the research methods used. Quantitative research method relies on the use of statistical reports to present data. On the other hand,

qualitative research relies on the use of narrative reports, with contextual descriptions, direct quotations from research participants, graphs and tables (Hancock, 1998). Qualitative presentations were employed in the presentation of research findings of this study. This was in the form of descriptive narrative, illustrative quotes, tables and a few diagrams and graphs.

3.13. **Validity and Reliability**

Creswell (2009) emphasizes that reliability and validity are of great importance when doing a research. This idea is further supported by Patton (1990), who points out that validity and reliability are two factors, which must be of great concern to the researcher in qualitative studies while designing a study, analysing results and judging the quality of the study. Validity refers to whether the researcher measured what he/she wanted to measure (Creswell (2007)). Reliability, on the other hand, means responses to the questionnaire were consistent.

To ensure validity and reliability of the study findings, Creswell (2007), Hoyle et al. (2002) and Patton (2002) argue for triangulation, as a strategy to improve validity and reliability of research. For this study, observation, document search and interviews were used to ensure validity of the findings. The reliability of interviews for this research was observed through pilot testing. This was done to ensure that no information was missed from the respondents. Questions that were not clear to the respondents were noted and rectified.

3.14. **Chapter Summary**

This chapter discussed the research design and methodology and explained why the qualitative case study approach was used. The population was explained as well as the sampling techniques. The chapter also looked at issues of reliability and validity and ethical issues highlighting how the researcher ensured reliability and validity and took care of ethical considerations in this study. Analysis of data, research process and evaluation of the research methods were also covered in the chapter.

The next chapter presents and interprets result of the analysis carried out.

CHAPTER 4

PRESENTATION AND INTERPRETATION OF RESULTS

4.1. Introduction

This chapter presents and interprets findings of the study obtained on the primary and secondary data. The findings are presented according to the outline of the study objectives. In addition to the predetermined objectives, additional thematic areas emerged during data analysis and these are listed below:

- Industry player and their roles
- Company challenges
- Motives of companies
- Extent of involvement of companies
- Guiding policies in waste recovery and recycling in Namibia
- Legislation controlling waste recovery and recycling in Namibia
- Emerging waste recycling trends.
- Recycling value addition processes and products.
- Benefits chains of the recycling industry in Namibia.
- Network linkages in the industry.

4.2. Motives and extent of involvement in solid waste recycling

The first objective served to establish motives, and extent of involvement of companies in the recycling industry. It is, however, very important to present first the profiles of those companies that participated in the study and the challenges.

4.2.1. Industry players and their roles

Different players were involved in the recycling industry, as shown in Figure 4.1.

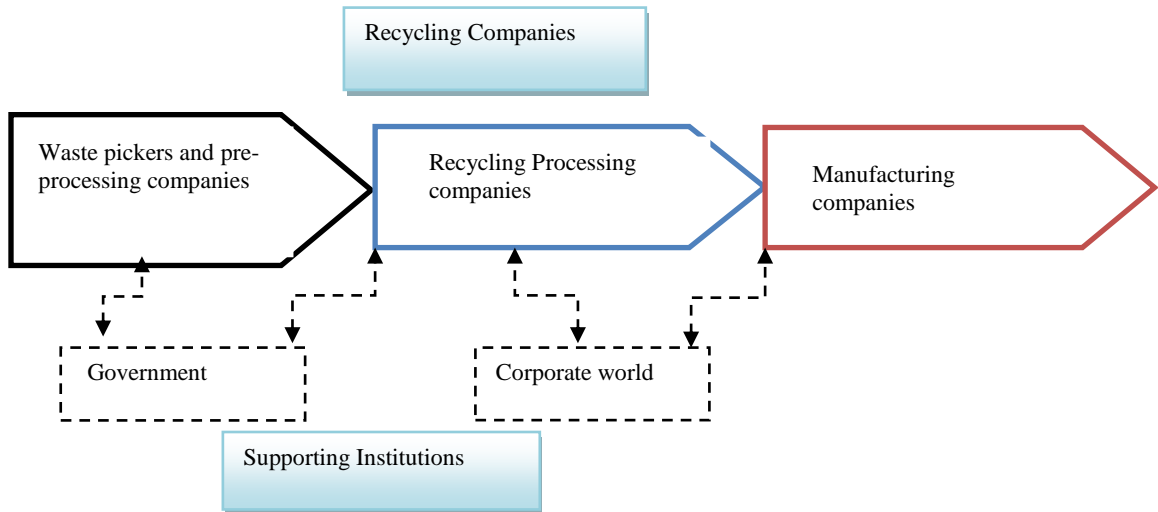


Figure 4.1: Communication lines of the players in the industry
Source: Research Data

The following sections outline the demography of participants, the roles companies were playing in the industry, the distributions of their operations within Namibia and the challenges they were facing.

4.2.1.1 Role of players in recycling industry

Both public and private institutions are involved in this industry in their different capacities, as shown in Figure 4.1. During the interviews, it emerged that players have been involved either as collectors and processors, manufacturers and packagers or supporters and promoters of recycling activities, as given in Table 4.1.

Table 4.1: The role of different players in the recycling industry

Player	Role
Government	Regulation and promotion of the industry (policies, legislation, land and other services)
Recovery participants (informal waste pickers and waste collectors)	Recovery of recyclables from bins, dumpsite, homes and institutions
Processing companies	Raw material production and distribution
Manufacturing companies	Production and selling of new products
Corporate companies	Other (supporting through transport, education, awareness raising, funding and depository facilities.)

Source: Research Data

The players were identified mainly through exploratory interviews with local authorities, desktop studies through the Internet as well as secondary sources like local media publications. Several players were identified throughout the whole country. However, only those who were willing to engage the researcher made up the sample of study. Ten companies that participated in the study were in Windhoek, the capital of Namibia. The results revealed that the years of existence of the companies varied from four years to 95 years of operation, which shows how old the participating companies were in Namibia. The number of years does not reflect years of recycling for half the companies since recycling was incorporated as a cost saving measure, a sideline activity or a valued addition process e.g. Company A. The number of workers also varied from three to over 500, indicating the size of companies and its involvement in the industry.

4.2.1.2 Demography of companies

Table 4.2: Demography of participating companies

Company	Gender of participant	Location of Company	Title of Participant	Age of company in business (years)	Years of experience with recycling	Number of Workers
A	Male	Windhoek, Walvis Bay, Oshakati, Swakopmund & Husab mine	Business Developer	27	5	+_500 total 35 Swakopmund 34 Walvis Bay
B	Male	Windhoek	Public Relations Manager	34	10	400
C	Male	Okahandja	Director(owner)	48	20	74
D	Male	Okahandja	Production Manager	10		35
E.	Male	Windhoek, Swakopmund, Walvis Bay, Rundu, Ondangwa, Oshakati, Angola, South Africa	Plant Manager	35	35	150
F	Female	Windhoek	Supervisor	8	8	56
G	Female	Windhoek	Country Representative	22	22	Not given
H	Male	Oshikango	Supervisor	20	20	53
I	Male	Windhoek	Contract manager	15		Not given
J	Female	Windhoek	Director(owner)	8	8	10
K.	Male	Windhoek	Logistic Manager	4	4	3
L	Female	Windhoek	Corporate Relations Manager	95	5	Not given
M	Female	Windhoek	Coordinator	10	10	Not given
N	Male	Keetmanshoop	Director (Owner)	22	22	17
O	Male	Windhoek	Solid Waste Management Education & Marketing Officer	19	5	322

Source: Research Data

4.2.1.3 Distribution of companies and contributory factors

Recycling activities in Namibia are concentrated in Windhoek, Swakopmund, Walvis Bay, Keetmanshoop in the southern parts of the country and the northern towns, where Namibia's largest concentration of people or major industrial activities are located. Nevertheless, in the other small urban centres' recycling efforts were being facilitated through the establishment of collection depots and buy-back centres.

An official in one company said *“Namibia is a very large country and because of that, areas in the peripheral are sometimes left out in the operations. There is a lot of recyclables lying all over the country, especially in resort areas and small settlements. Move around and see how many plastic and glass bottles are lying around.”*

The researcher also observed these recyclables heaped next to roads at small business centres, especially in the northern part of Namibia: Oshana, Oshikoto, and Ohangwena and Omusati regions. According to the participants, this was attributed to several challenges highlighted in the next section and general awareness, especially in towns. Thus, recycling efforts were concentrated in major towns but in most small centres in the countryside, it remained a challenge.

4.2.2. Challenges in the industry

While the issue of motives and extent of company involvement in recycling was being investigated, it came out that the industry faced several challenges, which, if they could be addressed, the industry would realise its full potential, as respondents pointed out.

Table 4.3: Challenges in recycling industry in Namibia

Challenge	Number of Responses
Transport and Logistics Availability of transport was a problem to some companies and where it was available the transport costs were high	3
Labour issues Lack of trained staff (skills shortage) was noted for processing and manufacturing companies, And of those skills readily available there was	5 4
lack of commitment and high turnover of skilled staff	
Financial Constraints The industry was considered capital intensive for start up companies and its viability was very marginal	4
Weather Condition Harsh weather conditions especially coastal environment affected equipments and storage of materials	2
Space Shortage of storage and operational space affected normal operations	5
Low Volumes Low volumes affected viability of establishment of recycling plants for scrap metal, glass and paper etc	4
Machinery Lack of operating machinery and equipment hampered loading and off loading, cutting, shredding, compaction of raw materials Vandalism and theft of equipment affected operations	2 1
Public Participation Poor public participation , lack of cooperation from the public and lack of awareness on recycling practices e.g. waste separation and drop off handicapped recovery and collection of recyclables	10
Enabling Environment Lack of clear policies and legislation on recycling affected full participation by all stakeholders. Lack of enough government support affected full operations of companies	4 2
Market forces - fluctuations in market prices of materials e.g. scrap metals, paper affected companies stability of income	2
Monopoly by big companies Some big companies dominated the industry through exclusive recovery and collection contracts hence disadvantaging small companies	2

Source: Research Data

Most respondents revealed that the industry was not an easy one. Respondents brought to the fore challenges they confronted in the industry after the researcher asked the question: “*What challenges are you experiencing in this industry?*” Challenges that were revealed are all shown in the Table 4.3 above.

The responses show that the companies faced different challenges. Among the challenges were poor public participation, which stood out as the major challenge reported by 10 respondents, and labour issues. Labour issues included lack of commitment and appeared to be one of the main sources of concern. In Keetmanshoop, at company N, on the interview day, the researcher confirmed during site observation that one out of 17 workers was present. At the same company, the researcher observed vandalised equipment. The researcher was shown some of the crushing machines that had their wheels removed.

4.2.3. Motives for Recycling

For the researcher to establish motives, the following question was posed to all participants who were interviewed: “*What motivated you to be involved in recycling activities?*” Respondents gave different views and some of the responses are captured in Table 4.4. Companies were driven into recycling due to three main reasons: environmental, economic and social.

All the 15 companies responded that the motivation for their involvement in solid waste recycling activities was based on environmental reasons, all companies (13) physically involved in recycling reported that their involvement was due to economic reasons and

only 3 company reported social reasons. Therefore, environmental and economic stood out as the main motives for recycling by companies.

Table 4.4: Motives for recycling by companies

Company	Environmental	Economic	Social	Core or Side Activity
A	Protecting the environment	Business Raw Materials		Side
B	Right thing to do for the environment	Business Raw materials		Core
C	Protecting the environment	Business		Core
D	Environmental	Business		Core
E	Waste reduction	Business		Core
F	Cleanliness	business	Earn a living	Core
G	Safeguarding environment	Entrepreneurs-hip	Uplifting families	Core
H	Cleanliness	Business raw material		Core
I	Waste reduction			Side
J	Environmental	Economic	livelihood	Core
K	Environmental protection			Side
L	Environmental Protection	Raw materials		Side
M	Environmental protection			Core
N	Environmental Protection	Economic		Core
O	Protect and Cleaning of the environment	Economic		Side
Total	15	13	3	

Source: Research data

4.2.4. Extent of Involvement in Recycling Industry

The extent of involvement of companies varied depending on their core activities in the recycling loop. As observed during the study, the recycling loop involves the following three major activities:

- Step 1: recovery and collection, pre-processing and processing,
- Step 2: manufacturing;

- Step 3: purchasing/selling of new products made from the recycled materials

The companies aligned themselves with all or some of these activities as will be seen in sections to follow. There were other peripheral activities which included promotion, financing etc which some other companies were involved.

4.2.4.1 Extent of involvement regarding processes

The study was based on the assumption that companies are involved in the three steps mentioned above, but these activities could be further broken down into smaller activities as illustrated later in this section.

To establish the extent of involvement regarding the processes, the following question was posed: “*What is the extent of your involvement in the industry in terms of collection, processing, manufacturing and purchasing and selling of new products?*” Responses are as shown in Table 4.5. The extent of involvement of companies emerged into five categories: collection, pre-processing, processing, manufacturing, purchasing, as summarised in Table 4.5.

The responses illustrate that all companies were involved in one way or the other, though one of the respondents had indicated during the interview that: “*There is no recycling here. We just collect and send the materials to South Africa.*” Ten (10) companies were involved in collection and pre-processing activities, the first step of the recycling loop; three (3) of the companies were into manufacturing and selling of products, while seven (7) were involved in other activities and only one (1) company was in processing of collected materials.

Table4.5: Extent of involvement with regards to the recycling process

Company	Collection and Processing			Manufacturing	Purchasing/ selling	Others/ Promoting	Total Activities Per Company
	Recovery and Collection	Pre- processing	Processing				
A	✓	✓				✓	3
B				✓	✓	✓	3
C				✓	✓		2
D	✓	✓	✓				2
E	✓	✓					2
F	✓	✓					2
G	✓					✓	2
H	✓	✓		✓	✓		4
I						✓	1
J	✓	✓					2
K	✓	✓					2
L	✓					✓	2
M						✓	1
N	✓	✓					2
O						✓	1
Total	10	8	1	3	3	7	

Source: Research Data

The findings will be further categorised into non-metallic processing, metallic processing and manufacturing and selling companies. Some companies participated in one or more activities.

a) Non-Metal Waste Processors

The following companies were directly involved with non-metals recycling. Companies A, D, K, and N. These companies are involved in raw material recovery, collection, pre-processing as well as promoting recycling as a sideline activity. The contribution and involvement of these companies in the recycling loop is given in more detailed in the following sections.

Company A: The main activity of the company was collection and processing of recyclable raw materials in Windhoek, Swakopmund and Walvis Bay, with other collections activities reported to be carried out in the northern regions of the country through depots that were established over the years. Collection was from different sources such as households, commercial businesses and industries through the use of a fleet of about 70 vehicles, which had grown over the years from one small truck. The company was involved in the free collection of a wide range of materials such as aluminium food cans; papers, glass bottles and plastics, which was also witnessed by the researcher during on site observations. However, confidential documents were charged on collection and companies were issued with destruction certificates on accomplishing the task. About eight to nine /trucks export these materials to SA per month comprising an average of 300 tonnes of glass, 100 tonnes of cans,700 tonnes of paper and 29 tonnes of clear plastic, the study found. However, these figures varied in amounts from month to month. One branch in tyre collection revealed that lack of markets for the product had resulted in the stoppage of collection of the product resulting in 70 tonnes of rubber tyres lying idle.

Company N was established in 1994 as a family business in Keetmanshoop. Initially, the company started with scrap metal recovery but at the time of research, the company was collecting and processing carton boxes, plastic paper, glass, metal cans and scrap metal (ferrous and non-ferrous). Raw materials were collected in and around Keetmanshoop, Karasburg, Ais Ais, Nerkatal dam, Gondwana lodges and NWR in the south. Most of the raw materials in Keetmanshoop were recovered from the dumpsites by contracted workers, who collected about 15,000kg of plastics per month. Individuals

who brought recyclable raw materials were paid but the practice was said to be creating challenges as the people ended up stealing from each other to get more money. After collection, materials were sorted, crushed, baled and transported to SA. Plastic and paper was chipped and used to make pillows and duvets. Apart from this effort, the company was educating people about benefits of recycling, which were met with resistance. The researcher found out that anyone who was known to support the initiative was discouraged and vandalism of equipment was evident. Efforts to open recycling stations in Karasburg and Luderitz were futile due to lack of cooperation from the people. Despite these challenges, the company was working hard to promote a culture of recycling in southern districts of Namibia. The company worked hand in hand with all recyclers from top levels down to grassroots levels. In 2013, the company was involved in a cleanup campaign, which took place at the /Ai-/Ais Resort, which yielded 17,357kg of glass in the form of bottles, 1,684kg of tins and 1,641kg of steel metal. The dumpsite was established in the early 1960s and had accumulated domestic and industrial waste over the years. The company later donated metal bins and plastic collector bags, which were used to store the materials. The raw material was transported to Keetmanshoop, where it was weighed and the proceeds were divided among the volunteers, as a token of appreciation and also as an incentive for future initiatives.

Company K: Only one company was involved in e-waste recycling at the time of study. This was a Windhoek-based company whose main business was transport and logistics and e-waste was being done as a sideline business. At the time of study, this company was involved in the collection and processing of e-waste from any generator such as residence, government institutions, commerce and industries. Collection was done for

free. However, some of the materials were brought in by the residents themselves. With the cooperation of the corporate world, the company introduced some drop off points at colleges, schools and universities and other institutions in the city. Generation of e-waste has increased in Namibia just like any part of the world due to increased usage of electronic gadgets in homes, institutions, retail and industries. A wide range of products is given in Table 4.7. Before e-waste recycling, all e-waste generated in the country was disposed at landfill and dumpsites or left idle in homes, institutions or industries. Even up to this day, not all e-waste is being recycled in Namibia. Outside Windhoek, e-waste is still being disposed at dumpsites, since this company is only operating in Windhoek and does not take e-waste from outside the capital due to a number of logistical and legal issues. Legally, the Local Authorities Act stipulates that each local authority is responsible for its waste; hence recycling across local authorities is seen as illegal. Therefore, in small towns e-waste is still finding way to dumpsites together with general waste despite known hazards to the environment and humans (for recycling to be effective and contributory to waste management this issue needs addressing). E-waste processing involved sorting, dismantling of the different components of the gadgets, baling of precious minerals and their transportation to markets and subsequent disposal of unwanted materials such as plastics to Company D and scrap metal to Company E or to the dump site. A visit to the company found that this was done in a metal structure, which was going to be replaced with a bigger and better structure as the current one was not up to standard. However, on the day of the visit, the researcher was not able to see them working and taking photos was not allowed. The researcher was able to see a variety of e-waste raw materials that were still to be sorted and dismantled.

Company D: The Company was started in 2005 and its core business was the production of plastic pellets from recycled waste plastic materials. Plastic was the only raw material, which was processed completely in Namibia and the establishment of this company was key to completing the recycling loop. About 60% of plastic raw materials were recycled to pellets at this company. Pellets are the main raw material in the manufacturing of plastic products. The recycled pellets are considerably cheaper compared to virgin pellets. A kilogram of recycled pellets is sold for N\$3 compared to N\$20 per kilogram for virgin pellets as reported earlier. Companies involved in plastic manufacturing reported that this was quite important as this reduced their costs of raw materials.

b) Scrap Metal Processors

Of the 15 companies that were under study, companies E, F and N were into scrap metal recycling.

Company E: This is a scrap metal processing company which is the largest in Namibia with branches all over the country. The company began recovery activities of scrap in 1982, as a business idea by the owner after completing tertiary education. From a small collecting truck, the company had 82 heavy trucks and an assortment of machinery for the business. The company's core business is the collection and partial processing of scrap metal, both ferrous and non-ferrous. Company E has branches in Swakopmund, Walvis Bay, Rundu, Ondangwa, Oshakati and the head office in Windhoek. The company has established two branches in Angola and the company is also a major shareholder in Scrap for Africa in Cape Town, which consists of two scrap yards. The company has contractual agreements with various industries in vessel shipping,

agriculture, fishing, transport, mining and manufacturing industries where they collect any scrap metal. Since the company only does semi processing of the products, further processing and manufacturing is done in SA and other Asian countries. Materials processed included batteries, microwaves, irons, fridges and stoves from the e-waste collected from company K, vehicle bodies and parts, steel, aluminium, copper or any scrap metal they could lay their hands on, big and small. Due to a good network of existing infrastructure, the company has gained market leadership in scrap recycling in Namibia. To promote the industry, the company was also supporting its own workers to start their own businesses in metal recycling. The researcher visited some of the small companies and, even though was not allowed to interview the companies, noticed that there was proof of scrap metal recycling that was going on.

Company J: This was a small scale-scrap metal recycling company born out of the major company E. The owners were mostly former workers of company E. As a way of empowering them; some of them were given the choice to start their own businesses. Their operations were not very different from those of Company E. As small businesses, their operations such as lifting of heavy goods, storage space depended on company E. At the time of study, company E, was involved in the collection; recovery and processing of scrap metal for onward transmission to Asian markets such as India and Indonesia through Company E.

c) Manufacturers (B, C, H)

Companies in this category were involved in manufacturing products from raw material obtained from recyclables. These companies complete the plastic recycling loop in Namibia.

Company B: Company B is a leading company in the local manufacturing industry. The company is involved in the manufacturing and distribution of plastic packaging products in Namibia, Angola and South Africa. The researcher found that products of the company span a wide range of the Namibian market such as the retail and wholesale businesses, industrial, agriculture, mining sectors, meat processing, fishing, dairy, catering and food processing industries as well as any other segment that requires packaging products. Products included the manufacturing of LDPE, HDPE and LLDPE products, and plastic bags, and sheets such as shopping bags, wrapping bags, household bags, shrink film, and many more. During the manufacturing process, there was the waste factor of about 10% of a carry bags, due to cut-out for handles and sizing. As a result of increased waste, the company failed to handle it all and this prompted it to open up a branch just for recycling plastics in Okahandja: company D. To date, the company is one of the largest plastic recycling companies in Namibia with 60% of plastics in Namibia being recycled there to produce pellets. Together with other private companies, this company spearheaded the starting of recycling stations in Windhoek at shopping centres in order to promote the industry. Today, the company as a main producer of plastics, a product which is non-biodegradable, is in the forefront of promoting recycling efforts in Namibia particularly plastics.

Company C: Indirectly, the company is supporting recycling in Namibia by buying locally produced recycled raw materials for manufacturing pipes and tanks. The company has been in the business of pipe manufacturing since 1968 producing PVC- M and PVC-U pressure pipes; PVC solid wall sewer pipes for water supply and drainage, etc. Before 2008, their raw materials were sourced from SA, which was quite costly in different ways. However, at the time of study, the company got 10% of its raw materials

locally from company D in the plastic recycling business. So the company products were for both the Namibian and regional markets such as Angola, Botswana, Zambia and Zimbabwe.

Company H: This Company, located in the northern parts of Namibia close to the Angolan border, was established in 2003. It recycles plastic to produce pellets for use in the manufacturing of its products. Initially, the company was manufacturing various plastic products, using virgin raw materials. At the time of research, online secondary sources revealed that the company was also using secondary raw materials from recycled plastic, which the company was collecting from around Oshikango and some bought from company D in Okahandja. The company specialised in the production of a wide range of plastic products, which included buckets, chairs and tables, shopping bags, and much more for both the local and international market. Although, the company is into manufacturing, it is also trying to promote the concept of recycling among the people, as it observed poor management of waste in the northern regions of the country. The company is well equipped with latest heavy machinery including injection moulding, extruders, printing machines, sealing machines, treatment machines and grinding machines.

4.2.4.2 Extent of involvement with regards to type of product materials

Not all solid waste materials were recyclable. Recycling of solid waste involves handling plastic, paper, glass, e-waste or scrap metal. The residue after sorting recyclables was thrown in the landfills. To find out more, the researcher had to establish types and nature of recyclables that companies handled. To establish this, the following

question was posed: “Which type of recyclable raw materials do you deal with?” It emerged that seven (7) product materials were being recycled as indicated in Table 4.6.

Table 4.6: Product material handling per Company

Company	Plastic	Paper	Glass	Cans	Tyres	Scrap Metals	e-waste	Total Products
A	✓	✓	✓	✓	✓	✓		6
B	✓							1
C	✓							1
D	✓							1
E						✓		1
F	✓		✓	✓				3
G	✓			✓				2
H	✓	✓	✓	✓				4
I								0
J						✓		1
K							✓	1
L	✓		✓					2
M								0
N								0
O								0
Total	8	2	4	4	3	1		

Source: Research Data

A total of eight (8) companies handled plastics, two (2) handled papers, one (1) company was involved in e-waste recycling and three companies were recycling scrap metal. Three (3) companies were not involved with any product material. These companies were not involved in physical recycling of materials, but provided more of policy, regulatory and support services. Only three (3) companies were handling more than three (3) product materials with one (1) company handling almost all the products except e-waste.

Companies A and H recycled paper and company K was involved in e waste recycling. Companies E, J and N were recycling scrap metal. Companies I, M and O were not

involved in physical recycling of materials but their roles were more of managerial and supportive in nature. Company A had the highest range of recyclable products. Six products were recycled. Companies B, C, D, E, and J only recycled one (1) product as shown in Table 4.6.

These plastics as shown in table 4.7, were divided into two major categories, that is soft and hard plastic. Soft plastic was mainly carrier bags, sheeting, wrapping and packaging, whilst hard plastic was materials like wheelie bins, refuse bags, juice and water bottles, storage containers, HDP, PVC, UPVC pipes, chairs, tables, cutlery, crate boxes, detergents containers and tyres.

Companies A and H were involved in paper recycling. Like plastic, paper was also grouped into two main categories as shown again in the same table 4.7. Paper was divided into white and brown categories. The white paper was mainly bond paper or printing paper, writing, newspapers, magazines, envelop sand brown paper consisted of carton boxes, envelops and wrapping paper. In all cases, cardboard boxes were the most in volumes and the officials explained that Namibia uses a lot of imported products and these come in various packages and cardboard-boxes were some of these. Hence, the large volumes of this waste stream.

Glass bottles were another product. Companies A, F, H, L, and N recycled glass bottles. The product was categorised according to colour that is clear, brown and green. Clear bottles were mainly of milk, soft drinks and juice, whilst brown and green bottles were for beer, soft drinks and wine bottles.

Companies E, J and N which were in scrap metal recycling concentrated on two categories that are ferrous and non-ferrous as shown in the table 4.7. Company K was involved in e-waste recycling at the time of study. This was a Windhoek based company whose main business was transport and logistics and e-waste was being done as a sideline business. A variety of e-waste materials were being processed by the company such as computer monitors, printers, personal computers, computer mouse, keyboard cables, phones, swiping machines, and any other electrical electric kettles, hair brushes, microwaves which were sourced from industries, households and institutions.

Some of the respondents (Company A & D) further categorised their plastics into recycling symbols or codes as shown in Table 4.8.






Respondents categorised these materials further as shown in Table 4.7.

Table 4.7: Spectrum of recyclables materials in further categories

Material	Category	Types
Plastic	Soft	Carrier bags, sheeting, wrapping packaging,
	Hard	Wheelie bins, refuse bags, juice and water bottles, storage containers, HDP, PVC (vinyl), UPVC pipes, chairs, tables, cutlery, crate boxes, detergents containers, tyres
Paper	White	Bond paper, writing, newspapers, magazines, envelops
	Brown	carton boxes, envelops and wrapping paper
Glass/ Bottles	Clear	Milk, soft drinks and juice
	Brown	Beer, soft drinks
	Green	Beer, soft drinks,
Scrap metals	Cans	Steel and aluminium (soft drinks, beverage, fruit)
	Ferrous	Steel, iron
	Non-ferrous	Aluminium, copper, brass, silver, lead, nickel, tin, zinc, gold, silver, platinum
E-waste	Industrial	Desktop computers, mouse, and computer screens, mp3 players, irons, microphones, laptops, calculators, printers, copy machines, keyboards, fax machines, cod players, video machines, speakers, remote controls, cameras, kettles, toasters, vacuum cleaners, answering machines, DVD players, electronic toys, servers, modems swiping machines mobile phones, batteries, circuit boards, hard disks, and monitors and sporting equipment, and any other electrical
	Household	Televisions, electric kettles, hair brushes, microwaves, irons, food processors, toasters: home appliances such as, air conditioners, electric cookers and heaters, fans, DVDs, radios

Source: Research Data

Table 4.8: Plastics recycling codes and symbols

Recycling Code	Recycling Symbol	Examples	Recycled Products
Code 1 PET or PETE plastics		Soft drink, water and beer bottles; mouthwash bottles; peanut butter containers; salad dressing and vegetable oil.	fleece, tote bags, furniture, carpet,
Code 2 HDPE plastics		milk jugs, juice bottles; bleach, detergent and household cleaner bottles; shampoo bottles; some shopping bags; motor oil bottles; butter and yogurt tubs; cereal box liners.	laundry detergent bottles, oil bottles, pens, recycling containers, floor tile, drainage pipe, lumber, benches, doghouses, picnic tables, fencing
Code 3 PVC or V plastics.		Plastics like window cleaner and detergent bottles, shampoo bottles, cooking oil bottles, clear food packaging and piping.	Are rarely recycled and are recycled into: decks, panelling, mud flaps, roadway gutters, flooring, cables, speed bumps, mats
Code 4 LDPE plastics		plastics such as those found in squeezable bottles, bread, frozen food, dry cleaning and shopping bags; tote bags; plastic benches; carpet	recycled into bin liners and cans, bins, packaging materials, floor tiles
Code 5 PP (polypropylene) plastics		Yogurt containers, syrup bottles, sauce bottles, caps, straw. Companies, however, handled mainly caps	Can be recycled into signal lights, battery cables, brooms, brushes, auto battery cases, ice scrapers, landscape borders, bicycle racks, rakes, bins, pallets, trays.
Code6 PS (polystyrene) Plastic		Disposable plates and cups, meat trays, egg cartons, carry-out containers, aspirin bottles, compact disc cases	Insulation, light switch plates, egg cartons, vents, rulers, foam packing, carry-out containers.
Code7 Miscellaneous plastic		Gallon water bottles, 'bullet-proof' materials, sunglasses, DVDs, iPod and computer cases, signs and displays, certain food containers; Recycled into: Plastic lumber, custom-made products	Recycled to: Plastic lumber, custom-made products

Source: Horward (2008)

4.2.4.3 Extent of involvement in collection modes and other activities

Different modes of collection were used and materials collected from different sources as well. The researcher also established how companies were able to source materials for recycling. The following question was posed: “*Where do you get the recyclable materials and how?*”

a) Source of material

Recyclable materials were collected from different sources. Table 4.9 shows sources of raw materials.

Table 4.9: Sources of raw materials by company

Sources of Products						
Company	Household	Institutions	Commercial	Industries	Others	Total Sources
A	✓	✓	✓	✓	✓	5
B					✓	1
C					✓	1
D				✓	✓	2
E		✓		✓	✓	3
F					✓	1
G			✓		✓	2
H	✓	✓	✓	✓		4
I						
J		✓	✓	✓	✓	4
K	✓	✓	✓	✓		4
L					✓	1
M						
N	✓	✓	✓	✓	✓	5
Total	4	6	6	7	10	

Source: Research Data

Five areas for material recovery were identified. Companies A and N collected their raw materials from all five sources, while five companies indicated less than two sources. Ten companies had other sources of material from farms, mines, construction site, shipwreck site, fisheries, and resorts. Table 4.9 also shows that companies were competing for the recyclable raw materials, with seven companies collecting from industries, while only four companies were collecting from households. The fact that more companies were collecting from industrial than residential areas may suggest that there were incentives given by industries than residential areas.

b) Collection modes

Recyclable raw materials were collected through different modes, as shown in Table 4.10.

Table 4.10: Collection Modes

Collection Modes	Source of Collection
Kerbside	Door to door
Drop-off centres or clear bag systems	Shopping centres, residential, open spaces, company premises
On-site	Landfill, industries, mines, schools, institutions

Source: Research Data

Table 4.10 shows that three modes of collection were identified: Kerbside (door to door), drop-off centres (shopping centres; open spaces) and on site (landfill, industries, mines, farms, schools and institutions). From Table 4.11, only 2 companies collected through kerbside system and the majority of the companies collected using drop off centres and on site collection.

Table 4.11: Modes of collection by company

Company	Kerbside	Drop-off or clear bag systems	On-site
A	✓	✓	✓
D		✓	
E		✓	✓
F			✓
G		✓	✓
H	✓	✓	✓
J		✓	✓
K		✓	✓
L			✓
N		✓	✓
Total	2	8	9

Source: Research Data

c) Other activities

Companies A, B, G, I, l, M and O were involved in recycling through other activities such as promotion, education and awareness campaigns about recycling. During the time of study, respondents were in agreement that much more still needed to be done with regards the public and industries awareness about the benefits of recycling. Based on the findings, seven (7) companies were involved in general awareness and education about the need to support recycling in the country. The following companies were involved in promoting recycling efforts: company O, G, M, I and L. This section briefly outlines the activities of companies in this regard and an endeavour to change attitudes and behaviour of people towards recycling.

Company O: The Local Authorities were not involved in physical activities of recycling. However, it was their responsibility to facilitate recycling activities in

Windhoek. Company O in Windhoek which also doubled up as a local authority had to ensure that systems were well developed and implemented to manage the waste and any waste related activities because they were obliged to do so according to law. In addition, the company had the responsibility to ensure coordination among various stakeholders, in both public and private sector in as far as recycling is concerned. In order to control and regulate the companies involved in recycling activities, company O developed a Registration and Licensing System (RLS), for instance, contracts were issued to recycling companies for a period of 5 years. Through the strategy, recycling companies were compelled to register with the CoW and to submit Waste Management Plans of their recycling businesses as well as providing data pertaining to their operations. At the time of study, the study established that a number of small companies who had registered to be in the recycling business had stopped operations due to failure to meet all business requirements but the most crippling factors noted was financial and technological.

In addition to management tasks, company O was also involved in recycling education and public awareness. This awareness was in conjunction with other companies (B, D, M and L) and any other interested stakeholders like banks. In support of this, the researcher noted company O had a newsletter specifically for public awareness and clean-up campaigns program for 2015 for school education programs, public awareness and community meetings. The company thought that people's attitudes and behaviour had to be changed to ensure the success of recycling as a waste minimisation and prevention strategy. In Windhoek, public participation was mixed in this regard. Population in high income suburbs were considered more receptive about the idea than

some of the population in low income suburbs. Therefore, local authorities were instrumental to the success of recycling by promoting it, availing land for establishment of facilities and registration, licensing, monitoring and coordinating the efforts of recycling and waste management companies.

Company G: Through a telephone interview with the country representative, the researcher established that company G had been in operation for the past 25 years. The founder started the company to address proactively the steel beverage can industry's waste. So the company was involved in facilitating the collection of beverage cans both aluminium and tin-plated steel cans around Namibia in partnership with other private partners. Having realised that some parts of the country had a lot of waste left littering the country side, company L, and Dresselhaus Transport assisted in the transportation of metal cans to Windhoek where the compressed scrap is sold to steel mills in South Africa. The company took the initiative to be involved in clean up campaigns as well as recovery and collection of beverage cans. It operates on the principle of people taking responsibility for their environment. According to records made available, since 1994 just over 809 tonnes of metal cans were removed from the environment, by 2015 the amount has increased six fold to an average yearly load of 4 000 tonnes being collected for recycling. In 2002, a record amount of more than 7 000 tonnes of cans were collected across Namibia. Apart from assisting with collection of cans, the company together with other private organisations promoted recycling through cleaning campaigns as well as sponsorship programs.

Company M: In 2008, company M was established by a group of individuals and organisations to promote and facilitate recycling in Namibia. The company partnered

with different interested stakeholders in its efforts to establish collection points in different parts of the country. For example, in 2012, they partnered with the Global United Football Club Environmental Programme (GUFC) to place recycling stands in Henties Bay (coast). In 2013; Henties Bay became the focus of the GUFC activities with the Henties Bay Municipality as their main partner. According to the coordinator of the company, it was the mouthpiece of the Namibian recycling industry, which was committed to promote the 3 R's: recycling, reducing and reusing of solid waste. It was the aim of this company to successfully implement projects that raise awareness, and changed the behaviour of Namibians to embrace the 3 R's through projects such as the Schools Recycling Competition with the theme 'Catch them young', donation of recycling bins, clean up campaigns and provision of transport as the country was said to be still lagging behind in terms of the culture of recycling. A number of companies were reported joining the organisation where networking in the promotion of the 3Rs was facilitated. As a result, the company found it imperative to bring different stakeholders together including the general public to share relevant information about recycling. Unfortunately, the company bemoaned limited data and information on recycling and that despite the enactment of the Environmental Management Act No.7 of 2007, waste management and in particular recycling, was not yet high on the agenda of most stakeholders sharing the same sentiments aired by company G.

Company L: Company L is committed to environmental protection among other social responsibilities outside their core business of brewing beverages. In order to achieve this, the company was involved in promoting recycling at the corporate level. During the production process, it was reported that their manufacturing business produced a lot of

waste both liquid and solid. Solid waste generated was sorted on-site into plastic, glass (where possible, already colour-sorted), steel, aluminium and paper. Over 80% of all inorganic solid waste produced was collected and recycled by an accredited waste contractor. The waste contractor also provided, what it calls, File 13 containers for offices use. Its involvement is pronounced in Sponsorship of Schools recycling competition. The company recently added Namibia Wildlife Resorts - in particular the Okaukuejo and Halali rest camps - to its list of companies with collection points where it picked up recyclable raw material such as paper, glass, plastic and tins destined for its depot Windhoek. Company L was part of this, since the introduction of the initiative in 2010. The company sponsored a number of clean-up campaigns across the country and schools competitions. One of the schools in Windhoek won N\$10 000 cash prize as part of the competition.

Company I: During the interview, with the Contract Manager of company I, it was revealed that the core business of this company was construction and management of landfill sites in some towns of Namibia. Although, it was not physically involved in recycling activities directly, the company was facilitating and managing logistics for picking and collection of recyclable raw material from landfill sites by waste pickers to recycling facilities.

4.3. Policies and legislation guiding waste recycling

The existence and awareness among companies of policies and legislation that governed their activities as well as procedures and guidelines in use was investigated. This next section establishes policies and legislation guiding waste recovery and recycling in the industry. It presents the interview results, as reflected by the participants regarding their

general knowledge on policy and legislation governing their activities and information from secondary sources. The views of the respondents varied from one participant to the other.

4.3.1. Policies and guidelines guiding waste recycling

The existence and awareness among companies of policies, procedures and guidelines that regulated their activities were investigated. The researcher asked the question: *“Are there any recycling policies that govern your activities and, if not, what do you do?”*

No national policies on recycling was the general answer given. *“We have our company policies, procedures and guidelines that we follow”*, company N responded.

Although there is no direct stand-alone national policy on recycling, there are policy components that are directly and indirectly promoting recycling in Namibia. Authorities in Namibia have shown support for recycling indirectly through four policy instruments.

4.3.1.1 Government Waste Management Policy

Through literature, the researcher discovered one such policy that was on the ground, the Government National Waste Management Policy, July 2010 of the Ministry of Health and Social Services. Directly, the policy objective advocates for waste minimisation, which can be achieved through waste recycling among other initiatives.

The objective of the policy is to:

“Ensure public health and safety, and the conservation of the environment by encouraging proper waste management by all stakeholders in order to reduce risks from transmission of diseases and injuries, reduce environmental pollution,

improve astatically the surrounding and derive economic benefits from waste minimization and improved land values” (Performance Audit Report,2013).

Companies B, C, D and O were aware of the government’s need to ensure public health and safety in their operations as industries. In order to ensure this, some of the companies had waste management plans which are a requirement, according to the WMP.

4.3.1.2 Public Private Partnership Policy

The government was promoting industrialisation in the country through the Public Private Partnership (PPP) policy considering the benefits that come with it, as revealed in literature. Industrial development was seen as a shared responsibility between the private sector and the government, hence the government was advocating for this approach.

The aim of PPP is to:

“deliver improved services and better value for money primarily through appropriate risk transfer, encouraging innovation, asset utilization and integrated life management under pinned by private financing of infrastructure and government services (Namibia Public Private Partnership (PPP) Policy”, p.3).

Although the policy does not directly talk about recycling, it addresses issues of service provision by government and government entities e.g. company A and Municipal Authorities were working together to promote recycling, hence the issues of waste management services and the need to reduce waste and protect the environment were part and parcel of this cooperation.

4.3.1.3 City of Windhoek Waste Management Policy

Company O, took a proactive approach through the development of a Waste Management Policy (2009). The main objective of the policy was to provide a framework for promoting effective waste management in order to reduce undesirable impacts of waste on the environment and human health as a result of unnecessary waste generated and unacceptable waste practices. In addition, the Waste Management Policy was aimed at reducing the amount of waste per capita as well as reducing waste treated at landfill sites. Prevention measures could only be achieved at industry level, therefore, Namibia being primarily a consumption society; can only minimise waste by promoting recycling. It was a requirement for all businesses to have a waste management plan given to the council and failure to comply resulted in business permit being withdrawn.

4.3.1.4 Formal–Informal Partnership Policy (Integration Policy)

During discussions with company O, it was evident that the company had embarked on a policy that promotes the integration of formal and informal waste recyclers. It was observed that, at landfill sites, instead of previous attitude of opposition and indifference waste pickers (scavengers) collected discarded recyclables from refuse landfill or dumping sites and sold them to the formal recycling collectors. Some were even contracted to reclaim these recyclables on behalf of the recycling companies A, F and N. This was also observed in other towns of Windhoek, Swakopmund and Keetmanshoop.

4.3.2. Legislation regulating recycling

Legislation enabling and governing the companies' operations in recycling was investigated. The research question was: *“Are there any recycling laws that govern*

company businesses and what they do? The study established that Namibia did not have an overall waste recycling National Act or regulations to provide a framework for solid waste recycling. Neither did it have an overall waste management act to provide a framework for solid waste management. Instead, individual local authorities controlled waste management through creation of their own by-laws approved by the local government ministry.

Companies felt that the industry could perform better if there was legislation to provide rules on how the industry should operate. *“No recycling law, so no one can take me to court for not recycling”* was a clear indication that companies, households and individuals were not obliged to participate in recycling. Despite that the industry was regulated just like any other business operating in the country.

4.3.2.1 Regulatory Environment

To solicit information about the regulatory environment, the researcher asked the question: *“What legislation guides the work that you do?”* Responses varied from one respondent to the other. Some respondents displayed ignorance of the regulatory environment that they operate under. However, most participants identified Council Regulations to be controlling their operations. This is what they had to say:

- 1) According to company A officials in Windhoek: *“Oooh, yes, the municipality regulates all our activities. Moreover, we also follow labour regulations and safety procedures where applicable. For instance, our workers are supposed to put on protective clothing like boots, overalls and goggles when breaking glass bottles”*.

- 2) *“No one can take me to court because I am not recycling. The law is not there. My vision is to see Namibia turning into a recycling nation. Go to Europe, in Sweden, recycling is a must,”* said Company A official in Swakopmund.
- 3) Company L official, was very detailed in the response to the question. *“Yes, these are the regulations that we have to follow; EMA, 2007, Labour Act, Health and Safety, Employment Act, Local Authorities Act, ISO Standards and others”*.
- 4) Companies K and L highlighted that they follow most of the industrial regulations in the country.
- 5) Company N official in Keetmanshoop said, *“There is no one who controls our activities or checks what I do. I just do what I want. The council is not even interested in recycling, they just dump”*. This is something the researcher witnessed when a council official came to the landfill and dumped cardboard boxes among recyclables.
- 6) Company I official, who held the position of supervisor, showed ignorance on this matter as she was even hesitant to give a response *“I don’t know, but yes the council”*.

These responses coupled by the fact that almost all towns practised open dumping with on a few land-filling highlighted the need for legislation.

4.3.2.2 Legislation controlling company operations

Some participants highlighted some pieces of legislation which controlled their day-to-day operations as businesses. A summary of legislation cited is given in the Table 4.12. At the time of study, any company was legally bound to operate within the framework of

these pieces of legislation. Eight (8) of the respondents indicated that the Health and Safety Act controlled their operations, while seven (7) mentioned the Labour Act and the Local Authorities Act, and six (6) the environmental management act (EMA).

Table 4.12: Legislation guiding recycling

Company	Legislation						
	EMA 2007	Labour Act	Health and Safety Act	Affirmative Act,1998	Local Authority Act,1992	ISO Standards	Other
A		✓	✓	✓	✓		
B		✓	✓		✓		
C	✓	✓	✓	✓	✓	✓	
D.	✓	✓	✓		✓		
E.			✓		✓		✓
F.							
G.	✓	✓	✓			✓	✓
I.							✓
J.							✓
K.	✓	✓	✓	✓		✓	✓
L.	✓	✓	✓	✓	✓	✓	✓
M.							✓
N.							✓
O.	✓				✓		
Total	6	7	8	4	7	4	8

Source: Research data

4.3.2.3 Environmental Management Protection Act, 7 of 2007

Any business operating in the country is obliged to ensure its activities do not cause health and environmental hazards. The Environmental Management Act No. 7 of 2007 – states that “*sustainable development must be promoted in all aspects relating to the environment; and that damage to the environment must be prevented and activities which cause such damage must be reduced, limited or controlled*”. The Act also promotes Integrated Waste Management Hierarchy that focuses on waste prevention and minimisation ahead of waste disposal.

According to this law, any activities carried out need to cause minimal damage to the environment. In order to reduce the effects of waste generated during the manufacturing process, company B reused and recycled its waste component according to the guiding principles of the EMA. Moreover, they were taking their campaign even to the consumers to avoid indiscriminate dumping of package materials through reuse or proper disposal as they were fully aware of the environmental hazard of plastic waste, which takes long to decay due to its polymer elements. Company O, as a regulatory body, ensured proper waste management by any waste generator and operators within its area of jurisdiction.

4.3.2.4 The Local Authority Act, 23 of 1992

Under this Act, local authorities are required to administer, control and manage local areas of their jurisdiction. Among the many responsibilities, they were to manage any solid waste related activities such as generation, transportation, treatment and disposal. In order to meet these requirements, local authorities made some by-laws under the Act, such as waste management regulations. At the time of study, not all local authorities had these by-laws as revealed by the Auditor General Report of 2012/2013. However, the City of Windhoek was one of few municipalities, which had some regulations in place. In addition, it was the duty of the council to register all business activities related to recycling. Companies reported they were complying with the set rules and regulations although monitoring was done once in a while.

4.3.2.5 Solid Waste Management Regulations No. 16 of 2011

The Company O, being a regulator at local level by virtue of the Local Authorities Act, Act 23 of 1992, developed Solid Waste Management Regulations. Among other goals, the Solid Waste Management Regulations support the implementation of the waste management hierarchy and waste management plans. The regulations also allow various strategies to be developed in order to promote sound environmental waste management practices. All waste-related activities are controlled by these by-laws within the city, hence all activities had to be registered with the City Council and operations monitored through health inspectors. Non-compliance was accompanied by some penalties as provided for by the by-laws. It was a requirement by council regulations in Windhoek, that all operating businesses furnish the Department of Waste Management with their waste management plans. According to the Regulations, the Council may identify and require a waste generator to submit a Waste Management Plan according to which their waste will be managed to ensure human safety and protection of the environment against waste hazard.

4.3.2.6 Labour Act, Number 11, of 2007

The Labour Act regulated health and safety issues of employees at work which employers were expected to adhere to. It protected employees from unfair labour practices and regulated basic terms and conditions of employment. It was an obligation by companies to adhere to the conditions as set out in the labour statutes. For instance, workers in company A, B, C and E were provided with protective wear such as boots, goggles and overalls although some workers did not use them.

4.3.2.7 Water Resources Management Act, No. 11, of 2013

The law aims to provide for the management, protection, development, use and conservation of water resources and to provide for the regulation and monitoring of water services. According to the law, any person or business activities which involve the generation, transportation, storing as well as waste disposal, have to ensure precautionary measures are taken. Even though participants did not mention this piece of legislation, they were legally bound by it through the Municipal by-laws and regulations just like any other person in the country which states that “*A local authority or any other authority or person that has authority over any area in which any domestic or industrial activity, that may cause pollution, takes place, is ultimately responsible for the prevention of any pollution in that area.*” In relation to this, recycling companies were to take the necessary precautions to ensure that no activity or situation resulted in water resources pollution. In line with this, local authorities were bound to monitor any water polluting activities in areas of their jurisdiction. For example, Company O through its SWMP ensured that waste generators or industries had the necessary measures in place for proper waste monitoring. They also monitor activities of waste disposal so as to ensure environmental protection.

4.3.2.8 Standard Act. No. 18, of 2005

Quality standards in Namibia are regulated by the Standards Act of 2005 (Act No. 18 of 2005). The Act provides for the promotion, regulation and maintenance of standards relating to the quality of goods for use by consumers. It is the duty of the Namibian Standards Institution to monitor quality of manufactured products in the country.

Companies B and C, which are into production of plastic goods, pointed out that their products adhered to required standards both nationally and internationally for trading purposes. Company C complied with ISO 9001, 14001 and 18001 at the same time.

4.3.2.9 Affirmative Action (Employment) Act, No. 29, of 1998

Article 10 and Article 23 of the Namibian Constitution provides for the establishment of the Employment Equity Commission; to redress discrimination in employment. In line with this, the Affirmative Action (Employment) Act, 1998, was introduced to achieve equal opportunity in employment and to eliminate discrimination in employment among certain groups, for example, disability, women and race which was linked to discriminatory laws and practices of colonial governments. This Act was another legal control measure that specifically applied to industry in Namibia and the recycling sector was not an exception. Four companies were aware of this law and its principles. In line with this Act, companies were taking the initiative to promote balanced employment of all genders as women in the past were discriminated upon on employment matters. The majority of workers at company A were women at all the three stations in Windhoek, Walvis Bay and Swakopmund. At Company E, women were employed in positions traditionally reserved for males with targets already surpassed. *“Yes, we are now also employing women, but this industry is not for them. The work is strenuous and dirty.”* The researcher observed one lady at company E, who was struggling to shred an iron block.

4.3.2.10 Public and Environmental Health Act No. 1, of 2015

The main objective of the Act is to create a healthy environment among other objectives by promoting public health, preventing injuries and disability through encouraging community participation. In terms of Section 3, it is the duty of every local authority to take all necessary and reasonably practicable measures for maintaining its local authority area in a clean and sanitary condition for the prevention of health nuisance, unhygienic conditions and other harmful occurrences or for remedying conditions liable to endanger public health. Section 51 stipulates that all waste generated must be collected, disposed of and recycled in accordance with the management of the waste stream. It also provides for efficiency, affordability and sustainable access to collection, disposal and recycling of waste in the community. None of the recycling companies were aware of this new Act but the old Public Health Act of 1919. This is the only piece of legislation which directly addresses recycling but only in general terms. It places the responsibility of recycling on the local authorities in line with Agenda 21, which promotes the implementation at local level.

4.3.3. Summary

The general response was that no specific policy on recycling existed except for company policies. One company held that they had a policy commitment for recycling to maximise the diversion of waste materials from disposal sites and to encourage waste generators and operators to recycle through their waste management plans enacted in 2009. Thus, the consensus was that there are no direct policies and legislation for governing recycling in Namibia hence there is a need for these instruments to focus on raw material recycling.

4.4. Emerging waste recycling growth trends

This section presents the interview results to questions regarding recycling patterns in the industry established during the study, in terms of recycling trends, areal expansion, number of companies, growth in volume and employment,

4.4.1. Emerging waste recycling trends

To establish trends within the industry, the researcher asked: “*Can you please highlight any changes that have taken place since efforts to promote recycling began?*” Table 4.13 shows the established trends and patterns that came out clearly from the responses.

Table 4.13: Recovery and collection trends in recycling

TREND	
Informal-to-formal sector collection	Private companies observed to be playing a more active, role which was traditionally performed by the informal sector and growth in number of players in the industry on the increase
Mixed-to-source separation and collection	A move away from traditional approach to <ol style="list-style-type: none"> i) ‘drop-off centres’ at shops and schools ii) ‘drop-off-points’ in residential areas iii) ‘buy-back’ centres in small towns iv) Source collection from households (kerbside), commercial businesses, institutions, industries, mines, farms, construction sites, resorts, open spaces observed and waste generators contracts signed with big recycling companies.
Recycling collection programmes	Identified programmes were <ol style="list-style-type: none"> i) Clear bag system in Windhoek, ii) Orange bin in Swakopmund, iii) Buy-back centres, iv) Catch them young schools recycling competition
Recovery facilities	The new trend being that of establishing <ol style="list-style-type: none"> i) Material recovery facilities ii) MRF at the landfill sites as observed in Swakopmund
Formal and informal sector partnerships	Working together moving from the traditional approach of not paying attention to the sector

Source: Research data

4.4.2 Areal Expansion (recycling outside major centres)

Two company officials (A, E) reported that their operations had expanded outside Windhoek through the establishment of branches in Walvis Bay, Swakopmund, Henties Bay, Oshakati and Ondangwa. In smaller centres, recycling depots are being set by big companies in the industry e.g. in Rundu Recovery of materials is taking place both in urban and non-urban environments, e.g. construction sites, resort centres all over the country. Table 4.13 already shows these places of operation.

4.4.3 Growth in the number of companies in the industry

Statistical information about the exact number of companies in the industry at the time of study could not be obtained. However, information made available by three participants indicated that there were a growing number of companies that were getting involved. *“It is no longer the case of big companies but even small and medium enterprises (SMEs) is getting involved, especially in Windhoek as reported.”* Several companies were reported to have shown interest around 2010 when City of Windhoek was promoting recycling efforts. Nevertheless, by the time of study, Company O official reported that many small companies had pulled out, as they could not meet the operational requirements because they were undercapitalised and lacked knowhow.

4.4.4 Trends in prices of products

Company N gave information on scrap metal prices that showed fluctuation over the period from 1994 to 2016. Table 4.14 shows price fluctuations for scrap metal over the period.

Table 4.14: Scrap Metal prices over the years

Year	Price range/tonne
1994	\$1200/
2008	\$6,000/
2016	\$2,000/

Source: Research data

Companies E and N officials highlighted that price fluctuations were common due to market forces. In 1994, one tonne of scrap metal was sold at N\$1 200. The highest price was in 2008 when one tonne was sold at N\$6 000. In 2015, prices were reportedly subdued, thus companies were holding their products in anticipation of better prices.

4.4.5 Growth in volume of recycled waste

Companies were quick to mention that the amount of recyclable raw materials was increasing but refused to give statistical information, citing confidentiality. Hence, descriptive information of what was happening in general was all the researcher could get. However, Company O made available data for clear bag system on domestic waste generated and recycled in Windhoek for a period of four years.

a) CBS domestic waste generated and recycled in Windhoek

Figure 4.2 shows a comparison of waste generated, recycled and disposed in suburbs using the clear bag system from 2011 to 2014 when recycling promotions started.

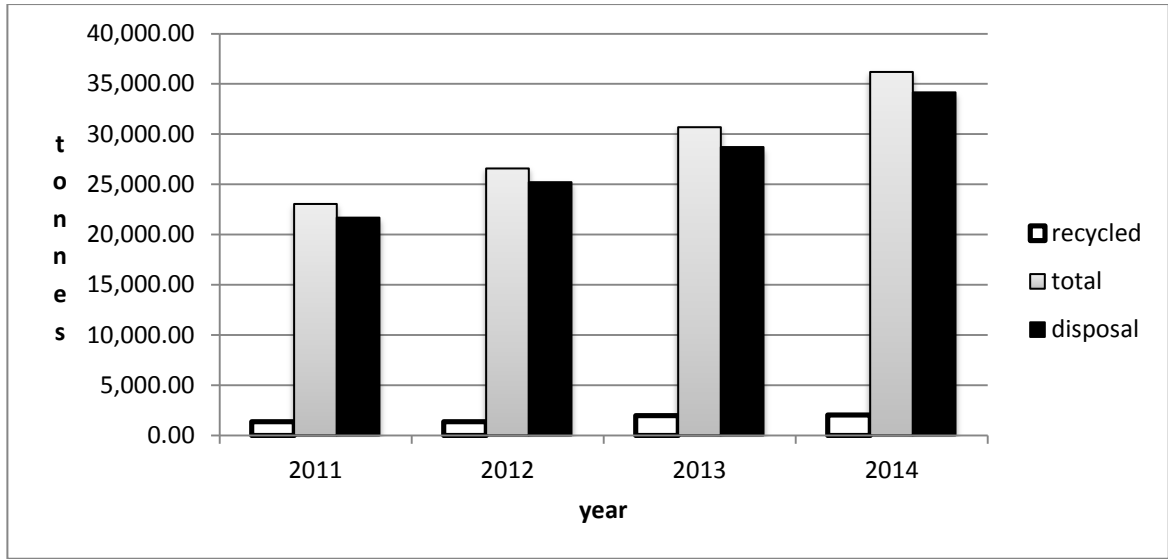


Figure 4.2: Domestic waste generation and recycling in Windhoek
Source: City of Windhoek, 2015

The figures show an upward trend corresponding with the amounts of waste generated, disposed or recycled. Table 4.15 shows the amount of waste generated and recycled in the form of figures.

Table 4.15: Percentage of waste recycled in Windhoek

Year	Weight from CBS recycled (tonnes)	Weight generated (tonnes)	Recyclable material raw
2011	1,361	23,042	5.9%
2012	1,366	26,578	5.1%
2013	1,975	30,685	6.4%
2014	2,033	36,188	5.6%

Source: City of Windhoek, 2015

The percentage of household waste diverted from landfills through recycling was very low. The figure was almost constant but, volumetrically, the figures are on the increase.

b) Recyclable material collected at MRF vs. ward contractors in Windhoek

Figure 4.3 below shows the quantity of recyclables collected through the household collection system and the ward contractor system.

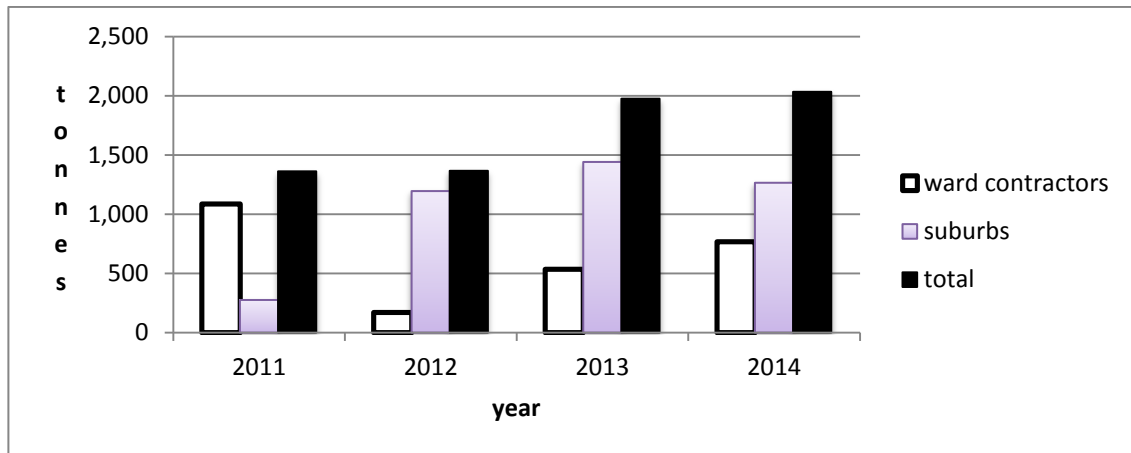


Figure 4.3: Trends of recyclables collected at MRF (tonnes/year)
Source: CoW, 2015

Figure 4.3 also shows that the volume of recyclable material collected at MRF by ward contractors was high in 2011, slightly above 1,000 tonnes. There was a drop in 2012 and slight increases in 2013 and 2014. The only explanation for the drop was high operation costs, which forced small companies to stop recycling. Recyclables from suburbs started off low in 2011, rising to a peak in 2013 before dipping in 2014. In general, there has been a combined increase in the tonnages collected over the three years, with more waste collected in 2013 and 2014. This could be due to the increase in awareness and effort by the collectors.

c) **Recyclable material collected by companies in Windhoek**

The total quantity of materials recycled by companies by material category could not be availed to the researcher. A few companies like E and K availed their monthly and

yearly production figures shown in Table 4.16 and 4.17 respectively at the time of the study in 2015.

Table 4.16: Company E production figures

Recyclable raw material	Production (kg/month)	Annual Production (kg)
Scrap metal	35,000	420,000
Steel cans	12,000	144,000
Aluminium cans	1,000	12,000
Glass	42,000	504,000
Plastic	15,000	180,000
Carton, boxes and paper	20,000	240,000

Source: Research data

Company E was producing an average of 12,000kg of recyclable raw material per annum based on these figures. Scrap metal was the main product, which was recycled ever since the practice was introduced in the country. Since 2010, recyclable materials recovered have increased in diversity.

Recycling of e-waste started in earnest in 2011. The few records of e-waste collected demonstrated a decline in volumes over the years. This could be tribute to a decline in disposal of stock accumulated by companies and individuals over the years.

Table 4.17: Company K production figures

Year	Volumes (tonne/yr)
2013	59
2014	28
2015	9.2 (Jan-Oct)

Source: Research data

4.4.6 Employment trends

Company A revealed that women were becoming more involved in the industry, particularly in the pre-processing segment of the industry. Previously, male dominated the industry. However, despite women involvement, the official emphasized that:

“This is not an industry for women. The tasks are very strenuous and also dirty. Women need light jobs. Look at that one dismantling that iron block, that’s hard work.”

4.4.7 Growth of total recycling in Namibia

Notable efforts to promote total recycling of products were reported. However, during the time of the research, total recycling in Namibia was still limited to plastics. Table 4.18 shows companies involved in total plastic recycling and product manufacturing in Namibia. Four companies were involved in total plastic recycling, as shown in the table. A variety of products were also produced locally.

Table 4.18: Companies contributing to total recycling in Namibia

Company	Activities by company	Product
A	Recovery of recyclables material	raw Plastics recovered: bins, carrier bags, detergent bottles, plastic sheets, wrapping packaging, wheelie bins, refuse bags, juice and water bottles, storage containers, chairs, tables, cutlery, crate boxes, detergents containers, tyres
D	Production of recycled materials (pellets)	raw Pellets produced: <ul style="list-style-type: none"> • PETE (Polyethylene Terephthalate) • HDPE (High Density Polyethylene) • V (Vinyl’s including Polyvinyl Chloride) • LDPE (Low Density Polyethylene) • PP (Polypropylene) • PS (Polystyrene)
C	Manufacturing of pipes	Pipes produced <ul style="list-style-type: none"> • HDPE (High Density Polyethylene) • PVC (Vinyl’s including Polyvinyl Chloride)
B	Manufacturing of plastic products	Packaging plastic, containers, bins
Wholesalers and Retailers	Selling and packaging	Pipes, packaging plastics, bins, containers

Source: Research data

4.5. Value Addition Processes and Benefit Chains

Value addition processes to produce various products and benefit chains associated with the industry were investigated and the results are presented in this section.

4.5.1. Value Addition Processes

The researcher wanted to establish how companies were involved in value addition processes in the recycling industry. A question was posed to the participants: “*What value are you adding to the recyclables you are involved with?*” Responses varied. The general answer from companies which were involved in recovery activities was that little value addition was done. ‘*I wish everything is done here because we sent our things out and later buy them very expensive*’ company N official said. What follows is a presentation in tables highlighting the different products and the value addition processes that were involved. Figure 4.4 shows the observed processes in Namibia especially in plastic recycling where total recycling was taking place.

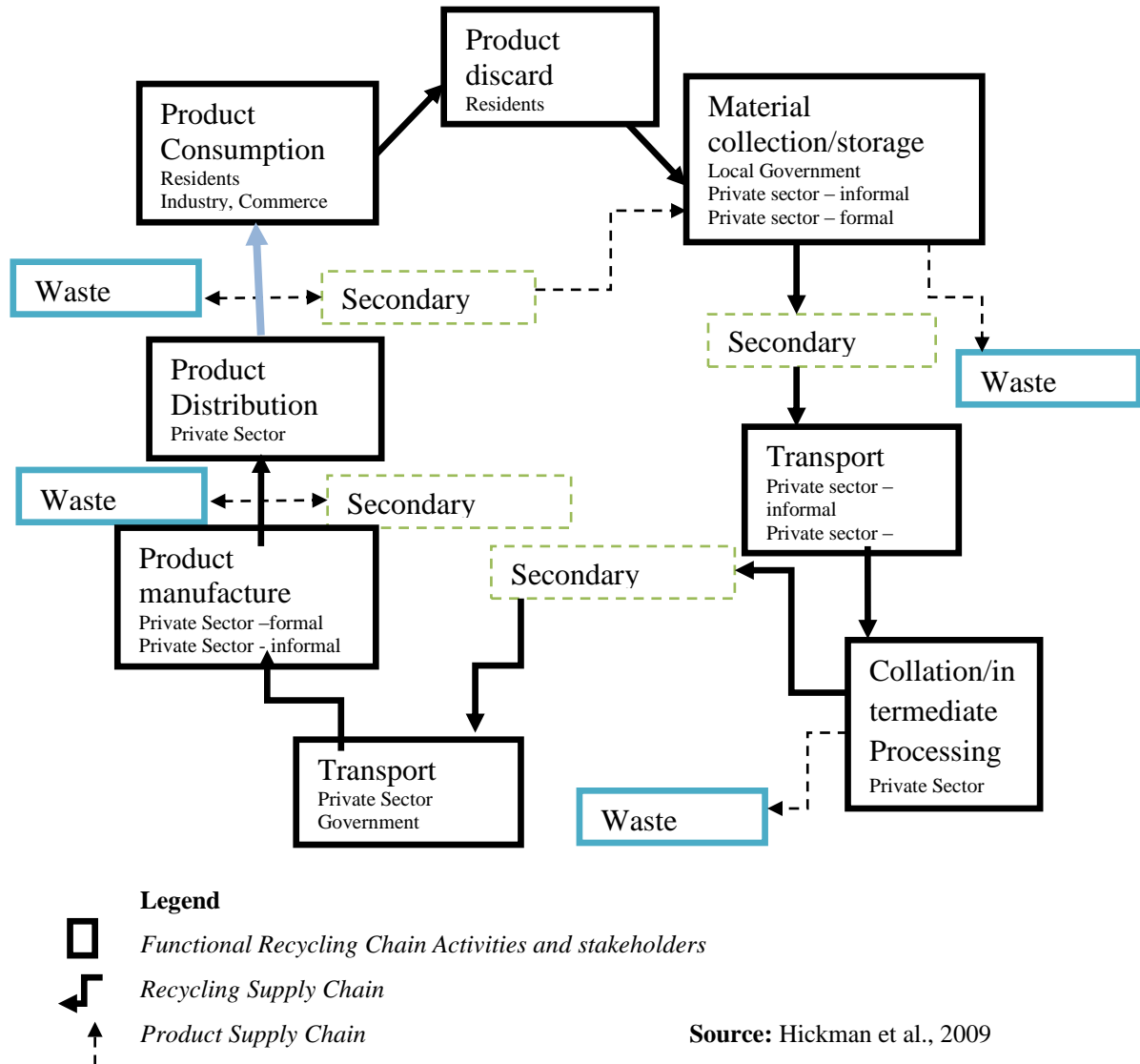


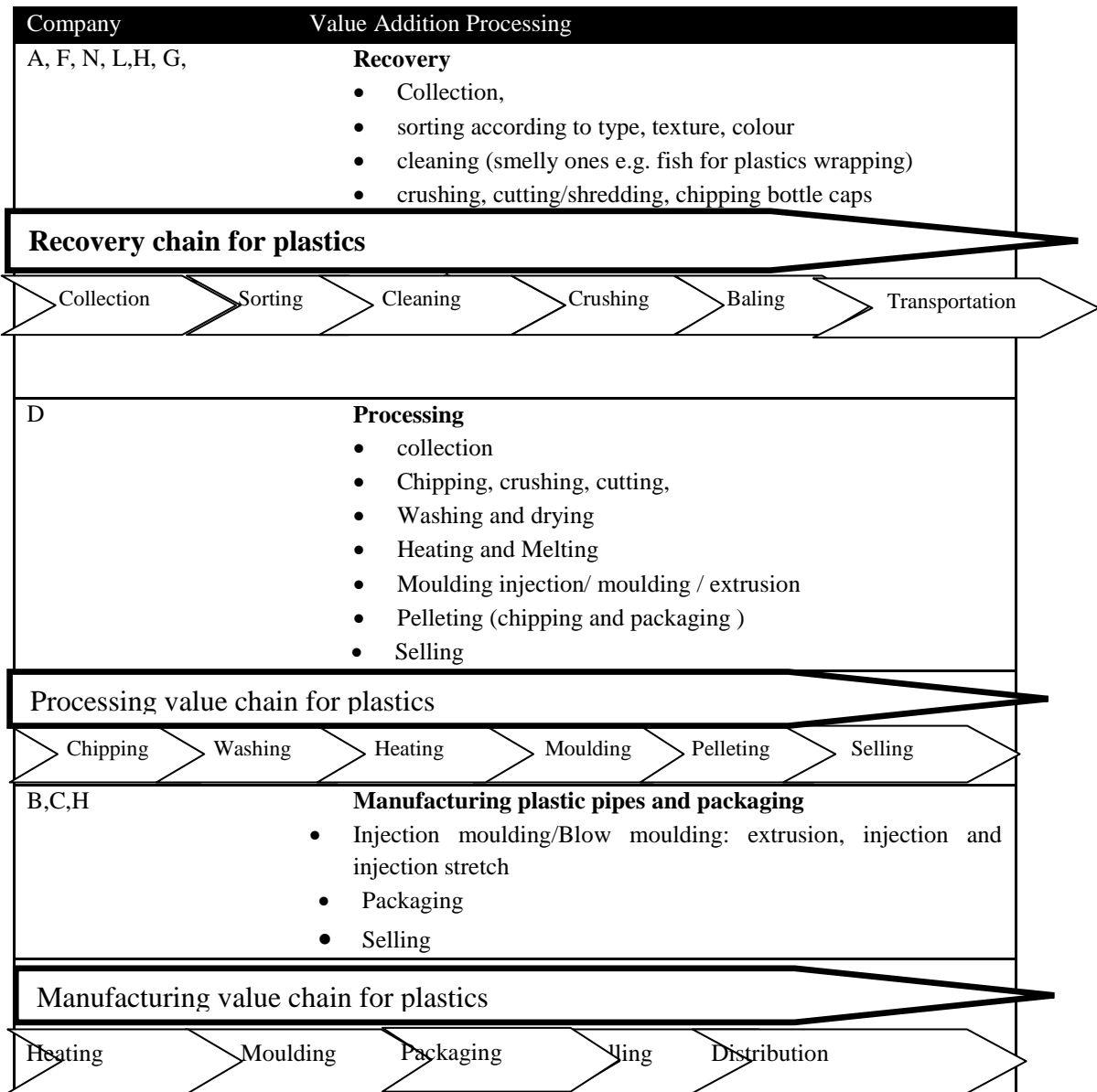
Figure 4.4: Processes observed in Namibia total plastic recycling

4.5.1.1 Total recycling in Namibia- value addition processes for plastic

Plastics undergo various processes during recycling, as highlighted in the Table 4.19. Four major processes of value addition for plastics were identified, that is recovering, processing, manufacturing and selling. At the time of study, seven companies were involved in recovery activities of plastic; companies A, F, G, H, L, and N. Only one company was involved in production of pellets as raw materials; three companies were

into manufacturing of plastic products like pipes and plastic packaging as well as selling to wholesalers. Table 4.19 shows the value addition processes for plastic as observed in Namibia during the study.

Table 4.19: Value addition by Company for Plastics in Namibia



Source: Research data

Plastic was the only product which was undergoing 100% recycling in Namibia that is from collection to sell of new products. As mentioned earlier on, plastics of different types, as shown in Table 4.7 and 4.8, underwent different processes in order to enhance product value. According to self-observation, the recycling of plastics in Namibia involved processes such as collection including transportation, storage, sorting, baling and transportation; chipping/ shredding, washing using disinfection chemicals, pelleting, packaging, and transportation; product manufacturing, quality control, packaging, and distribution; and marketing and selling were considered as the main recycling value chain processes observed for plastics.

These steps were observed as value addition processes in the recycling of plastics. The study established that collection marked the first step in the recycling value chain process following discard of the plastic waste materials. Plastics for recycling came from two main sources: post-consumer (households, institutions, businesses) and post-industrial (rejects from industries, for example, off-cuts, damaged batches and packaging material) which mainly came from company B.

Upon collection, materials were stored ready to be sorted, which was done manually. At company A, in Windhoek, there were 35 sorters on the conveyer belt. Each one of them concentrated on one type of plastic, for example, Polyethylene Terephthalate (PET), High density Polyethylene (HDPE), Vinyl Plastics (PVC or V) as given in table 4.8. These were also further sorted according to texture and colour.

At Company A plastic from the fish industry was cleaned using a cleansing detergent, which was considered very expensive. The same was reported for plastic from mines

which was said to be heavily polluted with corrosive materials at times. Great care was needed during the cleaning process since some of the plastic containers were used to carry dangerous products. The company ensured adequate protective clothing for its workers. All this added to high costs of plastic recycling for the company.

After sorting, most of the plastic materials were compacted or chipped to reduce bulkiness and volume before they were baled for the end user market. Compaction was done using machines or by hand depending on available company's resources. Wheelie bins, beverage crates were washed to remove any impurities and chipped into small pieces. At company A, drinking bottle tops were granulated before baling.

At company N, some chipped soft clear plastic was used to make pillows, duvets and throw over blankets. The owner of the company however complained about the lack of markets for the products as people preferred to buy elsewhere. As a result, the researcher just saw these products piled with prospects for finding buyers. However, most of the plastic from these companies were transported to South Africa for further processing. However, some of the plastic was taken to Company D which is in Okahandja, about 100km north of Windhoek, for further processing.

Company D: The major business of company D in the value chain for plastics was the production of plastic pellets which are the main raw material for manufacturing of plastic products. This is the only company identified to be producing these raw materials locally. The different processes involved in pellet production are discussed below.

The company collected all sorts of plastics sourced and received from anyone including companies highlighted in the previous section. Chipping of the plastics was the first step.

This involved cutting products such as wheelie bins, beverage crates into small pieces to be melted down. Dirty wheelie bins had to be washed first to remove contaminants. Chipping was done using a chipper. After chipping of all plastics, the next stage was washing. The chips were washed in an alkaline detergent to remove glue, paper labels, dirt and any remnants of the product they once contained. This was done in a spinning tower after which, the plastics were rinsed and dried ready for the pelleting process.

The pelleting process was considered as the most important part of the processing. The extrusion process was the technique used during value addition at this company, whereby the plastic material was melted in a tubular metal chamber. The molten paste was then extruded like toothpaste from paste tube through hole like mince grinder. The plastic came out like spaghetti strings. In order to avoid tangling of the strings, the strings were immediately immersed in cold water to solidify before cut into very small oval shaped pellets using a rotating cutter. The pellets were dried and packed. The different plastics such as PET and HDPE were produced in a similar manner.

Company B and C: Only two companies A and B visited were manufacturing plastic products using some of the raw materials obtained through the pelleting process described above.

Colour difference distinguished the recycling pellets from virgin pellets which are pure crystal white. Only 10% of raw materials used were from company D however, the official interviewed at Company C emphasized the importance of supporting this company to promote local industrial development tend cheaper products. At the same company, pellets were used to make pipes for a variety of purposes, for example, irrigation, sewage and waste water supply. According to the company director, virgin

pellets produced more durable pipes compared to secondary or recycled pellets. Thus, water pipes which were some of the products manufactured were made only from virgin pellets, but Irrigation and sewage pipes were mainly produced using secondary raw materials.

Company B, the mother company for company D, produces a variety of plastic packaging products such as carrier bags, meat packaging plastics, agricultural bags, refuse bags as well as liquid containers. Both virgin and secondary pellets were used in the production process. Only packaging made from virgin pellets are used for packaging consumables as those made from secondary raw materials are considered not safe. Company H was also into manufacturing of plastic products such as chairs and household utensils etc. The researcher could not manage to visit the company due to logistic problems.

Production of these plastic products at company B and C was through injection and blow moulding processes. Through the injection moulding process, pellets were first melted before injecting the melt into a cavity mould followed by the cooling and ejection processes for subsequent finishing. At company B, films of plastics were produced from the mould upon which the films were fed into cutting machines to produce carrier bags or waste bins; packaging plastics were labelled later. In order to produce coloured plastics, colourful virgin pellets were mixed with secondary pellets before the melting process. The researcher established that a number of carrier bags used by most retail shops in the country as well as wrapping plastics used in the meat industry are manufactured at company B. The company produced products according to customer's specifications. For example, some customers require thinner packaging plastics whilst

others require thicker packaging plastics. The thinner the packaging the cheaper they were.

Upon production of new products, manufactured products were first checked for any defects before packaging and storage in a large warehouse before delivery to different customers in and outside the country. Any products with defects were considered waste and thus sent to company D for recycling. Quality control was considered very important as part of policy requirement by the government and international standards. The researcher witnessed the loading of carrier bags destined for Angola during the study period. The company has wholesale shops around the country, thus some of the products were sold locally.

The same also applied to company C, the pipes manufactured were stored in company warehouses awaiting dispatch to local and regional markets. Quality control is also considered to be very important. Thus, any defects detected, the products were abandoned as rejects and sent back in the recycling chain.

4.5.1.2 Value Addition for Paper

Paper undergoes varying processes during recycling. The different processes carried out in Namibia are highlighted in the Table 4.20.

Table 4.20: Value addition by Company for Paper in Namibia

Company	Processing
A,N	<p>Recovery</p> <ul style="list-style-type: none"> • Collection • Sorting • Shredding • Baling • Transportation to final destination
<p>Recovery chain for paper</p>	

Source: Research data

Companies A and N were the only two companies that were involved in paper recycling. Different types of paper such as newspapers, white printing paper, writing papers, paper packaging, and envelopes with or without plastic windows, telephone books, magazines and cardboard/carton boxes were handled as shown in table 4.20. Company A handled a lot of cardboard paper since most of the country's consumer goods are imported packaged in various packages including cardboard. Wholesalers disposed a lot of these paper products. The rest of paper products were collected from various sources such as households, retail shops, industries and institutions. Upon collection of the different papers, sorting of the papers was the first process that was done by the two companies. At Company A, apart from receiving single stream waste, they also received comingled waste which was sorted into different categories of paper. To reduce dust emission and odour, the waste was constantly sprayed as the labour-force hand sorted the materials. The papers were sorted by type, colour, texture i.e. hard or soft and white or khaki. After sorting, cardboard/carton boxes were simply compacted and baled before transportation to South Africa for further processing. On average 700 tonnes of cardboard boxes were

being exported to South Africa every month by company A. Newspapers were also treated the same baling in 5-tonne batches. Paper with contaminants such as glue or paper clips was condemned and thrown at dumpsites as it was costly to clean them. However, soft white paper especially from institutions such as banks, government offices was shredded first for confidential or sensitive documents before baling them. The rest of the papers were simply sorted and then baled. The final step was transportation to South Africa since Namibia does not have facilities for further processing. The study found that it was quite difficult to set up a paper recycling plant in the country due the fact that most paper packaging is done in South Africa for the products that Namibia imports. Thus, the companies found it cost effective to export the recyclables. However, the researcher feels that some of the paper could be recycled locally to produce smaller products with a ready market.

4.5.1.3 Value addition for glass bottles

Companies A, N and F were into glass bottle recovery. The bottles underwent varying processes during recycling at different companies in Namibia. The different processes are highlighted in the Table 4.21.

Namibian recyclers are also involved in glass recycling. Pre -processing of glass is the only value addition process done as no facilities are available in the country for total recycling. A glass recycling company which was meant to carry total recycling failed to be built in Tses a small settlement town in the southern part of the country. According to information gathered during interviews this failed due to lack of support from relevant authorities despite endless efforts by the entrepreneur. At companies A, F and N involved in glass recycling, upon collection, glass was sorted according to colour:

brown, green and clear, as well as type of use: juice, soft drinks, beer, milk jars, beverage drinks. Beer bottles constituted the most. After sorting, bottles were either sent to local bottling companies and wholesales that paid the providers of these products or reuse or crushed. Crushing of the glass was done manually, but due to the hazardous nature of the job, workers involved had to put on goggles.

Table 4.21: Value addition by Company for glass in Namibia

Company	Processing
L	Transportation <ul style="list-style-type: none"> • Glass bottles
A,N, F	Recovery <ul style="list-style-type: none"> • Collection • Transportation • Sorting • Crushing • Baling Transportation to final destination

Recovery Chain for Glass bottles

Collection → Transportation → Sorting → Crushing → Baling → Transportation

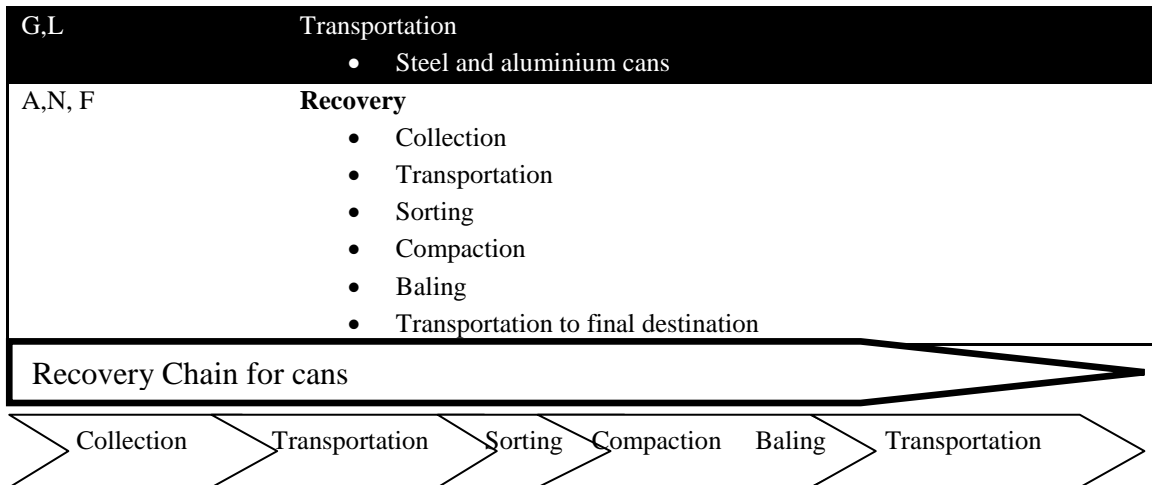
Source: Research data

After crushing, the glass was baled into 5 ton bags ready for transportation to South Africa for further processing and subsequent production of new glass containers. At company F, lack of transport resulted in hording of excess stock leaving no spare capacity to accommodate any new supplies. The study also found out that some of the glass bottles collected especially outside major centres do not reach their destination due to transport problems and loading equipment. Consequently, some of the bottles are simply left lying at assembly points in the rural areas and eventually destroyed. The issue of buy- back centres is therefore suggested as a solution to this problem.

4.5.1.4 Value addition for cans

The main processes of value addition for cans are highlighted in the Table 4.22

Table 4.22: Value addition by company for cans in Namibia



Source: Research data

Namibia is also involved in cans recycling. Five companies were involved in recycling cans. G and L were involved in the transportation of these cans while companies A, N and F were involved in recovery and the other value addition processes identified in Table 4.22. Pre-processing of cans is done as no facilities are available in the country for total recycling. Both steel and aluminium cans were collected and pre-processed by different companies. The major value addition process was collection, crushing of the cans to reduce bulkiness, baling and finally transportation to South Africa for further processing.

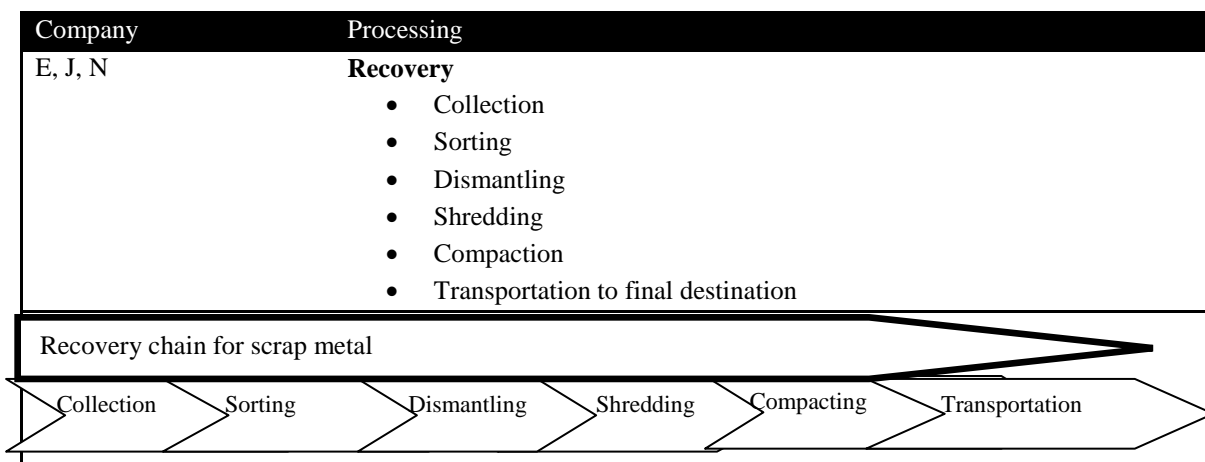
4.5.1.5 Value addition for scrap metals

Companies also collected a variety of scrap metal: ferrous and non-ferrous from industries, from construction companies, farms, ship wrecks and mines as well as

individuals. Scrap metals were reported and observed to undergo various processes, which are summarised in the Table 4.23.

Three companies (E, J and N) were involved in scrap metal recycling, which involved separating metals from the mixed scrap metal stream or the mixed multi-material waste stream.

Table 4.23: Value addition by scrap metal companies in Namibia



Source: Research data

Company E had contracts with mines, NAMDEB, Nampower, shipping companies and Trans-Namib for scrap collection and disposal. Collected scrap metals could be seen in heaps in the scrap yards ready for dismantling and sorting, which were done mechanically, but some materials were also dismantled manually. The final step was crushing or compaction and baling of the pieces before transportation and shipping to Asia via Walvis Bay port. Loading machines were used to load the materials onto the containers. Due to lack of equipment, small companies like Company J hired loading equipment from company E adding more costs to their operations. The company paid about \$400 per hour for hiring the equipment. Although this was a reasonable rate for

the construction industry, it was considered very high due to low returns from the recycling industry.

4.5.1.6 Value addition for E-Waste

Only one company K in Windhoek was involved in e-waste recycling at the time of study. The company was involved in all the processes highlighted in Table 4.24 plus transportation to South Africa for further processing.

Table 4.24: Value addition by Company for E-Waste in Namibia

Company	Processing
K (E-waste)	<p>Recovery</p> <ul style="list-style-type: none"> • Collection, • Sorting, • Dismantling, • Cutting • Baling • Transportation to final destination

Recovery chain for e-waste

Source: Research data

The e-waste recycling process was found to be highly labour-intensive. According to literature, e-waste recycling involves the following further steps: use of over-band magnet, non-metallic and metallic component water separation. Components of e-waste retrieved are sent to recyclers of plastic and metal. Complete e-waste recycling value chain involves primary processing: collection, transport, sorting, devolution and dismantling, shredding and separation; and secondary processing. The study established that in Namibia, primary processing is the only processes done before to South Africa

were secondary processes were carried out. A variety of electronic waste materials such as desktop computers, mouse, computer screens, mp3 players, irons, microphones, laptops, calculators, printers, copy machines, keyboards and ATM machines were collected from various sources within Windhoek only. These materials were either collected by the company mobile trucks or dropped off at the industry by the consumers. On the day of visit, the researcher witnessed, an assortment of materials that had already been sorted, dismantled and some shredded. A lot still had to be processed and baled. Dismantling was done to retrieve essential elements as well as to remove hazardous metals before sending to further markets. South Africa was the final destination of all the retrieved valuable materials for further processing. The products were baled in 5 ton bags.

4.5.2. Benefit chains associated with recycling processes.

Recycling is known to have a lot of benefits, according to literature, and the study sought to establish the situation relating to Namibia. The researcher posed the question: *“What are the benefits associated with recyclable raw material wastes in the area you are involved in?”* Responses of individual companies are summarised in the Table 4.25.

Table 4.25 summarises the views of the different participants regarding recycling benefits. Fourteen (14) of the respondents highlighted that the industry creates employment, while 8 revealed that it saves natural resources, 8 pointed out that it is a source of raw materials and 9 noted it keeps the environment clean.

Table 4.25: Benefits of Recycling

Benefit	Company														No.	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N		O
Environmental																
Reduces waste dumped at landfill	√								√						√	3
Promotes sustainable development	√	√											√	√		4
Cleans the environment		√		√	√		√			√	√	√	√	√	√	9
saves natural resources	√	√			√		√			√	√	√		√		8
waste reduction measure	√						√						√			3
reduces pollution	√	√	√								√		√			5
Economic																
creates employment, source of income	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	14
defer investment on landfill									√						√	2
creates and promotes new businesses	√															1
Cheap raw material	√	√	√	√	√				√	√			√			8
Cheaper goods		√	√				√	√								4
Cost saving on wastes removal operations									√						√	2
Local economic development			√		√											2
Potential Source of revenue			√		√											2
Social																
Source of livelihood for the poor									√	√				√		3

Source: Research data

Figure 4.5 gives an illustration of the fish-bone diagram to represent primary and secondary benefit chains of recycling. Secondary benefits can further be sub-divided into indirect benefits.

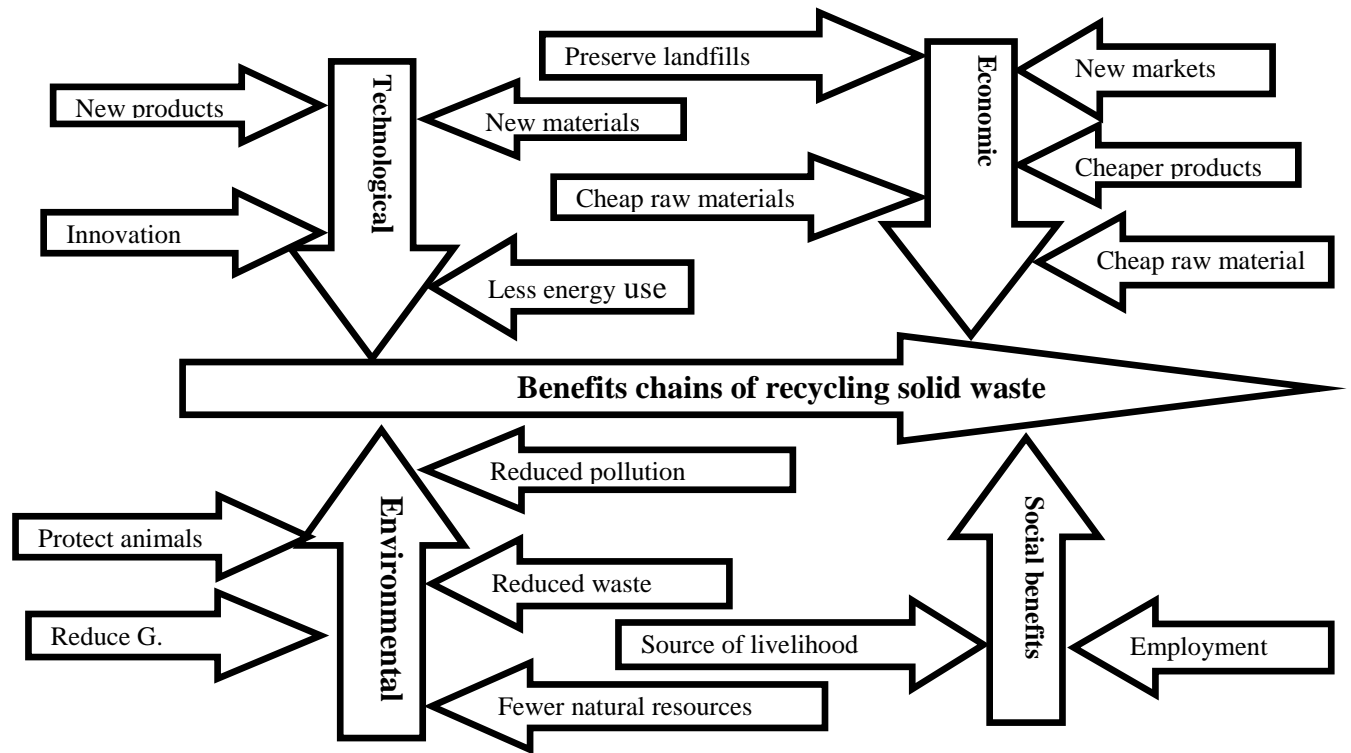


Figure 4.5: Benefits chains of recycling solid waste

Source: Research data

4.6. Network Linkages in the Industry

Local and regional backward and forward operational network linkages in the industry in Namibia are presented. Information gathered shows that most companies had both local and regional linkages.

4.6.1. Forms of linkages

Table 4.26 shows forms of network linkages in the industry from secondary sources.

Table 4.26: Forms of linkages

Institution	Recycling Companies	Linkages
Government institutions	Recycling Companies	Education information flow Promotional information flow
Waste Generators		Raw material flows Promotional information flow
Waste Pickers		Raw material flows Promotional information flow
Transporters Corporate World		transport and logistics Promotional information flow, Funds flow, Education information flow receptor material linkages, transport logistics linkages Partnership
Academic Institutions		Research information flow

Source: Research data

The predominant forms of linkages are material flow, and promotional and education information flow. Due to the infancy of the industry in Namibia, the latter are very important linkages.

4.6.2. Local Company Linkages

Local linkages are considered as linkages between companies in Namibia. Table 4.27 shows the entity's backward and forward linkage players and the form of linkage that exist between them.

Table 4.27: Local backward and forward linkages of companies

Company	Backward Linkages	Form of linkage	Forward Linkages	Form of linkage
A	Municipalities, Households, Industries, Commercial Retail and Wholesale companies, Government institutions, banks, schools, colleges, universities, Waste Management companies, waste pickers, Mines, Fishing Companies	Promotional, Information flow, land resource and Material flow Funds flow	Company D, Transport companies and Landfill companies	Raw Material flow Waste flow Transport logistics
D	Company A, Households, Fishing Companies, plastic packaging c	Raw Material flow	Hardap Plastic Distributors, North West Plastics-Ondangwa, Ogowa Vehicle Company, O, H, C, B	Raw Material flow
E	Government, Trans-Namib, Nampower, Namdeb, Oshakati, Mines, SMEs, trolley-man, Shipping Companies	Raw Material flow	none	Raw Material flow
K	Windhoek-Households, Industries, Institutions, individuals, corporate World-Private companies promoting the Green Movement, FNB, Samsung, NEC	Raw Material flow	Company O, landfill sites, Company E, Tsumeb Customs Smelters	Raw Material flow Manufacture products flow
B	Government, Company O, Company D Okahandja, virgin RM from Overseas Suppliers, Financial Institutions, Company M, Company A	Raw Material flow information, financial	Markets-shops, wholesales	Manufacture products flow Funds flow
N	Keetmanshoop, Karasburg, Ais Ais, Company NWR, Gondwana Lodges, Nerkatal Dam	Raw materials flow		
L	Individuals, Wholesalers and retailers, NWR, Companies M, G, educational institutions, O		Company A	Raw material flow
C	Company D	Raw materials flow	Markets-shops, wholesales	New products flows
F	Landfill sites, open space picking	Material flow	Company A, Coca Cola	
I	Waste Management Divisions, Scavengers, WM companies			
M	Namibian Populace, WM companies and recycling companies, institutions e.g. schools, Corporate World	Education information flow Promotion information flow	local	Education information flow Promotion information flow
J	Local businesses, trolley-man, farms,	Raw material flow	Company E	Raw material flow
O	All Companies	Education information flow Promotion information flow	All Companies	Education information flow Promotion information flow

Source: Research data

Information gathered shows that all companies had local linkages in one form or the other.

4.6.3. External Linkages

Table 4.28 shows external linkages for the companies under investigation. The backward linkages are as presented in Table 4.27. For confidentiality purposes, the actual company names were not given but only cities and countries of operation are provided.

Table 4.28: Forward regional and international linkages

Company	Forward Linkages	Form of linkage
A	Regional: South Africa Companies in Cape Town, Durban and Johannesburg, International Company in Finland	Raw materials flow Partnership
E	Regional: South African scrap metal companies, International: Asian Markets- Vietnam, India	Raw materials flow
K	Regional: South Africa	Raw materials flow
B	Regional: South Africa, Angola,	New products flows
N	Regional: South African Markets, International: Asian Markets	Raw materials flow
C	Regional: Angola, Botswana, Zambia, Zimbabwe	New products flows
F	Regional: South Africa	Raw materials flow
J	Regional: South African Markets International: Asian Markets	Raw materials flow

Source: Research data

Most companies had internal and regional linkages in terms of raw material flow, but a few had information and resources flows (human resource, transport, machinery, financial, partnerships) linkages. For raw material flows, regional links were mainly with South Africa and international link with Asian markets. For new products, the links

are mainly regional with South Africa, Zambia, Zimbabwe, Botswana and Angola. The researcher was not privileged to get the name of recipient companies in these countries.

4.6.4. Regional and Local Linkage Nodes

Figure 4.6 shows the local, regional and international material flow linkages networks and nodes.

4.7. Summary

The study established that recycling is still in its infancy in Namibia, and the industry faces challenges such as weak legislation resulting in low participation levels. Plastics, papers, glass, cans, scrap metals and e-waste are the materials that were being recycled at the time of study. Recovery and pre-processing were the main recycling activities that were executed in Namibia with further specialised processing and manufacturing completed outside the country. Only plastic had complete recycling in Namibia.

Data showed that recycling was undergoing transformation with private sector involvement becoming more entrenched in an industry that was previously dominated by the informal sector. The establishment of material recovery facilities at the source was a great step towards promoting the industry and employment creation. All actors viewed linkage networks in the industry as very important for survival.

Discussion of these findings follows in the next chapter.

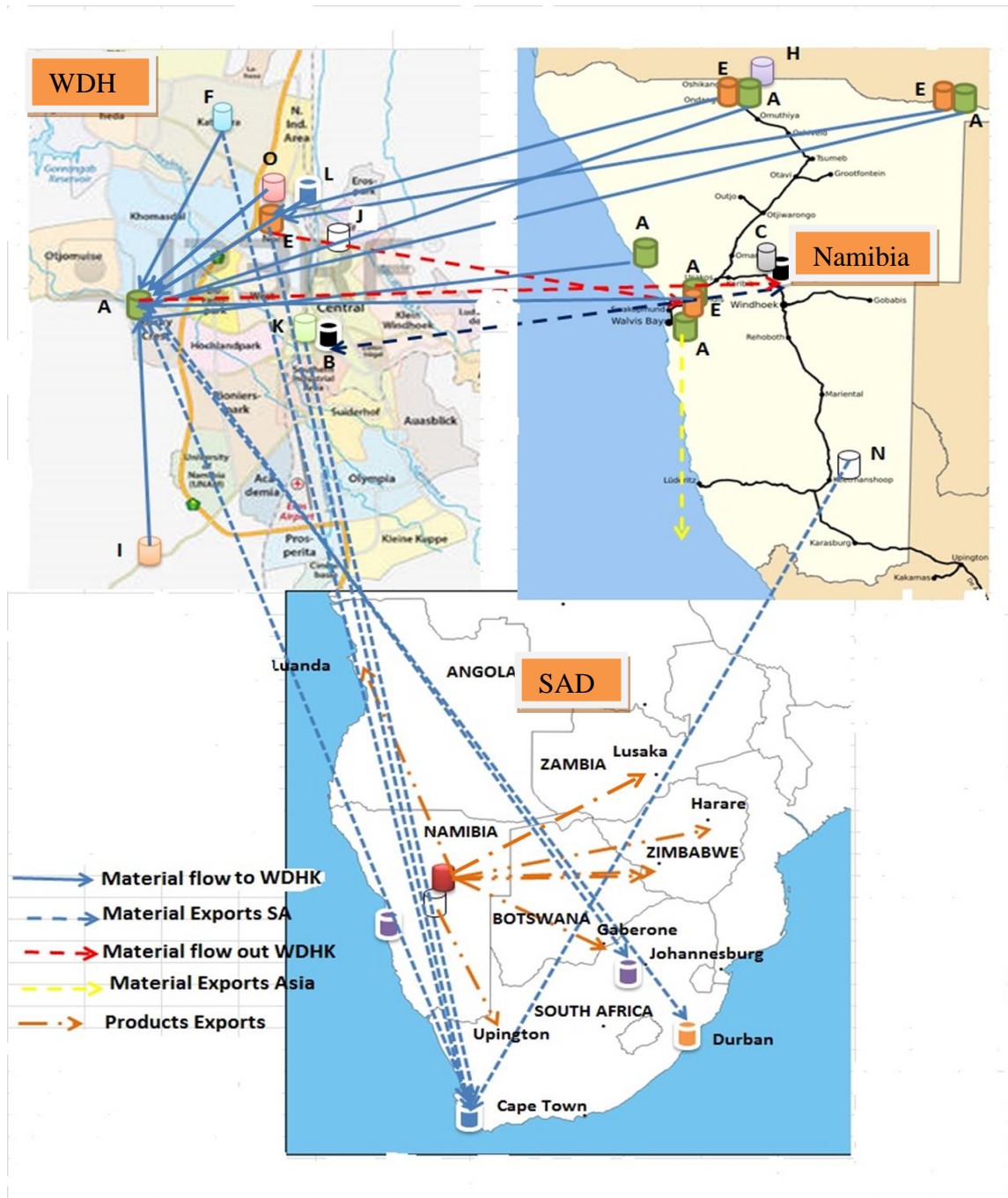


Figure 4.6: Recycling linkages: Local, Regional and International

Source: Research data

CHAPTER 5

DISCUSSION OF RESEARCH FINDINGS

5.1. Introduction

The research data as presented in Chapter 4 is organised according to the research objectives and research themes. Therefore this chapter is also organized according to objectives and research themes. This chapter discusses and interprets the findings of the study.

5.2. Motives and extent of involvement in solid waste recycling

This section presents the findings in the following four thematic areas: industry actors and their roles, company challenges, company motives and extent of company involvement.

5.2.1. Industry players and their roles

Like any other industry in the country, actors in the industry were varied, as shown in Figure 4.1 in Chapter 4. The actors in the industry included government ministries, non-profit organisations, the business world, recycling companies, manufacturing industries and waste pickers. Their involvement was a result of the nature of their business, that is, collecting and processing, manufacturing, packaging, promoting and regulating recycling in Namibia.

All business activities in Namibia are controlled by the Government through ministry policies and regulations. The Ministry of Industry and Trade (MIT), Ministry of Environment and Tourism (MET), Ministry of Urban and Rural Development (MURD),

Ministry of Health and Social Services (MOHSS) and Ministry of Agriculture, Water and Forestry (MAWF) directly governed the activities of the recycling industry. MIT is involved in the governance of all business activities in the country through policies and legislation. Waste management activities and operating licensing are overseen by the Directorate of Regional and Local Government, Traditional Authority Coordination within MURD. Environmental management is the responsibility of the Department of Environmental Affairs (DEA) under MET.

In addition to formal companies, waste pickers (informal sector) were also part of the recycling system. Even though some companies were not very clear regarding the position of the informal sector, the researcher established that they were part of the recycling industry. Companies A, F, I, N and O reported receiving recyclables from informal waste pickers. At company E, one of the big scrap metal recycling companies in Windhoek, waste pickers could be seen trickling in and out with an assortment of materials. This scenario of waste pickers in Namibia was like what happens in other developing countries. In South Africa, waste pickers are part of the recycling value chain system as well. They are mainly involved in recovery and collection activities (Muzenda, 2013; Mosia, 2011; Mamphitha, 2009). They are driven by poverty and unemployment. Croset (2014) points out that these are marginalised as well as poor people trying to eke out a living through scavenging.

In Namibia, recycling activities are concentrated in Windhoek, Swakopmund, Walvis Bay, Keetmanshoop and the northern towns of Oshakati and Ondangwa where the country's largest population or major industries are found. A high concentration of companies is found particularly in the capital, Windhoek. This is not peculiar, according

to Weber's Least Cost Location theory (1909), which looks at industrial location. According to Weber, industries tend to agglomerate (cluster) in certain areas in order to take advantage of the pool factors present by Malmberg (1996). This gives the industries the opportunity to maximise their profits.

However, efforts were being made to spread recycling all over the country, for example, to resort centres through the efforts of companies A, L and M in conjunction with a government entity responsible for wildlife and resorts. At Sossusvlei, one of the premier tourism spots in Namibia, waste separation was on-going, taking predominantly glass, tin cans and sometimes plastic back to Windhoek. Due to health as well as safety and security aspects, landowners in some of these areas have expressed concern over the idea of having recycling centres close to their land. In urban centres, recycling efforts were being facilitated through the establishment of collection depots and buy-back centres.

Years of companies involvement in recycling industry varied from four (4) to thirty five (35). Company E had been into scrap recycling for the past 35 years, a business created when only a minority were interested in the business. More players joined the recycling business following the launch of the recycling program in 2010 by some local authorities.

The number of workers also varied from three (3) to over five hundred (500+) depending on company size and activities done as shown in Table 4.2 Chapter 4. Males in management positions dominated the industry according to the number of male

respondents interviewed whilst women as observed dominated in pre processing activities as males shunned the jobs.

It emerged during the study that both formal and informal sectors were involved in recovery and recycling activities in Namibia. However, the formal sector had become deeply involved in the activities of the industry through the involvement of privately owned companies, a situation similar to the one highlighted by Muzenda (2013) in South Africa. Manufacturing industries in South Africa were found to be driving the recycling initiatives in the country with new recycling centres developing in major cities.

5.2.2. Challenges in the industry

The research wanted to establish the challenges that were experienced in the industry. It was established that the industry was faced with a number of challenges, as shown in Table 4.3 Chapter 4.

The majority of companies highlighted poor public participation as one of the major challenges that was affecting progress of the industry. Poor public participation was attributed to lack of cooperation and awareness. Company A and O officials highlighted that it was quite difficult convincing everyone to take recycling seriously. Particularly in Windhoek, low levels of public participation resulted in a project to promote recycling that was underway during the study to be abandoned. In Walvis Bay it emerged, the older population had attitude problems, claiming they were paying rates and it was not their duty to separate recyclables for recycling. This phenomenon is not peculiar to Namibia, as some studies done elsewhere reported the same findings. A study by Kotze (2015), in South Africa on perceptions and attitudes found out that participation in

recycling was poor due to ignorance and lack of knowledge to implement effective recycling practices. In Malaysia, Omran (2008) found out that household participation in recycling was low due to attitude problems as well. Participation in recycling of household waste was a function of level of awareness and understanding, level of education and availability of recycling facilities. These factors were considered important as they help to remove barriers preventing households from recycling. In Namibia, there was need to raise awareness on the benefits of recycling to bring everyone on board. Magen (2010) studied waste management and recycling in Namibia and found out that recycling levels in Keetmanshoop and Ondangwa were still low partly due to lack of awareness and education. For recycling to be up-scaled, much more still needs to be done in terms of awareness and education about the benefits of the industry both humans and the environment.

Shortage and exorbitant prices of transport was another challenge that affected the industry. There was agreement across companies that it was very expensive to transport materials, especially from sources in the northern part of Namibia to outside markets like South Africa. Only perceived high value recyclables like metals were lucrative at times owing to fluctuation of fuel and the commodity prices, which affected the viability of recycling the commodity. All companies agreed that the average price for one trip to South Africa, which ranged between N\$10 000 to N\$12 000, was quite costly. Availability of transport was considered a big challenge as smaller companies could not afford to have their own or even hire transport. The issue of transport was greatly affecting operations of the industry resulting in recyclables not being collected from other parts of the country. The findings of this study are consistent with those of Croset

(2014) who concluded that the long transportation distances made it expensive to move recyclables from different areas of the country. Jacobsen et al. (2014) also agreed with these findings that transport problems were hampering recycling efforts in Namibia. As a solution to this problem, many respondents suggested government involvement through relaxation of transport regulations that stipulate that goods transport across borders should not ferry goods back and forth.

Labour issues also stood out as some of the challenges of major concern. Low skilled workers, lack of commitment and high turnover of skilled staff were some of the concerns raised. It is recommended that the government should step up its efforts to address this challenge through vocational and technical training skills as highlighted by the Namibian Manufacturing and Processing Directory Volume 1 (2014/15).

Weather conditions also affected operations of the industry. This was particularly so along coastal towns such as Swakopmund and Walvis Bay. Buildings and machinery needed constant repair and attention due to wearing by corrosion. In Walvis Bay, this was an issue of concern as the operating space was limited, leaving some equipment lying exposed to weather elements. There was hope in future for land allocation from councils for the construction of bigger premises to accommodate everything in doors.

While the industry was reported to have potential for growth, the issue of low recyclable volumes was reported as a concern. The volumes that were being collected could not sustain the establishment of local processing and manufacturing plants. Similar challenges were found in different studies carried out in other African countries by Tas & Belon in 2014; Senzige et al. in 2012; Fadlalla in 2010; and Bolaane in 2004.

This, therefore, shows that the recycling industry in Southern Africa still has challenges. The challenges the industry faced could explain why the recycling initiatives were concentrated in Windhoek, Swakopmund/Walvis Bay (coast) and in Ondangwa/Oshakati in Namibia. In order to up-scale recycling a lot need to be done. The researcher suggests and recommends a recycling model as outlined in Chapter 6 as a solution to overcoming these challenges.

5.2.3. Motives for recycling

One of the main objectives of the study was to establish the motives behind companies' involvement in recycling activities. This was so in order to understand the driving forces in recycling of waste. The next discussion presents the findings of the study regarding these motives and discusses the issue.

The study established that all the fifteen (15) companies were driven into recycling by three main reasons; environmental, economic and social. These findings concurred with those of Sukholthaman in 2012 that recycling is influenced by environmental, economic and legal considerations. Although legal reasons were not cited in the findings of the study, it is an underlying social, economic or environmental concern. The legal system regarding recycling was still weak that is probably the reason it did not feature as a motivating aspect of the industry. The major factors that stood out as an influence to solid waste recycling activities were environmental and economic as evident from empirical data presented in Table 4.4, Chapter 4.

In Namibia, issues of environmental protection are high on the government's agenda, as stipulated in the Namibian Constitution. Namibia is a signatory to several international

environment treaties and declarations for environmental protection. Thus, the Namibian government emphasizes the upholding of environmental protection by all for the benefit of everyone now and in the future. No wonder during the interviews, all participants were aware of this national duty.

Generally, all companies agreed that their motive for recycling was driven by the need to protect the environment because they thought waste was a major cause of environmental water, land and air pollution. When waste is disposed through burning and indiscriminate dumping, environmental pollution may create many challenges such as groundwater and air pollution, and destruction of scenic beauty. Waste sent to landfills if not properly managed, was noted to produce methane, a powerful greenhouse gas, which causes global warming. Thus, the move towards the 'zero waste' policy to landfills with proper management is being promoted as a sustainable option for waste management and environmental protection. This view was supported by Lindell in 2011 and Hasheela findings in 2009 that waste recycling was an important waste management strategy that assist local authorities in dealing with waste. Thus, the need to recycle was considered very important.

Waste generation in Windhoek was noted to be increasing and becoming a major cause of concern at disposal site. In 2014, 75 594 tonnes of waste was generated, and it was projected to rise to 86,977 tonnes by 2019. It was noted that if waste was left unchecked additional challenges were bound to be experienced; lifespan of landfill sites was under threat and yet the establishment of new sites was considered very costly even though Namibia has vast tracts of land. Landfills need to be closer to the areas they serve to reduce transport costs. Nearby suitable land was considered a challenge since the terrain

is mountainous. In order to prolong the lifespan of the landfill sites, the need to recycle was inevitable. Therefore, it was observed that the drive to promote recycling was partly due to land scarcity for waste disposal. Even though the motives were different, waste recycling was considered a waste reduction measure. This is supported by Liebenberg findings in 2011.

While waste recycling was considered a waste reduction strategy, recycling was still a long way to yield desired results of reducing volumes of waste disposed at landfill sites. A lot of waste was still being disposed at landfill sites in towns such Windhoek Swakopmund and Keetmanshoop. In Windhoek, the amount of waste generated and disposed was increasing as shown in figure 4.2 in Chapter 4, which did not correspond to efforts put into recycling. Several factors contributed to this, chief among them was low public participation coupled with rising consumption patterns. This scenario pointed to the need to upscale awareness campaigns among the different sectors of society in these areas. Tukahirwa (2011) concur with the findings of this study that the problems associated with waste management require an integrated approach to arrive at a possible long-term solution. It, therefore, shows that recycling efforts in Namibia are in line with global trends.

The study also found that the other motive for recycling was to protect the environment from hazardous materials. For example, e-waste was considered dangerous since it contains hazardous metals such as lead and mercury. In most cases, not everyone was aware of the proper disposal of this kind of waste. Indiscriminate dumping in some cases occurred. In most parts of the country, this waste stream was still being disposed together with other waste streams at dumpsites despite their potential danger to the

environment and human health. The study confirmed findings of studies carried out in India by Anwasha & Kunal in 2013, which revealed that improper e-waste disposal had immense potential to harm human health and the environment. The study also revealed that although e-waste was hazardous producing toxic substances such as lead, mercury, cadmium and beryllium, it contains many important precious mineral components such as gold, silver, copper, palladium and platinum. Therefore, responsible end-of-life management of e-waste is imperative in order to recover these mineral components and properly manage hazardous components.

Waste was also considered a health hazard to both human and animals. There was a need for sustainable management to avoid some of the health challenges associated with waste. Plastic is one such waste that was considered dangerous to both domestic and wild animals. The need to recycle plastics was considered a necessity in order to reduce some of the dangers they pose. Therefore, there was need for all local authorities to protect dumpsites in order to prevent animals, particularly cattle, from feeding on waste such as plastics. The findings of this study are in line with the findings of Mughal in 2014 in a study on waste management in the northern towns of Namibia. Common waste like bottles was also established to be dangerous to children who are often victims of broken bottles in playgrounds. The occurrence of such incidents in high-density suburbs was considered high. Such occurrences pushed some companies to start recycling business and eventually earn a living in Windhoek.

Companies were quite aware of the impact of the need of raw materials. Globally, the need for raw materials for manufacturing has risen. Recycling was considered as one of the means to reduce the demand on natural resources and thus the drive towards

supporting it was justified to reduce the quantity of virgin materials in the manufacturing process. In 2012, Sukholthaman and 2014, Sharpe and Agarwal, studies supported these practices. The studies emphasized the need for sustainability in natural resources conservation in line with the Rio Summit sustainability agenda.

Apart from environmental motives, economic forces were also the major push factors among the companies that were directly involved with recycling activities. All these companies felt that recycling was a business opportunity just like any other businesses that bring in profits, which sustains the ventures. Thus, companies felt the value in waste could be tapped for economic development.

The economic importance of recyclable products like scrap metal, plastic and e-waste was also considered. With the demand for raw materials rising, accompanied by escalating prices of virgin materials, companies felt it was an opportunity to participate in this industry as a way of making money. Those in manufacturing felt it was cost-saving, as they could buy cheaper raw materials from recycling. Those involved in manufacturing of products, especially plastics said that virgin pellets (raw materials) needed for the production of their goods were quite expensive compared to recycled ones (secondary raw material). Virgin materials were sourced abroad, which made them expensive due to high transport costs and foreign currency demands. The price of imported virgin pellets was N\$20/kg while recycled pellets cost N\$3/kg locally. Companies viewed using secondary raw materials as a cost-cutting measure as their imports of the raw materials from international sources were making their goods less competitive on the regional market.

Furthermore, regulatory companies felt recycling made economic sense as it reduced municipal cost of waste management. Waste management was considered quite expensive particularly maintaining landfills required a lot of money. In Windhoek, for instance, the mountainous terrain was one of the greatest challenges for the development of new sites at reasonable cost and with the “*Not In My Back Yard Syndrome*” this could leave council with no choice but to develop distant sites, which would attract high transport cost. The promotion of recycling was a welcome development as it assisting with extending life span of landfills in towns such as Windhoek and Swakopmund.

It cannot be overemphasized that without economic benefits, the perpetuation of recycling would be virtually impossible, hence it can be concluded that companies directly involved in recycling were doing so as a business although they were aware of the environmental obligations.

Recycling was considered as a source of survival by some companies. As family businesses, their involvement was driven by the need to earn a living as they could not find alternative employment opportunities. Thus, involvement in recycling was the only option. This finding is also supported by studies in other African countries by Mamphitta, in 2011; Mbeng, in 2013; Dlamini & Simatele, in 2016 where this industry is a saviour for the unemployed, as anyone can earn a living through recovery of recyclables.

Even though the researcher did not interact with the waste pickers, involvement by waste pickers was driven by poverty. The findings of this study are consistent with the

findings of a study done by Reno in 2009, as cited in Mampitta, in 2011, who also concluded that most waste pickers collect waste merely as a means of survival.

Findings from this study revealed that the high level of unemployment in Namibia has contributed to a number of individuals joining the informal recycling industry as supported by Croset's findings in 2014.

The researcher concentrated mainly on formal companies due to language barrier. This is an area of further research to understand the contribution of waste pickers to the recycling economy.

The Global 'Green Initiative' was also another driver for recycling in Namibia. Dirty surroundings compromised the beauty of the environment. In Windhoek for example, one of the major drivers for recycling was to ensure that Windhoek remained one of the cleanest cities in Africa as well as become a green City for the benefit of its people. In support of this, the city implemented a Cost Recovery Accounting Model based on the principle that sufficient income be generated from the residents to whom the service is rendered, in order to be able to sustain the required standard of service delivery.

As highlighted earlier, companies were motivated by the need to reduce disposable waste as the implementation and maintenance of waste management systems and services was getting more and more expensive. These findings are consistent with other studies by Cheru, in 2016; Mahajan, in 2016; Mosia, in 2014; Makwara & Magudu, in 2013; and Reno 2009, as cited in Mampitta, in 2011 which concluded that the need to recycle in most countries' municipalities is inevitable in the face of increased waste generation.

In this study, most respondents considered recycling as environmentally driven. However, most companies involved in recycling indicated outright that it was for business purposes as well since it was a business venture like any other as well as a source of new raw material. Only small companies and government institutions did not mention recycling as a business. Thus, both environmental and economic factors were the major drivers of recycling in Namibia. From an environmental perspective, it is clear that global efforts of sustainability have influenced the development of recycling in Namibia. Most companies were very supportive of this goal for the sake of the future generations, but these efforts could not be achieved without economic backing.

5.2.4. Extent of Involvement in Recycling Industry

The researcher wanted to establish the extent of companies' involvement in recycling. Companies were involved in recycling according to these broad categories: involvement in the recycling processes, product range, and other activities.

According to findings, complete recycling involves three major steps: collection and processing of raw materials, followed by manufacturing, and finally purchasing of new products made from the recycled materials. The loop was not considered to be complete without purchasing. The study revealed that companies were involved in recycling in different capacities in all the three processes. Of these companies, the majority were into collection and pre-processing activities such as sorting, cleaning and volume reduction. Very few were involved in processing, a situation attributed to lack of knowhow and skills, and manufacturing and selling activities. About half of the companies were involved in recycling through other activities such as promotion, education and awareness campaigns about recycling. During the time of study, respondents were in agreement that much more still

needed to be done with regards the public and industries awareness about the benefits of recycling.

It was established during the study that lack of awareness and low participation by the generality of the population as well as other industries was hampering progress in recycling, a scenario similar to other countries studied by other researchers. Education and awareness took different forms like road shows, meetings, clean up campaigns as well as recycling competitions, in schools. Over and above this, the recycling industry was promoting the spirit of recycling among the young generation. In order to do so, recycling companies are working together with the corporate world in this regard to raise awareness.

These findings concur with Magen's study in 2010, who concluded that in Keetmanshoop awareness campaigns were greatly required if recycling was to bring more positive results. Low levels of public involvement in recycling activities were also revealed in a study by South Africa's Council for Scientific and Industrial Research (CSIR, 2013), which revealed that only 3.3% of the country's urban population regularly recycled household waste in 2010 (CSIR, January 11, 2013). According to the survey, about two-thirds of the population surveyed did not know where to dispose of their household recyclables. In addition, over 73% of South African population living in urban areas reported no recycling activity at all. This was due to lack of space or time, inconvenient positions of recycling facilities and ignorance as to what is recyclable and what is not.

Low public participation in Namibia is not peculiar if compared to what is happening elsewhere. Efforts should increase to encourage participation as suggested in the model in chapter 6.

5.3. Policies and legislation guiding recycling in Namibia

The existence and awareness among companies of policies, procedures and guidelines as well as legislation that regulated their activities was investigated.

5.3.1. Policies and guidelines guiding recycling

In interviewing action officers the researcher wanted to establish awareness regarding policies that govern recycling business. There was a clear indication that there was no direct national policy on recycling as revealed during the study. There was general consensus that no such policy existed in the country.

Comparing to other countries in the region such as Zimbabwe, Botswana and Mozambique where such policies do not exist, Namibia is considered not an exception. Contrary to this, most developed countries have established policy frameworks for their recycling industries where EPR policy principles are mandatory. The policy mandates the producers of products to be liable for their management even after the post-consumer stage; a situation found promoting the recycling industry greatly. Germany, Sweden and Japan are some of the countries with high levels of recycling partly due to such supporting policies.

Although there was no direct stand-alone national policy on recycling, there were policy components that directly and indirectly had some influence on the industry in the country e.g. Government waste management policy, Public-Private Partnership policy, City of Windhoek Waste Management Policy and the Formal Informal Partnership Policy (Integration Policy).

5.3.2. Legislation governing the recycling industry in Namibia

In interviewing officials, the researcher wanted to establish existence of legislation governing recycling industry. The study established that Namibia did not have an overall waste recycling act to provide a framework for solid waste recycling. Neither did it have an overall waste management act to provide a framework for solid waste management. Instead, individual local authorities controlled waste management through creation of their own by-laws approved by the local government ministry. The lack of national waste regulations made it difficult for the local authorities at all levels to manage waste effectively with the exception of a few like Windhoek Municipality. The country could perform better if there was a legislation to provide rules on how the industry should operate. It was clear that companies, households and individuals were not obliged to participate in recycling despite the fact that the industry was regulated just like any other business operating in the country.

However, any business in Namibia is compelled to comply with any applicable occupational health and safety law, environmental law, health law, labour law, tax laws and any other relevant laws or directives or orders issued to operating industries by government. In line with this, the industry was controlled by a number of pieces of legislation which included Environmental Management Act 2007, Labour Act, Affirmative Action Act, Health Act, Financial Acts, Water Management Act and municipal by-laws which fell under different government ministries as shown in Table 4.11, in Chapter 4. Companies acknowledged that they followed most of the industrial regulations in the country.

The researcher came across two pieces of legislation that could be useful in future as a guide as recycling unfolds: the Solid Waste and Recycling Act of Australia and the Recycling Regulations in Taiwan which focus on the importance of the Extended Producer Responsibility policy. However, it should be noted that other companies had made considerable strides in pursuit of recycling and many others were following suit. On the other hand, the Public and Environmental health Act has already laid a foundation by clearly stating industrial regulations and on the other hand, the funding and the responsibility of the producers of waste, manufactures or importers of the product are not yet clear.

Again, Namibia was found sailing in the same boat with other African countries where no clear laws regarding recycling exists. Not only in Africa, but in other third world countries as-well as no incentive-based recycling programme, laws or regulations are found that directly mandate recycling of waste as well as regulating health problems caused by municipal solid. As highlighted earlier, in Europe and other Asian countries, these laws are quite clear and enforced. Taiwan's recycling regulations and the Australian Waste Management and Recycling Act spell out clearly what every waste generator should do with regards to recycling. Japan also passed the 'Law for the Recycling of ELV in 2005 and as result of this law only 5% of ELV waste goes to landfills.

The protection of the environment is not only a concern, but a constitutional issue in Namibia as stipulated in Article 95(1). Namibians are obliged to protect the environment and to promote a sustainable use of natural resources. All these laws are in-line with environment protection with very little reference to the recovery of raw materials. No

wonder why 100% of companies interviewed highlighted that they were recycling for environmental reasons. Moving forward, economics reasoning and recovery of raw materials need to be inculcated in the laws and policies.

To ensure this, some regulatory frameworks are in place, for example the Environmental Management Act of 2007. According to this Act, the principle of achieving and maintaining sustainable development must underpin all policies, programmes and projects undertaken within Namibia. In addition wise utilisation of the country's natural resources, together with the responsible management of the biophysical environment has to be practised for the benefit of both present and future generations. The government, therefore, calls for strategies to promote recycling since it is considered as one option for sustainable solid waste management in this regard.

5.4. Emerging waste recycling trends

In spite of financial, labour, transport and weather challenges the industry faces, recycling patterns were changing. The major change noticed during the study was the formal sector involvement in waste recycling in Namibia, which had gained ground, as evidenced by a number of actors in the industry and noticeable changes in the industry that are beneficial to the country and respondents. These are discussed in the following section.

The researcher wanted to investigate emerging waste recycling changes in terms of private sector participation, recovery of recyclables, growth of the industry and promotion of recycling.

5.4.1.1. Private sector participation

The study found the recycling industry in Namibia had evolved over the years to what it was at the time of study. The industry started off in haphazardly, as revealed by the managing director of company C. The industry began to take shape in the mid-90s when private companies in manufacturing started to organise the industry prompted by the increase in waste generated particularly plastic.

Formal sector participation in the industry was considered a new development in the country. Traditionally, the informal recycling sector dominated through waste pickers (scavengers) as a survival strategy. The scavengers recovered any useable items to them ranging from abandoned food, textiles, bottles, broken utensils, plastics and paper destined for personal use or for sale from bins, dumpsites or anywhere accessible. The initiative to promote recycling was started in Windhoek where by recycling stations were set up at shopping centres like the AiGams, Auas, Valley Wernhill Park and Maerua Mall by a few private companies. Materials such as cans and tins, papers, plastic and glass were collected. After collection, companies processed these materials and then exported them to South Africa for further processing into various products. The whole idea was to organize the industry in line with developments in countries like South Africa.

Although recycling efforts were mainly concentrated in major urban centres like Windhoek, Swakopmund and Keetmanshoop, private companies were making inroads to smaller towns like Rundu, and remote areas through opening of new depots and branches in these small towns. To compliment private–public sector efforts in recycling, the business world was reported getting involved as well across the full spectrum of

recycling. Companies had social investment programmes which focused on environmental protection. Some companies outside towns were supplying recyclable receptacles, as well as sponsoring recycling campaigns around the country.

5.4.1.2. Recovery of recyclables

A number of initiatives have evolved on the recovery of recyclables ranging from the traditional informal recycling to drop off centres, point source collection (CBS, and others) and landfill collection contracts to development of on-site material recovery facilities.

Originally, waste recycling was minimally practiced by a few and most of the materials had to be recovered after disposal, usually from disposal sites. With private companies getting involved in recycling, collection systems were changed. From disposal sites collection, private companies introduced drop off collection sites. At the time of study, changes in collection system of recyclables were evident. Companies A, F, G, J, N and L were becoming more involved in on-site collection, a departure from the traditional system where waste generators sent materials for recycling at drop off centres especially at shopping centres in Windhoek mainly or to companies that were known to be involved in recycling. However, this system was seen to be counterproductive to the recycling drive as not much was brought via this mode. Thus the on-site collection system of collection targeted homes, industries, retail outlets, hotels, lodges, landfill sites, mines, ship wrecks to farms. In their efforts to boost recycling activities in the country, some of the big companies in the private sector signed contracts with some waste generators such as mines, fisheries, farmers, shipping industry, construction industries etc., a slight departure from the original system of material recovery at

disposal sites. To facilitate collection of recyclables, some companies had their workers on site in these places as some of the industries were not keen on recycling activities as learnt during the study.

Skip bins for collecting recyclables were seen by the researcher in Windhoek at construction sites and industries a system termed recycling stations. Company E, which was into scrap metal recycling, was also involved in on site separation and collection for example at the coast where ship breaking was carried out. This was particularly so with large recycling companies, a situation which was not well received by small recycling companies. This was viewed as a setback as they were seen to monopolise the industry. Surviving under the situation was considered difficult as their sources for raw materials were limited. On-site collection system of raw material was being promoted through programmes such as the CBS, orange wheelie bin system, bicycle recycling, dumpsite picking through formal to informal sector agreements.

Clear Bag System

The clear bag system (CBS) was first introduced in Windhoek in 2010 by company A in partnership with the City of Windhoek. It involved distribution of clear plastic bags to households and File 13 Box in offices in Windhoek into which recyclable raw material were sorted from general waste by individual households. In offices, only paper was put in the File 13 Box. The CBS was first rolled out in high-income suburbs of Windhoek as pilot projects done proved that these areas were more receptive to the idea of separating recyclables from other waste streams. Although CBS has been implemented in the middle income areas, the information obtained shows a rather poor performance of these suburbs. In low income areas performance was reported very poor. In one of the

suburbs, the bags were actually being used as raincoats and in some cases the clear bags could not be even traced as the researcher learnt. As a result of this, Company A was not keen to continue with the project in those areas.

Apart from Windhoek, the system was rolled out to coastal towns by use of 240litre orange wheelie bins which were different from the municipal green or blue 240litre wheelie bins. This was done with the approval of the municipal authorities of concerned towns. On the day of waste collection, the orange bins were also collected from the households. Information gathered by the researcher established that performance was also high in high income suburbs than in low income suburbs. Introduction of CBS strategy was a way of encouraging more recycling as the drop off strategy was viewed as yielding less positive results particularly from the general population.

Landfill Site Reclamation

While waste pickers had usually operated from dumpsites, their interaction with waste recycling companies was minimal. Company A and N officials reported that they were recovering products at landfills through contracting waste pickers. A visit at the dumpsite in Keetmanshoop by the researcher verified the heaps of plastic bottles, cardboard boxes and glass bottles found ready for collection. In Windhoek, Contract manager of company I confirmed the development. A group of about 20 waste pickers operated at the landfill daily. This was also supported by Jacobsen et al. (2014) research which found out that authorized waste pickers operated at the Kupferberg landfill site in Windhoek. They recycled materials such as glass bottles, plastics cans and papers. In Swakopmund, it was also the same with women pickers recovering some materials from the landfill. At the time 35 women were involved in reclamation of recyclables at the

site. Efforts to work with the informal sector were not a new idea as literature reveals the importance of this sector in the recycling value chain. Even though they are the least in the ladder of the chain, their role cannot be underestimated.

On –Site Collection

The introduction of on-site collection led to an increase in volumes of recyclables waste collected. In Windhoek, trends showed that the quantity of recyclable raw material collected through the household collection system and the ward contractor system had increased in tonnages from 2011 to 2014 as shown in Figure 4.13, chapter 4. More waste was collected in 2013 and 2014 maybe due to the increase in awareness. Even though areal coverage of recycling was growing, amounts of recyclable raw material dumped at landfill sites was still on the increase attributed to low levels of participation by residents and continued growth of waste due to population growth.

Material Recovery Facilities

With the generation of a steady stream of recyclable came the introduction of the Material Recovery Facilities. The development was established by company A, starting in Windhoek in 2012 followed by Swakopmund in 2015. Plans were reported by the same company to establishing more MRFs facilities around the country. In Windhoek, the MRF one of its kind in southern Africa, is located about 10km on the western side of the City centre on a piece of ground that was donated to the company by the CoW. Materials collected in Windhoek by any recycler are brought to the facility where sorting, processing and baling is done before the same materials are sent to markets within and outside the country for further processing. In Swakopmund, the plant was established at the landfill site on land donated by Swakopmund Municipality. The idea

of having the plant at the landfill site was to reduce transport costs for collecting recovered material and disposal of residual waste from pre-processing activities in the recovery plant. Other reason highlighted was that residents were not separating organic and non-organic materials, hence the need to do on site pre-processing. In Walvis Bay, plans were also underway to have the MRF constructed at the landfill site in 2016. All materials sorted in Swakopmund and Walvis Bay had to be delivered to Windhoek MRF before they it was finally delivered to end user markets.

5.4.1.3 Growth of the industry

The growth in the industry has been noticed through the introduction of new players and the increased diversity of the recycled raw materials, the involvement of women and the introduction of total recycling of plastic waste.

Statistical information about the exact number of players in the industry at the time of study could not be obtained. However, verbal information made available indicated that there were a growing number of actors who were getting involved. It was no longer the case of big companies but even SMEs were getting involved especially in Windhoek. A large number of players had been interested around 2010-2013 when recycling efforts were being promoted by City of Windhoek. However, by the time of study, the number of small companies had reduced as they could not meet the operational requirements because they were undercapitalized and lacked knowhow. The researcher was only able to get a list of those who were operating in Windhoek. Out of the nineteen SMEs only one was willing to entertain the researcher as the rest were not forthcoming at all despite concerted effort. So, the researcher only got to know from the department of Solid

Waste Management of the CoW that they were also involved in recovery activities in different areas of Windhoek.

Another development observed at the time of study was recycling of e-waste. The recovery of e-waste began around 2011 in Windhoek. Only one company was in this business at the time of study. To facilitate e-waste collection, company K created 8 drop-off points within the City of Windhoek at institutions such as schools, colleges, universities and at the company premises itself. Any e-waste was dropped in the secured cabin boxes. Most of the drops off points were sponsored by the business world as part of their responsibility to promote environmental conservation. Collection was for free although some customers delivered their items on by themselves.

In 2013, according to the logistics manager, the company collected around 60 tonnes of which 14 tonnes went to SA, 31 tonnes to company E and 14 tonnes to Kupferberg landfill after pre-processing. However, volumes were getting less and less; for example, in October 2015 Company K only received 12 tonnes, a situation attributed to depletion of reserves from generators, but in other towns, e-waste was still going to landfills together with other general waste a situation which was viewed as unsustainable considering the nature of e waste. E waste contains some hazardous components like lead, manganese apart from some valuable ones like gold.

Scrap recycling companies E, J and N were affected by fluctuation of demand for recyclable raw materials from international markets. It was revealed that before 2012, the business was quite lucrative as demand for both metals (ferrous and non-ferrous) was quite high both in SA and Asia. The world recession of 2008 was however impacting the

industry at the time. Huge stoke piles of scrap could be seen at one of the major scrap companies due to depressed market prices.

Another encouraging development established was the increase of women employment in the industry. Company A reported an employment complement of about 80% of their workforce to be women. Women were credited for being good and patient especially in sorting recyclable raw material. In addition, the empowerment drive being encouraged through the Affirmative Policy saw most companies employing more women even though some officials lamented that the nature of work in the industry was not suitable for women as it was sometimes hard and strenuous. But because most of the women did have little or no formal education, this was their only way for earning a living to support themselves and their families. Thus, they had no choice

Recycling efforts saw the development of a polymer recycling plant in Windhoek in 2005. Before this was established, all recyclables were sent to South Africa for further processing. This development was well supported especially by those in the manufacturing business. Originally, manufacturers in the plastic industry relied on imports for the much-needed raw material (pellets) which was considered very costly. However, with more plastic waste generation going on, one of the plastic manufacturing companies established a plastic polymer recycling plant in Okahandja. The company to date produces pellets from recovered plastics from Company A for local market.

Despite an increasing involvement of several companies in recycling initiative, Namibia is still not really where it is supposed to be as most recyclables were still finding their

way to disposal sites and at the time there was no marked improvement of recyclables from residential areas, with only 6.4% recycled.

5.4.1.4 Promotion of Recycling

Companies especially in the business world also took an initiative to implement the concept of recycling in schools to create awareness. The idea started in Windhoek. The initiative was also being taken to other urban centres to promote the spirit of recycling among school children in Namibia. Such an initiative was supposed to encourage learners to take from home recyclable raw material such as papers, bottles and plastics. The results of the initiative were reported as quite encouraging as more and more recyclable raw material were being collected from schools. Logistic problems were reported to be hampering the initiative to spread into rural schools.

The awareness initiative for recycling in schools culminated with schools competition. Company A in conjunction with other partners in the private sector supplied schools in the Windhoek with recycling bins for use by learners. The schools which collected the most recyclable materials per student at the end of the year won cash prizes for their efforts.

5.4.1.5 Summary

Around 2000, some private companies gave a boost to the industry growth by starting the idea of drop-off centres at major shopping malls in Windhoek like Auas Valley, Maerua Mall whereby waste generators would drop any recyclable raw material they had to dispose ranging from plastic, paper and bottles. In 2001, one of the leading recycling companies in the country began recycling in Windhoek. However, the drive

towards more recycling in Windhoek and other parts of the country followed the introduction of the SWMP (2009) introduced by the CoW which laid emphasis on an IWMA (waste avoidance, reduce, reuse, recycle and disposal) and Green Productivity (GP) measures as supported by Koehn, in 2007. The concept of Green Productivity (GP) refers to harmonization of environmental protection and economic development to enhance the people's quality of life. Prior to this, all generated waste in the city was disposed at landfill sites around the city as established by the researcher during the study a practice which was still prevalent in other smaller centres of the country.

Thus, the industry was getting organized in the hands of the formal sector and was slowly experiencing growth. At the time of study, formal sector participation was reportedly growing as evidenced by the many companies that were involved in the industry. Most of the recycling activities were in the hands of private companies that were given contracts to operate. This scenario is contrary to other developing countries in Asian and other African countries where waste pickers play an active role in the recycling industry, although without recognition in some countries as quoted by Dlamini & Simatele, in 2016; Chukwunonye and Clive, in 2013; Medina in 2012; and Mamphitta in 2011.

5.5. Value addition processes and associated benefit chains

This section deals with value addition processes of the main recyclables identified and their associated benefits.

5.5.1. Value addition processes in Namibia

The researcher wanted to establish recycling value chain of the different materials that were being recycled. Discussion of the findings is descriptive and based on responses and observations since companies were not willing to part with their financial figures. Responses varied among respondents depending on the nature of business. The general answer from companies which were involved in recovery activities was that little value addition was done in Namibia.

For companies which were into recovery activities such as A, E, F, H, J, K and N, collection of recyclable raw material was the initial process in the value addition process. Most companies indicated that they collected for free either directly from the source or point of generation: households, commercial businesses, industries, institutions like schools, colleges, mines and construction sites, while others indicated that they collected from drop-off centres located mainly at shopping centres, along streets, parks, open spaces and at landfill sites. Companies A, F and N were some of those who were collecting from disposal sites through the services of waste pickers. In some cases, companies used the services of middlemen to collect recyclable raw material from farms or tourism resorts. In such cases, they paid the middlemen based on weight delivered. Large companies also had active contracts with large industries such as fishing companies, mines to collect any recyclable raw material.

Collection, sorting, cleaning, crushing, shredding, baling, and exporting were the most common value addition processes most recovered materials underwent, but transportation and packaging featured many times throughout the processing of the material and distribution. However, this differed from company to company and material

to material. Plastic was the only product which had a complete recycling loop in Namibia followed by paper. For the rest, features occurring in Namibia were very limited.

Due to small manufacturing industrial base in Namibia, companies felt it was not viable to establish recycling plants for most of the recyclable materials. This was so because of high capital costs involved in setting up new industries and the low volumes of recyclable materials which could not sustain the industry. Since manufacturing is low, market forces for selling produced good were also cited as another factor hindering the full development of the industry. Thus, most of the recyclers exported their products for further processing to South Africa and further afield.

5.5.2. Benefit chains associated with recycling in Namibia

The researcher wanted to establish the benefits of the recycling in Namibia. Discussions on this issue with participants revealed that they were knowledgeable about various benefits of the industry.

Analysis of the data reveals that the economics of recycling brought about environmental benefits in the context of the recycling model prevalent in Namibia, where the whole system is financed by the proceeds from recycled raw materials and product. Unlike other models where recycling is financed by the waste producers, this model is self-perpetuating as long as it makes economic sense to recover, process and transport the material to manufactures. However, if the whole country is to benefit environmentally and socially the two dimensions should work hand in hand as presented in the model in Chapter 6.

The section of benefits is not much different from the section on motives. The motives section was focused on benefits to the proponent of the recycling business, whereas benefit chains section is focused on benefits derived throughout the country as whole. Three main themes of benefits chains identified similar to motives were economic, environmental and social as presented in Table 4.25 in Chapter 4. These will be discussed here.

5.5.2.1. Economic Benefits

Recycling was associated with economic benefits such as employment creation, creation and promotion of new businesses, production of cheap raw materials and goods, potential source of revenue among others as shown in Table 4.25 of Chapter 4. The major benefit of recycling economy identified by majority of the participants was employment creation both directly and indirectly.

The study established that recycling industry in Namibia brought relief to some people who were unemployed particularly the semi-skilled both men and women. Unemployment was considered a contributory factor to rising crime in the country as people struggled to survive particularly in urban areas. Even though companies highlighted that the numbers employed directly in the industry are not very big as compared to that of other countries, it was considered a great benefit. Employment figures for each of the companies visited are as shown in the table 4.2, Chapter 4. The finding on employment supports researches done earlier. According to Jacobsen et al., 2014 and Westphal & Pfeffer, K. (2013) recycling is a source of employment in Namibia particularly to those who cannot get employment elsewhere and considered a

great benefit as unemployment is a significant problem in Namibia just like in other parts of the developing world. Studying on the role played by informal waste pickers in recycling in South Africa (Mamphitta, 2011) observed that the industry is a source of employment not only to the skilled but also the semi-skilled. In Mozambique, Carbon Africa Ltd (2014) also concluded that the industry was contributing to informal employment opportunities to many people apart from other benefits it was bringing to the country. This situation is not different from findings in a study on e-waste recycling, in Nigeria, Manhart (2011)'s study also found that people were employed in recycling industry especially from rural areas because recycling does not always require specific skills. The study found out that the recycling sector has about 2000 casual workers.

From an economic point of view, recycling has been necessitated by high demand and scarcity of raw materials globally. Production of secondary raw materials through plastic recycling going on in the country is very important because these are relatively cheap. For example, virgin raw material pellets, an important raw material in plastic production, costs \$20/kg compared to secondary raw material pellets cost of \$3/kg, as highlighted earlier. Even though some companies still import some of the raw materials from South Africa and Saudi Arabia, production of secondary raw materials here through recycling in the country is a great benefit. Recycling was considered a saving in raw materials use as compared to the use of virgin materials. Researches done elsewhere also support this finding. For example, Koehn (2011) pointed out that scrap recycling is a vital source of secondary raw materials for the steel industry around the world. Around 34% of all global steel production is made from recycled material with Germany producing around 47%. Besides, Koehn (2011) also revealed the energy saving done through recycling

steel scrap than getting primary raw materials through mining. Use of recycled raw materials was also found less harmful to the environment. For example, it was observed that up to 1400 kilograms of iron and around 400g of coal can be saved when using steel scrap as raw material. From literature, recycling of every tonne of steel saves the mining of 1.2 tonnes of iron ore, 0.7 tonnes of coal and 60 kilograms of limestone, while recycling 1 tonne of plastics saves 3,000 litres of oil. In China, various industries are relying also on the use of secondary raw materials from recycling for paper mills, plastic manufacturing and other manufacturing sector as revealed by Trommer in 2011.

The economy of Namibia relies on agriculture, tourism and mining (gem diamonds, uranium, gold, silver, and base metals); therefore the recycling industry is an addition to the diversity of the economy. Coupled with this, is the production of cheap products which are easily accessible to the rest of the populace resulting in the availability of locally produced goods especially plastic products, for example, pipes, tanks and plastic containers. If one goes into Agra, Pupkerwitz, OBECO, ARK trading, these products are readily available. The industry also benefits indirectly other industries in the country. For example, transport and construction industries are some of the beneficiaries as the industry utilizes heavy vehicle and machinery to load and transport raw material. Most recycling companies do not have their own means of transport especially heavy trucks; hence they rely on hired transport. Thus, through this industry, the heavy-duty transport industry is growing.

Another benefit of the recycling industry which was highlighted was that the industry was a source of foreign currency earning. The sale of e-waste, scrap metals and products such as plastic packaging, pipes, chairs, cups etc. exported to international and regional

markets such as Botswana, Zambia, Malawi, Angola, and Zimbabwe were sources of foreign currency earning. However, no company was willing to delve more into this subject as it was considered confidential.

There was consensus among most respondents that waste generation was increasing particularly in urban environments a situation quite similar to what is happening in urban areas worldwide, because of more people moving from rural areas into towns as well as growing demand of goods. Recycling was therefore considered as a waste reduction strategy. Companies A and O were very supportive of this venture as a way of minimizing waste disposal volumes at landfill sites which prolonged their life spans as well. Therefore, recycling was a welcome initiative in the face of increased volumes of waste that were reportedly generated. It meant reduced volumes of waste destined for disposal effectively increasing landfill useful life, thus reducing municipal operational and investment costs, a finding supported by other researches like Ferronato, in 2016; Simelane & Mohee, in 2012; and Hickman *et al.*, 2009. With limited financial support, not all local authorities had the capacities to efficiently manage the waste. In the City of Windhoek, Solid Waste Management Department officials stated the City Council could still manage the situation; however, there was a need to be proactive in order to avoid future challenges of waste.

5.5.2.2. Environmental benefits

Some participants were quite articulate on how the industry was of benefit; whilst others did not give detailed information on how but just said it keeps the environment clean. The direct benefits identified were waste reduction, reduced pollution and a safe

environment hence less health hazards and conservation of environmental resources through use of secondary materials. Eight of the participants pointed that recycling saves natural resources through by use of secondary raw materials thereby reducing dependency on virgin raw material. In addition, extraction of virgin materials, for example, minerals was said to be associated with environmental destruction. Participants emphasized the importance of recycling as a way of reducing environmental destruction.

Recycling reduces pollution. Five of the participants had this to say. They argued that waste is linked to environmental challenges such as pollution if disposed either through open or crude dumping, burning, land filling or feeding animals or disposing in water bodies such as oceans. Pollution of surface and groundwater in a dry country such as Namibia has serious repercussions since the resource is so limited. With more waste, especially e-waste, disposed at landfill sites, potential of groundwater contamination is continually increasing. In Windhoek, it was highlighted that there was a lot of aquifers on the southern part of the City where the main landfill site Kupferberg is situated. It is therefore important to ensure that pollution of groundwater is minimized in this area. Thus, recycling made a lot of sense in this regard.

Apart from this, nine of the participants revealed that recycling keeps the environment clean. In areas where recycling is not practiced, litter is found scattered and was considered to result in negative effects on both the environmental and health (human and animal). Litter all over was considered unsightly. In Okahandja town, company C official was concerned about the problem of plastic waste particularly along the highway in trees. This was not pleasing considering the road is used by tourists visiting different parts of the country. The suggestion to upscale recycling awareness in the town for

people to desist from reckless management of their plastic waste was recommended. The official believed even though it was not easy to cultivate the new culture of recycling among the general public, with concerted effort keep the environment could be free of litter.

Not only is the environment at risk with litter, people as well as animals are also exposed. In the absence of pastoral grass during drought, animals like cattle, were reported feeding on anything, for example, plastics. In addition, children were also at risk. According to document search, the drive into recycling by company F was a result of lack of hygiene, general state of litter, injuries and lacerations inflicted on children from broken bottles. Thus, there was a strong drive to recycle as a way of getting rid of litter.

In Windhoek, since the adoption of the Solid Waste Management Policy, recycling efforts were scaled up in order to reduce volumes of waste disposed as it was becoming challenging to manage their disposal sites. Satellite dumpsites had already filled and decommissioned. Thus, to the City recycling was a welcome development to reduce waste. The site manager of the contracted company managing Kupferberg landfill confirmed that recycling was helping the City as he postulated that the landfill would have filled up had it not been for recycling. However, the research found out that more work still needs to be done since a lot of recyclable raw material is still entering the dumpsites. Through the interviews and document search, it was revealed that recycling is not doing much to reduce waste volumes disposed at the landfill site.

5.5.2.3. Social Benefits

In addition to environmental and economic benefits, the study established that the industry was a source of livelihood for some people in society particularly the poor as supported by one of participants. Even though it was pointed out that their earnings were quite low, it was considered a great benefit as it afforded them to put something on the table. In some major towns such as Windhoek, Walvis Bay and Swakopmund, informal waste pickers were now part of the recycling chain as they were contracted to pick recyclable raw material for sale to the formal recycling companies. In Windhoek, at Kupferberg landfill site, it was revealed that two companies contracted an organized cooperative of informal waste collectors that has been operating at the Kupferberg Landfill since 2000.

In Windhoek, companies A and F three quarters of their workforce were women. The supervisor for Company F said man shunned the work especially sorting or street picking recyclables because they said it was demeaning to be seen doing that especially by women. Nevertheless, the industry has been commended to be doing something for the unskilled women. This situation is not different from findings by Manhart (2011) in a study on e-waste recycling, in Nigeria, where people who are being employed in recycling industry were especially from rural areas because recycling does not always require specific skills. Thus, anyone can get a job as long as they are willing to cope with the nature of job. Participants further highlighted that if government could do more to come up with policies that support this industry this can assist with easing the problem of unemployment in the country.

Informal food vendors were beneficiaries of the industry as they sold their food stuff especially roasted meat to workers of recycling companies. The industry was also promoting some small-scale business entrepreneurs such as those in food making industry as the researcher learnt from company E. The entrepreneurs were seen selling roasted meat (kapana) to recycling workers nearby.

5.5.3. Summary

Even though the industry is still in its infancy, all participants commended the industry's welcome development particularly in terms of employment creation. With employment comes a lot of other benefits such as improvement in standard of living, housing, food, clothing, medical, children going to school, builds confidence, women empowerment, and reduced family conflict, crime, poverty, disgruntlement, social ills, loitering, less stealing, prostitution, passion killings, drug abuse, alcohol abuse, marriage breakdowns, government handouts and tax payer burden. According to literature, the finding were in agreement with a number of citations confirming by Chanda, in 2014; Mosia, in 2014; Muzenda, in 2013; Tischler, in 2013; Nahman, in 2009; and Hickman *et al.*, 2009 that recycling has economic, environmental and social benefits.

5.6. Operational network linkages in recycling

Industries survive because of links with other industries. One of the objectives of the research was to establish these linkages in the industry. This research found out the existence of local, regional and international linkages. Linkages were either educational, promotional and research information flows, raw material, receptor material and financial flows, transport and logistics and partnership. These linkages were either

backward or forward. Companies were linked among themselves; with local authorities; with transport and engineering industries; business world; waste generators, raw material producers, manufacturing companies, wholesale and retail companies, and academic institutions, see Table 4.26. The discussion which follows outlines the linkages at local, regional and international levels.

5.6.1. Local recyclable material linkages

Table 4.26 in Chapter 4 shows forms of recycling company backward and forward linkages within Namibia and outside. Locally, companies have linkages with a number of players supplying raw material such as households, industries, waste management companies, retail businesses, schools, waste pickers, SMEs, universities and colleges through material flows, information flow, transport logistics, financial flows, technology, physical resources, and educational promotions. Some companies were reluctant to divulge their linkages but could only say they work in partnership with the City Council. In this study, interviews with recycling players revealed the wider network with a number of businesses.

The following sections outline the major companies in the recycling industry and their backward and forward linkages.

5.6.2. Total plastic recycling linkages

Company A is at the centre of most of the activities in non-metal recycling in Namibia. The company works in partnership with local authorities, businesses and informal sector in an urban centre such as Windhoek, Swakopmund, Walvis Bay, Henties Bay and Oshakati as a recycler and a promoter of recycling. Networks among recyclers were

developed due to plastic raw material needs. Company A had backward and forward linkages with companies involved in plastic material recycling such as company B, C, D, F, G, I, L as well as waste pickers whose material sources varied from households, businesses, industries, mines, construction sites and institutions (government and private), dumpsites and even from open spaces. Some of the plastic materials collected and processed by these companies were traded with company A and in turn company A forwarded these to company D in Okahandja or to South Africa.

Company D is the only plastic raw material producing company in the country. Raw plastics of different types (soft and hard) are processed to produce pellets, the main raw material for the manufacturing of plastic products. Pellets produced by company D have local linkages with markets such as company B, C and H, and other plastic-producing companies around the country that produce various plastic products as well as transporting vehicle companies. These companies use both virgin and secondary raw materials acquired locally and internationally for the production of the various products. Company C supplies pipe products to building construction companies, farmers and wholesales. The same with company H that also has local linkages with wholesalers, retail shops and individual buyers.

Plastic was the only product where there was a complete recycling loop with linkages from suppliers of raw material, processors, manufacturers, retailers and recycled product consumers, and back to supplier of raw materials within the network.

5.6.3. Non-metal material linkages

Companies A and N were into paper recycling. These companies were linked to producers such as wholesalers, retailers and institutions (government, schools, colleges, universities, and banks). Company A; however, was the only major player using this material. Processed materials were only sent to regional markets in South Africa.

Companies A, F, L and N were the main recyclers of glass, which was collected from various sources by other companies linked to them as follows: waste pickers deposited these materials in bottle banks, which were found at some shopping centres in Windhoek or delivered to company A directly. Some of the glass material was sent to wholesalers by these companies; for example, company F and L sent some of the glass bottles to Coca Cola. However, company A received most of the glass materials from anyone. Upon pre-processing, companies sent their products to South Africa for further processing.

Both steel and aluminium cans were processed in the country, most of them were soft drink and beer cans. Companies A was linked to F, G, and L, N who receive raw material from the network and process it for the regional market. The rest of the companies were processing the cans upon collection from dumpsites, households and businesses.

5.6.4. Metallic material linkages

Company E was at the centre of most of the activities in scrap metal recycling in Namibia. The company was working in partnership with local authorities in a number of urban centres such as Windhoek, Swakopmund, Walvis Bay, Henties Bay and Oshakati.

The researcher observed the processing of a variety of recyclable aluminium, steel, cans. The company E had a wide network throughout the country, ranging from government institutions (TransNamib, Namdeb, and Nampower), mines, shipping companies and anyone who had any scrap to offer. The company had backward and forward linkages with other companies in the material flow network, for example, many small companies who were in this business were the brainchild of this company and were working in partnership with these upcoming small recycling companies. Company E provided the expertise, storage and equipment facilities to the small recyclers and in turn these companies traded some of their products with the company. This was supported by company J that was also into scrap metal recycling. So, it depended on company E for storage as well as equipment and marketing.

5.6.5. E-waste material linkages

Company K, which was involved in e-waste recycling, was also selling scrap metal and plastics- as by-products of e-waste produced during the extraction of precious metal - to company E and A, respectively. Other waste materials were deposited at the main dumpsite of Kupferberg under the care of company I. The semi-processed materials were exported to South Africa and Asian markets for further processing.

5.6.6. Local non-material linkages

In order to encourage recycling, local authorities assisted by providing recycling companies with land for operations. In return, companies recycled municipal solid waste. Company O donated land to company A in Windhoek in 2010 to build a MRF. In Swakopmund, a company site manager also confirmed receiving land they were working

from. However, in Walvis Bay, the company was still in talks with the local authority to give them land outside town to construct a MRF. These partnership arrangements enabled more recovery activities, as more space was made available, a development which other companies longed for as they lamented shortage of land as hampering their operations.

Company A was also involved in promoting recycling among the young generation working together with local authorities, other recycling companies and the business world. In order to do this, companies A, B, M, and L were linked in promoting recycling competitions among school children. The promotion, however, was mainly in urban schools during the time of study. Collection booths were placed in various schools in Windhoek and Walvis Bay. Thus company A was linked to the schools and other companies in a quest to encourage recycling.

Recycling companies were also partnering with waste pickers (informal sector) in most urban centres. At the time of study, in Windhoek, Swakopmund and Keetmanshoop waste pickers and companies A and N were working in partnership. Waste pickers recovered an assortment of materials from dumpsites, which were then collected by recycling companies in return for a fee.

Like any other industry, one of the factors influencing the performance of the industry is transport. Despite the numerous companies involved in recycling, the network could not manage to collect most of the glass bottles and cans as there were a lot left lying around in the countryside. This was a sign of weak linkages in transport logistics and low commodity price in the market to stimulate provision of this service. However, where

transport was economic, the industry is linked to transporters because not all of them have their own means of transport, for example, companies G and L were involved in provision of transport for collection of cans and a number of cross-border transporters carried recyclable across to South Africa.

5.6.7. Regional and international linkages

Total recycling was still limited to plastic products due to limited capacity in the country, hence, all products recovered and processed were sent to South Africa for further processing. Apart from the local networks, these companies also had regional and international linkages. The main trading partner for most of the companies was in South Africa, however, on the international front there were links with companies in India, Indonesia and China.

Company B had regional markets where its products were sold in South Africa and Angola. On the other hand, company C's products were sold to countries such as Botswana, Angola, Zambia and Zimbabwe as shown in Table 4.26. Company A was also in partnership with a renowned world-class international Finnish Waste Management company based on skills and technology transfer.

5.6.8. Summary on linkages

Company A had backward and forward linkages with most companies in educational, promotional, information flow, material flows, partnership and financial flows. Although, the research established a number of linkages; only material flow linkages could be demonstrated clearly with a map given in Figure 4.6. The linkages are both backward and forward with links showing the flow of materials and nodes showing

processing zones in the recycling industry of Namibia. According to one of the officials, this was unavoidable due to the nature of the business. On financial flows, none of the companies was willing to discuss this issue as they regarded it as confidential.

What came out during the study was that the industry was well networked with a number of players such as financial and academic institutions; recyclable raw material producers and generators; and processing and manufacturing industries just to mention a few. Networking was considered necessary in the recycling industry. Sharpe & Agarwal agrees that “the increasing sophistication of recycling processes requires collaboration and network linkages across different components of industrial activities, just like in any other industry, which requires a number of inputs for it to remain viable”.

Both backward and forward linkages existed in the industry with bigger companies at the centre of the network. The main companies identified were company E dealing with scrap metal; company K dealing with e-waste and company A dealing with the rest of the recyclable raw material. Only a few companies stood alone and were selling their produce directly to markets due to logistical issues.

5.7. Chapter Summary

Namibia is involved in recycling activities that are driven by three main motives, economic, environmental and social. The industry is still in its infancy, as reflected by large volumes of recyclable raw materials of different types still being exported for further processing outside the country, and some finding their way to dumpsites. However, the industry has brought some benefits to the country, such as employment creation, cleaning of the environment and availability of cheaper commodities on the

domestic market. In addition, recycling patterns emerging, such as government involvement, are an indication that the industry is gaining recognition among some of the long-established industries. The industry owes its survival partly to its networks with a number of players. Several factors, including transport and logistics, labour issues, financial constraints, public participation, governance and market forces, threaten the success of the industry, as although it offers a solution to waste management challenges affecting most local authorities in the country.

CHAPTER 6

PROPOSED RECYCLING MODEL

6.1. Introduction

Solid waste management is one of the several challenges facing most developing countries worldwide. Namibia is not an exception to this as revealed through studies like Croset (2014); Schioldborg (2014); Lindell (2012). Studies carried out in different parts of the developing world point at recycling as an option to assist with the challenges of waste management. Such revelations were partially revealed in previous studies conducted in Namibia (Hasheela, 2009; Jacobsen et al., 2014; Lindell, 2012).

Solid waste management practices in Namibia vary from town to town. Waste management practices such as collection and disposal were reported to be carried out by both public and private companies. The private sector responsible for collecting and disposing waste generated by private entities. However, the responsibility of waste management in both urban and rural areas lies with the local authorities. Most local authorities in smaller towns and settlements were experiencing challenges related to the provision of waste services (Auditor General's Report, 2012/2013). Among the challenges were improper waste collection and removal due to a lack of sufficient and appropriate waste equipment and vehicles, frequent breakdowns of the waste removal vehicles, lack of waste management rules and regulations. Consequently, environmental pollution in such places poses hazards to people and animals. Against this background, this study show waste management problems being faced in Namibia can be reduced beginning with addressing the recycling initiative itself.

It is important to recap the recycling activities in Namibia. A variety of materials were being recovered and recycled such as plastic, paper, glass, aluminium, scrap metals (ferrous and non-ferrous) and e-waste. These materials were sourced from domestic, commercial, industries, mines, fishing, ship wreckages, farms, dumpsites and even from open spaces. Most of the recovered materials were exported to South Africa, the country's main trading partner.

The Government of Namibia is not silent on issues of waste management. Principle (I), Part II, Section 3 of the country's EMA 2007 calls for the reduction, reusing and recycling of waste. The country did not have a comprehensive waste recycling policy document or waste recycling legislation. This was found unsustainable for the success of the recycling industry.

A model on how recycling can assist solid waste management in Namibia is presented. The study recommends an integrated solid waste recycling model. The researcher developed aspects of the model adopting the recycling chain depicted by Hickman (2009) as well as the Taiwan 4-in-1 Recycling Program. Recycling linkages put emphasis on all components in the model as well as participants in the recycling supply chain i.e. government, private sector, manufacturers, residents, etc.

Studies report high recycling rates in Europe and some Asian countries. In Taiwan, before the introduction of the 4-in-1 Recycling Program national recycling program was introduced, collection rate of recyclables was reportedly low. Collection channels were not coordinated despite the Waste Disposal Act requiring manufacturers and importers of goods to recycle. Underdeveloped regulations and lack of incentives contributed to

low support of recycling by manufacturers and importers. For example, they did not invest in recycling facilities. The 4-in-1 Recycling Program created in 1997 contributed to better connection of all parties involved in regulated recyclable waste (RRW) collection channels, including community residents, recyclers and collectors, local governments. In addition, they established a recycling fund, which gave a boost to the recycling efforts. Increased recycling rates were reported as well as reduced amount of solid waste sent for disposal.

The success of the proposed model in this study could be achieved if some of the issues addressed in this initiative being implemented as a complete chain. The proposed model is explained in detail in Section 6.2.

6.2. Integrated Recycling Model for Namibia

The model identifies three key stakeholders, which are waste management and recycling companies, government institutions that include ministries and local authorities and waste generators, which include households, businesses, industries and mines as shown in figure 6.1.

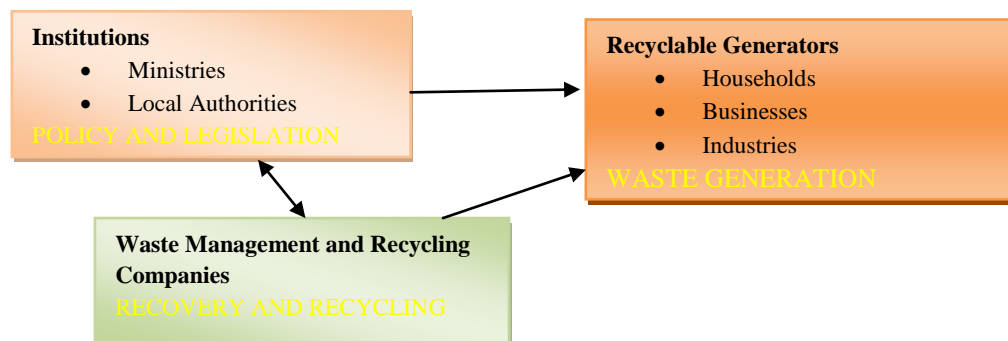


Figure 6.1: Integrated recycling model key stakeholders

Source: Researcher

The model is aimed at restructuring the existing system, which is plagued by, a number of challenges as mentioned earlier: lack of awareness of the importance of recycling, financial constraints, weak legal and regulatory framework, shortage of transport and logistics, high transport costs and poor public participation and cooperation.

The distances involved to transport recyclables make it difficult for all materials to reach Windhoek. Materials such as scrap metals are too heavy to load and off-load, thus cannot be transported from some parts of the country, leaving a lot of recyclables lying all over the country and eventually destroyed. The idea of buy-back centres in most parts of the country may assist with the collection of recyclables from the consumer.

6.2.1. Strengthening legal and regulatory framework

The study established that the legal and regulatory framework for managing recycling is weak. During the study, it came out that there is need for Namibia to update legislation concerning waste recycling and waste management. The lack of national policy and legislation for recycling prevents local authorities to face key challenges in waste management and recycling enforcement. *“No one can take me to court for not recycling because the legislation is not there in Namibia,”* these sentiments were echoed by a company A official underline the fundamental reason why recycling might not be taking centre stage. In order to address this issue, a lot needs to be done on the legal front to facilitate recycling.

The country can benefit by borrowing from EU countries like Germany and Sweden and Asian countries like Taiwan and Japan that have well defined policies and legislation for promoting recycling, e.g. the EPR policies are in practice in most of these countries. The

EPR is meant to enforce accountability over the entire life cycle of products after their useful life on the manufacturer of the product.

Ministries of industry, environment and tourism and MRLGHRD should play an active role during the drafting of the legislation to ensure that more relevant issues are addressed.

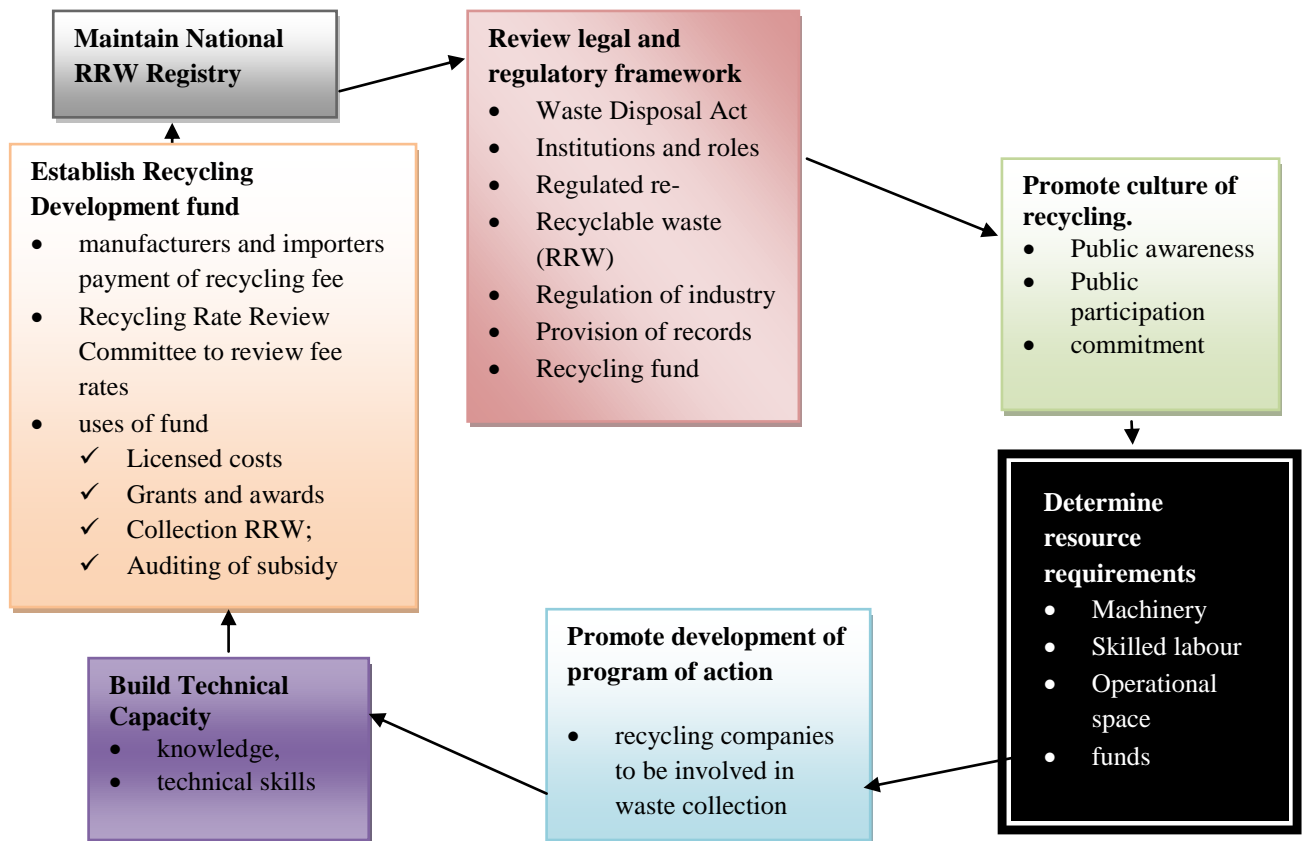


Figure 6.2: Proposed Integrated Recycling Model for Namibia

Source: Researcher

6.2.1.1 Recycling legislation

The recommendation is that the government introduce legislation compelling manufacturers, businesses and households to ensure that their products do not, at any stage of their life time, become waste. A circular economy may be promoted.

6.2.1.2 Recycling policies

The study observed an absence of specific recycling policies such as the EPR policy practised in other countries. Roles of stakeholders, manufacturers, importers, brand agents, distributors, retailers and consumers, can be clearly defined in the management of end-of-life products. This may assist with avoiding and reducing environmental effects associated with waste.

6.2.2. Promote culture of recycling

The recycling loop begins with virgin material product discarded by the initial owner because it is no longer desired. Efficient and effective recycling supply chains are facilitated where secondary materials are separated by the generator from wastes. Design and implementation of source separation must be sensitive to local cultural and socio-economic circumstances (Hickman *et al.*, 2009). This is not the case in Namibia among some people due to reluctance, lack of facilities and lack of awareness about the importance of recycling. This study realised the need to promote a culture of source separation to facilitate effective recycling as some materials are made useless due to non-source separation resulting in material contamination, especially at household level. For instance, organic and inorganic materials are all placed in one receptacle, making it difficult to recycle recyclables. Local government has a key role to play through the provision of separation bins, which can be placed by the roadside, in parks, leisure and cultural facilities, government buildings, hospitals, clinics, public and private housing estates, schools and at refuse collection points.

Some companies and CoW bemoaned the lack of recycling culture among some businesses, as not all businesses considered recycling. More awareness was required and CoW and some companies like A and M were doing so but with very little progress. Education should not be a one-day activity but an on-going process. It should also take different forms such as talks to residents during meetings, church gatherings and school assemblies. Drama or sketch performances can be organised as well, specifically carrying messages about solid waste recycling and waste management. The council can equally use posters to educate residents about waste management. The posters could be printed in all Namibian languages.

There is need to increase participation in recycling in the country. The level of participation in recycling activities varied in Windhoek, with high income suburbs involved more than in low-income areas despite efforts to promote a recycling culture. The reasons behind this need further research. In Walvis Bay, an official of company A highlighted that the youthful generation is embracing the culture of recycling more, as opposed to the older generation in the high-density areas whose attitude is still rooted in the belief that it is the duty of local authorities to do so as they are paying rates. Promotion and awareness campaigns are taking place, especially among school children so that they grow accustomed to it. However, much more effort was needed, as noted by the companies A and O, who highlighted that a lot of recyclables are still finding their way to dumpsites. The situation is made worse, as recyclables are mixed with organic waste making them unsuitable for recycling.

6.2.3. Resource requirements

The success of any recycling programme is partly a result of the availability of enough resources such as labour, land, infrastructure and transport.

6.2.3.1 Labour

Labour is an issue of concern within the industry. Four companies complained about lack of commitment by workers and high turnover of skilled staff despite training given. Without skilled and experienced personnel, these companies were found struggling to have all the activities adequately executed, especially those in the manufacturing sector. Many resources are put in training the local workforce, but lack of commitment among the workforce affected these companies.

6.2.3.2 Land Availability

The recycling industry can be supported through allocating affordable land solely for recycling purposes. As the profit of recycling is often marginal, donating land to waste recyclers could lower their operational costs and help promote the local recycling activities in Namibia. For example, in 2010 company O allocated land to company A in Windhoek for the establishment of an MRF for processing a wide range of waste materials. In 2014, the Swakopmund Municipality donated land to company A for its operations. The Walvis Bay Municipality was planning to donate land to company A and towns like Oshakati in the northern districts of the country had similar plans.

6.2.3.3 Infrastructure

Collation of materials into larger quantities is necessary to accumulate sufficient quantities to enable sale to end-users, an activity that also allows for intermediate processing to prepare secondary materials in order to minimise transport costs and which meets the delivery requirements of the end-user. The collation of materials into larger quantities may involve dealer networks. In Namibia, government together with the private sector may assist through the establishment of buy-back centres and other infrastructure around the country to facilitate public participation in waste separation and recovery. The absence of these in some places contributes to a lot of materials lying uncollected or dumped ending up a hazard to the environment and humans.

The distances involved to transport recyclables make it difficult for all materials to reach Windhoek. Materials such as scrap metals and bottles are too heavy to load and off load, thus cannot be transported from other parts of the country leaving this in the hands of few companies like company E that have the machinery and equipment for heavy workloads

6.2.3.4 Transport

The study's findings established that the industry was affected by transport shortage, which led to a lot of recyclables being left lying all over the country and eventually their destruction. Export of products suffered due to transport problems, one of the contributing factors to the collapse of some small-to-medium enterprises. Government could subsidize this through the establishment of a recycling fund.

6.2.4. Promote Programme of Action

PPPPs should be strengthened. Recycling could be strengthened if all private companies are involved in every aspect of waste management depending on their capabilities. This study established that recycling on its own is not viable.

6.2.5. Recycling Fund

In Taiwan, the recycling industry is supported through the Recycling Fund (Hand out 1Workshop, 2012).The Recycling Fund is raised through payments made by manufacturers and importers of products. Under the 4-in-1 Recycling Program, manufacturers and importers of new RRW products are required to pay fees to Environmental Protection Administration Taiwan (EPAT) depending on the quantity of goods they lay on the market.

The recycling industry is capital intensive. Recycling companies in Namibia were struggling due to inadequate financial resources and in some cases some SMES willing to join the industry failed to continue due to financial constraints. The study, however, established potential investment resources through interviews and secondary sources (Murghal, 2014) that were available in the country that could contribute to the development of the recycling industry together with the establishment of a recycling fund. Some companies were not aware of these potential funding programmes listed below.

- Environmental Investment Fund Namibia
- Development Bank of Namibia
- Partnership for Local Democracy Development and Social Innovation

- GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit)
- Königstein Capital
- Safland Property Group Namibia

Despite knowledge about their existence, some officials, such as official from company N raised concerns that it was not easy to get financial assistance from some of these sources. Suggestions were that government make it easier for entrepreneurs in the industry to get assistance with less hassle.

6.2.6. Records Management

Currently, Namibia does not have national statistics or centralised data on recycling, and the information that is available is very limited and fragmented. The study recommends a Recycling Agency of Namibia to capture and monitor recycling data, as records of recycling activities were not available in most companies. It was difficult to establish what was going on in the industry. The country could benefit more if records could be made available at national level through the development and maintenance of national centres for monitoring and evaluation of recycling statistics, that is, waste generated, recovered materials and processed waste. Ministry of Industry and Commerce, MET and MRLGHRD could be responsible for this. Ministry of Environment and Tourism could be responsible for this in collaboration with local authorities and companies involved in recycling.

6.3. Summary

The proposed model takes into consideration the existing operational difficulties of solid waste recycling in Namibia. The recycling sector consists of economic activities like

waste collection, waste trade and reprocessing and recycling of some of the materials in different forms. At the same time, recycling is considered as a waste management strategy among other options such as avoidance, reduction, reusing and finally disposal as depicted in the WMH. For sustainability, waste management recycling cannot be separated from these other waste management options. Thus most developing countries are also trying to move towards this new approach in line with the principles of the Integrated Waste Management Hierarchy and in Namibia during the time of study Windhoek was already moving towards the approach upon realising that end of pipe approach would not be sustainable in the long run. This followed the introduction of the SWMP in 2009. Against this background, this study found the proposed Integrated Solid Waste Management Programme relevant as a solution to waste management in Namibia, particularly in smaller urban centres where the strategy could assist many local authorities, give more attention to recycling.

CHAPTER 7

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1. Introduction

This chapter presents a summary of the findings, conclusions and the recommendations of the research study. The summary is arranged according to the themes of the research: the motives of recycling by companies, their extent of involvement in the industry, government policies and regulatory framework of the industry, recycling trends in Namibia, benefit chains in the industry, value addition processes for different recyclables and national and international network linkages within the industry. According to Bless and Higson-Smith (1995), the purpose of this chapter is to summarise the aims of the research, compare them with the findings and draw conclusions on how much and in which manner, the goal has been achieved. The recommendations include a model to guide waste management in rural and urban centres in Namibia and areas for further research.

7.2. Summary

The summary is presented using the thematic headings as used in Chapter 4.

7.2.1. Motives of companies in solid waste recycling in Namibia

All of the companies interviewed said recycling was conducted for environmental reasons, but 86% of the companies that were directly involved in recycling said they were recycling as a business venture. Only two companies (J and F) said they were doing it for social reasons. Recycling is an expensive venture with very low returns. It also requires a constant supply of working capital to fill the gap between export receipts

and daily expenditure. Although all participants were recycling for environmental reasons, it was clear that everyone who was recycling was doing it as a business venture. It is evident from the findings that most of the companies came on board when recycling started, but at the time of study, some had pulled out due to lack of sufficient working capital.

The findings were that recycling activities were driven by environmental and economic forces. Environmentally, companies felt waste was a threat if not taken care of properly. Taking heed of the recommendations of the Earth Summit of 1992, the government of Namibia has embraced recycling. All the companies' involvement was hinged on this environmental requirement. Despite the importance of the environmental movements, companies were driven by the economic entrepreneurial spirit. Recycling was viewed as a business like any other business, thus actors felt there was potential to make profit in the emerging arena of business, as demand for the different products for purposes of reuse and raw material production was evident.

7.2.2. Extent of involvement of companies in solid waste recycling in Namibia

Recycling involves three main steps, as Hickman et al. (2009), states: step 1-collection and processing; step 2-manufacturing; and step 3-purchasing of new products made from the recycled materials to complete the recycling loop. Five distinct areas of involvement were observed, which are collection, pre-processing, processing, manufacturing and selling. Companies such as A, F,G, N, E, K were involved in the collection and pre-processing stage, which is part of step 1 of the recycling loop, while very few companies were involved in processing raw materials and manufacturing recycled goods. Only plastics completed the recycling loop, but the rest of the recyclables were simply pre-

processed and sent abroad for further processing and subsequent production of raw materials and new products. Materials processed were paper, e-waste, glass, aluminium and metal cans and scrap metals. Low waste volumes, lack of machinery, skills shortage and financial constraints were the major reasons identified for the partial recycling of most materials in the country. High transport costs and transport logistical challenges affected the ferrying of materials from sources further afield to the markets in major centres in Namibia. Therefore, most recycling companies were mainly involved in the processing of raw materials sourced from their vicinity or brought to them by waste generators.

7.2.3. Policies guiding waste recovery and recycling

At the time of study, there was no specific national policy on recycling in Namibia. However, some elements of recycling policies were embedded in the MOHSS waste management policy, which promotes waste minimisation. Waste minimisation is one of the elements of the Waste Management Hierarchy promoted through Agenda 21 at the Rio Summit of 1992. At local level, only the City of Windhoek had embarked on recycling as an environmental concern, but not as a source of raw material or business venture. Other local authorities were also following suit by encouraging recycling companies, however, the researcher could not identify any policy documents employed.

7.2.4. Legislation guiding waste recovery and recycling

The study established that there was no direct standalone legislation governing the operations of recycling in the country. The researcher identified elements of recycling legislation from the Environmental Management Act, the Health Act, the Water Act and

Windhoek City by-laws. All companies operating in Windhoek were aware of council by-laws and the general laws that governed company operations, for example, the Labour Act, Employment Act and the Standard Quality Act. To incentivise the industry, legislation would be required to compel individuals, businesses and companies to participate in recycling.

7.2.5. Emerging waste recycling trends

Recycling has always been in existence in the country, but mostly driven by the informal sector. Full-scale recycling was formally promoted around 2000 through the initiative of a few private companies that started encouraging the use of drop-off centres at major shopping malls in Windhoek. In 2010, recycling was introduced by the City of Windhoek, working in partnership with the private companies. There was also involvement of ward contractors, who collected recyclables from households, businesses and institutions; and integration of the waste pickers and the formal sector. These efforts spread out to towns such as Walvis Bay (2012), Swakopmund (2015) and to northern towns of Namibia.

Little statistical information was obtained from companies about the recyclable volumes. Cow's limited records highlighted very little recycling taking place at the time with only about 6% of the waste from residential areas being recycled due to lack of cooperation from residents. The rest of recyclable material was still disposed at dumpsites, a situation which was a concern to Council authorities and recycling companies.

The recycling initiative witnessed the establishment of a plastic processing plant in Okahandja, which paved the way for full recycling of plastics in Namibia as well as the

introduction of MRF in Windhoek, Swakopmund and other major towns. The world economic downturn around the time of study resulted in the stagnation of growth in the volumes of materials exported; especially scrap metals, thereby hampering the momentum that had been gathered in the growth of the industry.

7.2.6. Recycling value addition processes and products

The researcher wanted to establish value addition processes in the industry in Namibia. It turned out that only plastics were undergoing the full cycle of recycling from waste collection to product purchasing and back to waste collection. Other materials like paper, scrap metals and e-waste were partly processed before export. It was established that there were plans to establish scrap metal a processing plant at Otavi and glass production plant at Tses. However, there was no concrete evidence of such development at the time of study. Even though the government and private sector were keen on having these industries, the handicap lay on the generation of sufficient volumes for economic viability of these industries and the technologies. In general, these efforts should be looked at from a regional point of view and not at country perspective for the venture to be meaningful.

7.2.7. Benefit chains of recycling industry in Namibia

Like in other countries, recycling was benefiting local authorities in delivering part of their mandate, labour market, construction industry, transporters, manufacturing industry and the environment. Recycling reduced pollution in towns like Windhoek. The City of Windhoek still maintains its cleanliness to a level, which the local authority has partly attributed to the recycling efforts. In addition, the benefit of the industry to the unskilled

labour market was immense, with large companies employing in excess of 1,500 employees, a benefit to a country with high unemployment rate. The researcher could not quantify secondary and tertiary benefits in various areas, but like any functioning economic venture, there were downstream benefits that were difficult to identify.

7.2.8. Establishment of operational network linkages in the industry

The recycling industry had both internal and external operational networks linkages. The linkages were associated with material and information flow, technological exchange, financial and transport services. The main operational network linkages were found to be in existence among waste pickers, ward contractors, residents, material transporters and processing companies, manufacturers, wholesale distributors and retail shops through material flow.

Transport, a critical factor in the movement of raw materials within and outside Namibia, was found to be critical component to the viability of the recycling industry. The industry worked in association with transporters in the transport industry. Many recycling companies suggested that the industry could benefit immensely if truckers that bring in goods from South Africa could also transport recyclables back to South Africa rather than going back empty.

Financial viability was another very important factor identified for the success and survival of the industry. Financial constraints were viewed as a limiting factor to companies' operations. The study found that big companies were linked to external partners for financial, technological and material support and had access to the Environmental Investment Fund, which was set aside for assisting entrepreneurs in

economic development. The acquisition of funds, even from lending financial institutions such as banks, was found to be difficult. Thus, this study recommends that accessing funding in the industry be made easier to avoid unnecessary delays in implementing plans.

7.3. Conclusion

Recycling is an industry like another, such as fishing, mining, agriculture and tourism in Namibia. As an emerging industry, the study came up with conclusions highlighted below.

7.3.1. Motives of companies in solid waste recycling in Namibia

Recycling has always been in existence in Namibia driven by the informal waste pickers. The turning point in the industry started in the mid-90s when industrialists got involved in organising the industry. Government agencies, private companies and the business world became participating actors in the industry driven by different motives. Depending on the nature of business of the actors, two major pull factors stood out as drivers of their involvement in this emerging industry. Companies, which were recycling were driven by economic reasons while regulators were driven by the environmental motives. For private companies, who were in this business, it was a business venture like any other business.

7.3.2. Extent of involvement of companies in solid waste recycling in Namibia

As a business venture, companies found a niche in the industry and were involved in different activities. Most recycling companies were involved in recovery, collection and pre-processing of recyclables. Total recycling was limited to plastics only; and further

processing and subsequent production of raw materials and production of new products were done outside the country for the rest of the recyclable materials.

7.4. Regulatory Framework

The responsibility of the government is to create an enabling environment and regulate businesses for reasons such as public safety, welfare and environment protection. There are many regulations in place such as licensing, permitting and inspections.

7.4.1. Policies guiding waste recovery and recycling

At national level, the policy thrust was on waste minimisation while at local level it was on waste reduction at dumpsites. Therefore, the policies available were targeted at reducing waste but not at the production of raw materials through recycling. As Namibia promotes industrialisation, raw material value addition policies should be promoted, and so should raw material from waste.

7.4.2. Legislation guiding waste recovery and recycling

At national level, Namibia does not have any direct legislation governing recycling. However, at local level, by-laws in place govern the activities of waste management in only one area where they exist, Windhoek. Therefore, there is no law governing recycling in the country. As recycling efforts continue an overarching law is required.

7.5. Emerging waste recycling trends

Recycling in Namibia is still at infancy stage and there is still great scope for areal expansion, recoverable volume of recyclables and more players in the industry in terms of the public and formal sector participation.

The researcher observed the following, as emerging issues in the industry:

- Bottles and plastics were still lying all over the country at business centres situated along major roads in remote parts of Namibia due to lack of transport to ferry them to markets.
- Schools recycling competition programmes sponsored by the corporate world were still concentrated in urban environments only. The industry was working with local schools to instil in the children a sense of environmental awareness and entrepreneurship.
- Formal and informal sectors were working together moving from the traditional approach of indifference.
- Traditionally, recycling depended on individuals who carried recyclables to drop-off centres or simply discarded them together with non-recyclables. At the time of study, there were efforts by recycling companies to encourage source collection of recyclables.
- E-waste recycling was practised in Windhoek only.

7.6. Recycling value addition processes and benefit chains

Total value addition was still limited to plastics only. The rest of the products were exported, mainly to South Africa, for further processing and subsequent production of raw materials and goods. Pre-processing was the main activity after recovery and collection. Government through its industrialisation policy is encouraging value addition on any raw material produced in Namibia and recyclable raw material is not an exception.

7.7. Benefits of the recycling industry in Namibia

The main beneficiary of the industry was the environment with secondary raw material a direct benefit at each stage of the recycling chain. Other benefits also spread across different sectors of the economy at national, local authority, company and finally at the individual levels through employment.

7.8. Establishment of operational network linkages in the industry

There were linkages associated with various industry actors: suppliers, creditors, customers and logistic providers. The linkages created a network of the flow of material, information, technological equipment and finances. Due to the infancy of the industry, outside networks were inevitable as these provided more of the markets as well as resourcing the industrial growth.

7.9. Recommendations

Following the revelation that the industry is still in its infancy, the study makes the following recommendations that could help the industry to grow.

- 1) The industry should be well supported, especially with financial capital and cross-border transporters of goods should be allowed to carry goods back and forth from Namibia without any restrictions.
- 2) There must be deposit incentive schemes to discourage people from throwing away bottles and rather encourage the transporters of bottles to take back their empty bottles.
- 3) There is a need for a national recycling policy and legislation in the country to promote awareness about the benefits of the industry. This way, everyone is held accountable.

- 4) Solid waste management is a challenge in some areas of the country. The study recommends the adoption of the proposed Integrated Recycling Model, which could help address some of the challenges faced in these areas.
- 5) Plastic is the most recyclable material. It is, however, the most challenging material affecting Namibia. It is freely available in shops. Its disposal into the environment is worsened by inadequate sanitary facilities. There is a need to control the availability of plastic through charges at point of sale if the problem of 'plastic landscape' is to be addressed.
- 6) The government should come up with a recycling fund to be funded by importers, producers and other environmental sympathisers and financiers.

7.10. **Contributions of the study**

The aim of this study was to investigate the recycling industry, an emerging economic sector involved in the recovery and production of raw materials, manufacturing and subsequent purchasing of produced goods in Namibia. This study offered insight into formal recycling business in Namibia; that is, the motives for conducting this business and the extent of involvement of the stakeholders and their roles, existing legal and regulatory framework and the possible economic, social and environmental impacts of the business. These results provide a baseline for future studies on recycling solid waste in Namibia as well as act as a guide to decision makers at different levels to promote the industry for economic development.

This research is valuable, specifically to local authorities and the recycling companies. The presentation and analysis of recycling impacts on economic, social and environmental needs provides local authorities with a framework for understanding

waste collection schemes and the wider issues related to recycling systems. The research also answered questions about the environmental benefits of recycling at national level and the importance of legislation to facilitate recycling in a broader sense. The importance and understanding of logistics such as transport and networks for the recycling community, allows one to delve deeper into the issues at the core of recycling. All this and more gives the research communities further understanding of the use of Life Cycle Analysis (LCA) methods and recycling logistics systems in general. Above all, this research provides insights to importers, retailers and packaging companies on the choices of packaging materials and the impacts of their decisions on the environment and recycling logistics and systems required to avoid the burden of waste in Namibia.

7.11. **Areas for further research**

The study identified the following areas for further research:

1. The study established that the industry of recycling in Namibia is operated by both formal and informal sectors. Focus of the study, however, was on formal sector recycling, leaving out the informal sector. As far as this researcher is aware, no studies have been conducted on informal sector recycling. Future research could look into this area to establish its role.
2. An area that also warrants further research is the role of buy-back centres together with the deposit schemes to establish the effectiveness of these methods in reducing mounds of recyclables at business centres throughout Namibia.
3. It would also be beneficial to look at the role of women and children in waste picking in the recycling industry in Namibia since the study established their participation in the industry.

4. Another possible topic for research is a survey on household source separation or kerbside recycling.
5. More research is required on the human health and safety risks associated with informal waste recycling in Namibia. A better understanding of the needs of the informal population can influence legislation and public policies for better working regulations.
6. Further research is needed to quantify the volumes of recycling and estimating the economic importance of the activity on a local, national and regional scale. If successful, this could bring about the true benefits of the sector and could drive greater integration with the formal municipal collection system. Economic incentives could overcome this, however in some instances it may be social aspects that hinder achieving efficient recycling targets.

LIST OF REFERENCES

- Abdelshafie, A.G.M. (2014). *Trends and Practices of E-waste Management through Reverse Logistics - A case study: Samsung Electronics Company*. Master's Thesis, Molde University College. Norway. Retrieved November 15, 2015, from https://brage.bibsys.no/xmlui/bitstream/handle/11250/221524/master_abdelshafie.pdf?sequence=1
- Abdul-Rahman, F. (2014). Reduce, reuse, and recycle: Alternatives for waste management. *NM State University Guide G-314*, 1-4. Retrieved April 4, 2014, from http://aces.nmsu.edu/pubs/_g/G314.pdf
- African Development Bank. (2014). *Namibia country strategy paper 2014-2018*, SARC. Retrieved July 18, 2015 from https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/2014-2018_-_Namibia_Country_Strategy_Paper.pdf
- Anderson, B.A., Romani, J. H., Wentzel, M., and Phillips, H.E. (2013). *Recycling behaviour among urban South Africans: The role of race and social status*. Research Report. Retrieved April 18, 2015, from <https://www.psc.isr.umich.edu/pubs/pdf/rr13-790.pdf>
- Anwasha, B., and Sinha, K. (2013). *Generation of electronic waste in India: Current scenario, dilemmas and stakeholders*. Research Paper. Retrieved December 19, 2015 http://www.academicjournals.org/article/article1380557326_Borthakur%20and%20Sinha.pdf

Ashipala, P. (2012, April 5). Reduce, Re-Use & Recycle; The Business of using rubbish again. *The Namibian*. from

<https://www.namibian.com.na/index.php?id=93737&page=archive->

Asong, F.Z. (2010). Recycling and Material Recovery in Cameroon: Implications for Poverty Alleviation and Ecological Sustainability. Retrieved 26, March 2019

<http://opus4.kobr.de/opus4->

[btu/frontdoor/deliver/index/docId/1831/file/Dok_finalized.pdf](http://opus4.kobr.de/opus4-deliver/index/docId/1831/file/Dok_finalized.pdf)

Babbie, E. (2004). *The practice of social research*. 10th ed. Southbank, Victoria: Wadsworth/Thompson.

Baeyens, J., Brems, A., and Dewil, R. (2004). Recovery and Recycling of post-consumer waste materials. *Engineering and Chemical Process Technology*,

4. Retrieved March 15, 2012, from <http://www.eolss.net/sample-chapters/c06/e6-34-06-03.pdf>

Banga, M. (2013). *Household Knowledge, Attitudes and Practices in Solid Waste Segregation and Recycling: The Case of Urban Kampala*. *Zambia Social Science Journal*, 2(1), Retrieved July 19, 2015, from

<http://scholarship.law.cornell.edu/zssj/vol2/iss1/4>

Becker, N. (2014). *Increasing High Recycling Rates: Socio-demographics as an additional layer of information to improve waste management*. Master's Thesis. Lund University. Sweden. Retrieved April 7, 2016 from

<https://www.sysav.se/globalassets/media/filer-och-dokument/informationsmaterial->

[broschyre-arsredovisningar-faktablad-rapporter-etc/rapporter/rapporter-2015/nathalie-becker---increasing-high-recycling-rates---msc-thesis-2015.pdf](#)

Belgiorno V., and Cesaron, A. (2017). Urban mining as a sustainable strategy for the management of residual solid waste. *15th International Conference on Environmental Science and Technology Rhodes, Greece, 31 August to 2 September 2017*. Retrieved April, 4, 2017 from https://cest.gnest.org/sites/default/files/presentation_file_list/cest2017_01438_oral_paper.pdf

Bell, J. (1993). *Doing your research project: A guide for first time researchers in education and social science* 2nd ed. Buckingham: Open University Press.

Benedicta, A.I. (2012). E-waste management: A case study of Lagos State, Nigeria. Master's Thesis. University of Jyväskylä. Finland. Retrieved January 30, 2015, from <https://jyx.jyu.fi/bitstream/handle/123456789/43156/URN:NBN:fi:jyu-201404031459.pdf>

Binda, M. (2014). *Recycling economics: savings versus prices*. Proceedings of the 20th Waste Conference 6-10 October 2014. Somerset West, Cape Town. Retrieved October 12, 2017, from <http://infrastructurene.ws/wp-content/uploads/sites/4/2015/01/Binda-M.-2.pdf>

Bird, J. (2010). New and emerging industries national research development and extension strategy. *Rural industries research and development corporation publication. No 10/159*. Retrieved April 12 2012, from <https://rirdc.infoservices.com.au/downloads/10-159>

- Bless, C., and Higson-Smith, C. (1995). *Fundamentals of social research methods: An African Perspective*. Kenwyn. Juta & Co.
- Bolaane, B. (2004). *Constraints to Organized Recycling in Developing Countries: A case study of Gaborone, Botswana*. Doctoral dissertation, Loughborough University Institutional Repository. Retrieved June 10, 2013 from http://ithuteng.ub.bw/bitstream/handle/10311/141/bolaane_constraints.pdf
- Botes, A. (2012, September 27). *Scrap metal recycling in South Africa*. Newsletter. Retrieved January 5, 2014 from https://www.osha.gov/SLTC/recycling/recycling_scrap_metal.html
- Broni-Sefah, K. (2012). A study of the scrap metal trade in the Kumasi metropolitan area. Master's Thesis. Kwame Nkrumah University of Science and Technology. Kumasi. Retrieved April 29, 2014 from <http://ir.knust.edu.gh/bitstream/123456789/5842/1/KWASI%20BRONI-SEFAH.pdf>
- Bryman, A. (1989). *Research methods and organization study*. London. Oxford University Press.
- Bryman, A. (2001). *Social Research Methods*. London. Oxford University Press.
- Bureau for International Recycling. (2009). *Recycled materials supply 40% of global raw materials needs*. Retrieved July 3, 2015 from <http://www.bir.org/industry/>
- Bureau for International Recycling. (2009). *Study on the environmental benefits of recycling*, Retrieved April 17 2015, from <http://www.bit.org/industry/>

Bureau for International Recycling (2013). *Global facts and figures ferrous metals world steel recycling in figures 2011 – 2015 Steel Scrap – a raw material for steelmaking* retrieved June 3, 2015, from https://www.bdsv.org/fileadmin/service/markt_und_branchendaten/weltstatistik_2011_2015.pdf

Bureau for International Recycling. (2016). *Global facts and figures ferrous metals world steel recycling in figures 2012 – 2016 Steel Scrap – a raw material for steelmaking*. Retrieved June, 3, 2017 from https://www.bdsv.org/fileadmin/service/markt_und_branchendaten/weltstatistik_2012_2016.pdf

Centre for Scientific Institute Research. (2011). *Municipal waste management - good practices. Edition 1*. CSIR, Pretoria. Retrieved February 29, 2016, from [http://climateinfo.pk/frontend/web/attachments/data-type/CSIR%20\(2011\)%20Municipal%20waste%20management%20-%20good%20practices.pdf](http://climateinfo.pk/frontend/web/attachments/data-type/CSIR%20(2011)%20Municipal%20waste%20management%20-%20good%20practices.pdf)

Chandak, S.P. (2012). Trends in Solid Waste Management: Issues, Challenges and Opportunities International Consultative Meeting on Expanding Waste Management Services in Developing Countries 18- 19 March 2010 Tokyo, Japan Retrieved April 8, 2015 from http://81.47.175.201/flagship/attachments/UNEP_Waste.pdf

Chatri, A.K and Aziz, A. (2012). Report: *Public Private Partnerships in solid waste management in India. Potential and Strategies*.8-81 Retrieved February 15, 2016 from

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/186990/ReportPPPMunicipalSolidWasteManagement270812.pdf

Chauldry, A. (2003). *Waste Pickers in India*. Retrieved March 3, 2012 from

<http://wiego.org/informal-economy/occupational-groups/waste-pickers>

Cheru, S. (2011). Assessment of municipal solid waste management service in Dessie town. Master's Thesis. Addis Ababa. Retrieved July 8, 2014 from

<http://etd.aau.edu.et/bitstream/handle/123456789/5962/Solomon%20Cheru.pdf>

Chiromo, A. (2009). *Research methods and Statistics in education: A students' guide*.

Midlands State University. Gweru, Zimbabwe.

Choi, T. (2012). *Economic and environmental input-output modelling: Building material*

recycling. PhD Dissertation. Georgia: Georgia Institute of Technology. Retrieved October 10, 2015, from

https://smartech.gatech.edu/bitstream/handle/1853/45924/choi_taelim_201212_phd.pdf

Chukwunonye, E., and Clive L. R. (2012), Analysis of barriers and success factors

affecting the adoption of sustainable management of municipal solid waste in

Nigeria. *Journal of Environmental Management*, 103:9-14.

http://www.researchgate.net/publication/45794853_Analysis_of_barriers_and_success_factors_affecting_the_adoption_of_sustainable_management_of_municipal_solid_waste_in_Abuja_Nigeria

City of Windhoek. (2009). *Solid Waste Management Policy*

- City of Windhoek. (2011). *Waste Management Regulations No.16. of 2011*.
- City of Windhoek. (2013). *Household Waste Audit Report*.
- City of Windhoek. (2015). Solid Waste Management Newsletter Issue 6 (January-March)
- City of Windhoek. (2015). Waste Reduction Strategy and Plan 3rd Draft.
- Cohen, L., Manion, L. and Morrison, K. (2005). *Research methods in education: 5thed.*
London: Routledge. Falmer.
- Courtois, A.L. (2012). *Municipal Solid Waste: turning a problem into resource.*
Retrieved May 15, 2013 from
http://www.ccacoalition.org/sites/default/files/resources/2013_municipal-solid-waste-turning-problem-into-resource_World-Bank.pdf
- Creswell, J. W. (1994). *Research design: qualitative and quantitative approaches.*
London: Sage Publications.
- Creswell, J. W. (2003). *Research design: qualitative, quantitative and mixed methods approaches.* 2nd ed. London: Sage Publications.
- Creswell, J.W. (.2009). *Research Design: Qualitative, Quantitative, and Mixed Method Approaches.* 3rd ed. Los Angeles: Sage Publications.
- Creswell, J.W. (2014). *First step in research*, 14th ed. Cape Town: Van Schaik.
-
- Croset, E. (2014). *Opportunities and Challenges of a Sustainable Solid Waste Management in Tsumeb: Namibia.* Master Thesis. Stockholm: Royal Institute of

- Technology. Sweden. Retrieved March, 30, 2016, from <http://www.diva-portal.se/smash/get/diva2:760986/FULLTEXT01.pdf>
- Denzin, N. K. (1978). *The research act: a theoretical introduction to sociological methods: a sourcebook*. New York: McGraw Hill.
- Dlamini, S. Q. and Simatele, D. (2016). *Unrecognized informal solid waste recycling ESDN Case Study No. 6*. Retrieved July 19, 2015, from
- European Technology Platform on Sustainable Mineral Resources. (2011). *Developing new innovative technology and high technology solutions for sustainable raw material supply*. Retrieved July 19, 2015, from https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/system/files/ged/85%20smr_en.pdf
- Ezeah, C., Fazakerley, J.A., and Roberts, C. L. (2013). Emerging trends in informal sector recycling in developing and transition countries. *Waste Management Journal*, 33, 2509–2519. Retrieved October 16, 2016, from <http://www.sciencedirect.com/science/article/pii/S0956053X13002973>
- Fadlalla, N.B.I. (2010). *Management of PET plastic bottles waste through recycling in Khartoum State*. Masters' Thesis. Khartoum: University of Sudan. Retrieved October13, 2015 from http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/44/007/44007611.pdf
- Fahmi, W. and Sutton, K. (2010).Cairo's Contested Garbage: Sustainable solid waste management and the zabaleen's right to the City. *Sustainability*, 2, 1765-1783. doi:

10.3390/su2061765 Retrieved December, 26, 2015 from

<https://fr.ircwash.org/sites/default/files/Fahmi-2010-Cairo.pdf>

Fall. (2015). *Waste and recycling programs in Hancock and Houghton, Michigan*

Michigan Technological University. Retrieved July, 5, 2016 from

<https://www.mtu.edu/social-sciences/research/reports/waste-and-recycling-full-report.pdf>

Fakir, S. (2009). *Global trends in waste management: some pointers for South Africa.*

Report. Centre for poverty employment and growth. Retrieved February 5, 2015,

from

<https://www.gtac.gov.za/Researchdocs/Global%20Trends%20in%20Waste%20Management%20%20Some%20Pointers%20for%20South%20Africa.pdf>

Federal Ministry of Economics and Technology, (2010). *The German Government's raw*

materials strategy: Safeguarding a sustainable supply of non-energy mineral

resources for Germany. Berlin. Federal Ministry of Economics and Technology

(BMWi). Retrieved from May, 5, 2018 from [https://ec.europa.eu/growth/tools-](https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/system/files/ged/43%20raw-materials-strategy.pdf)

[databases/eip-raw-materials/en/system/files/ged/43%20raw-materials-strategy.pdf](https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/system/files/ged/43%20raw-materials-strategy.pdf)

Ferronato, N., Marco Bezzi, M., Zortea, M., Torretta, V., and Ragazzi, M. (2016). An

interdisciplinary approach for introducing sustainable integrated solid waste

management system in developing countries: The case of La Paz (Bolivia). *Procedia*

Environmental Science, Engineering and Management 3(2), 71-81. 20th

International Trade Fair of material & energy recovery and Sustainable

Development, ECOMONDO, 8th-11th November, Rimini Fiera, Italy. Retrieved

- March, 16, 2017, from http://www.procedia-eseem.eu/pdf/issues/2016/no2/10_Ferronato_16.pdf
- Galizzi, P. (2005). From Stockholm to New York, via Rio and Johannesburg: Has the Environment Lost its Way on the Global Agenda? *Fordham International Law Journal*, 29(5), 3. 952-1008.
- Geo-Hive. (2013). *Namibia Population*. Retrieved June 13, 2014 from <http://www.geohive.com/cntry/namibia.aspx>
- Gertsakis, J.J., and Helen, L.H. (2003). EcoRecycle Victoria, Sustainability and the Waste Management Hierarchy. A discussion paper on the waste management hierarchy and its relationship to sustainability Retrieved August, 13, 2015 from http://www.helenlewisresearch.com.au/wp-content/uploads/2014/05/TZW_-_Sustainability_and_the_Waste_Hierarchy_2003.pdf
- Gjoksi, N. (2011). *Resource Security: The European Raw Material Initiative*. Retrieved April 20, 2014 from https://www.sd-network.eu/pdf/case%20studies/ESDN%20Case%20study_6_resource%20scarcity_final.pdf
- Guamba, J. M. E. and Tembe, A. A. (2016). Selective collection and recycling of solid waste case study: Recycling of solid waste in Hulene Ka-Mahota District. *International Journal of Research- Granthaalayah*, Vol. 4, No. 7, 84-93. Retrieved October 12, 2017, from http://granthaalayah.com/Articles/Vol4Iss7/07_IJRG16_C07_65.pdf

- Gunsilius, E., Chaturvedi, B. and Scheinberg, A. (2011). *The Economics of the Informal Sector in Solid Waste Management. CWG Publication Series No 5* Retrieved July, 5, 2013, from <https://www.giz.de/en/downloads/giz2011-cwg-booklet-economicaspects.pdf>
- Gutberlet, J. (2010). *Organized and informal recycling: social movements contributing to sustainability. WIT Transactions on Ecology and the Environment*, 109, 224-232. Retrieved April, 7, 2014, from <http://www.juttagutberlet.com/wp-content/uploads/2013/10/2008-WESSEX-Chapter-Social-Movement1.pdf>
- Hancock, B.T. (1998). *Focus for research and development in primary health care: An introduction to qualitative research*. Retrieved August, 1, 2014 from <http://classes.uleth.ca/200502/mgt2700a/Articles/Qualitative Research.pdf>
- Harris, T. R., Dick, R. M., Kim, M., Oliver, A. and Coronel, C. (2011). *Economic analysis of waste recycling options for Washoe County*. Technical Report UCED 2009/ 10- 12. Retrieved March 9, 2013 from http://www.ag.unr.edu/uced/Reports/Technical/Technical_Washoe_2011_483.pdf
- Hasheela, R. (2009). *Municipal solid waste management in Namibia: Windhoek Case Study*. PhD Dissertation, University of Azteca. Vienna, Austria: Retrieved February 5, 2013, from http://www.environment-namibia.net/tl_files/pdf_documents/selected_publications/WasteManagement_Hasheela_2009.pdf
- Haugnes, S.E. (2010). *Consumers in industrial networks: A study of Norwegian-Portuguese bacalhau network*. PhD Dissertation. Norway. Retrieved October 11, 2014, from https://www.impgroup.org/uploads/dissertations/dissertation_47.pdf

- Hecker, B. (2012). E- Waste management: An emerging environmental and health issue in India. *National Journal of Medical Research* 2 (1).107-109 Retrieved July 18, 2014, from <https://www.ejmanager.com/mnstemps/78/78-1334079845.pdf>
- Hedayati, M. (2016).*System Model for Sustainable End-of-Life Vehicle Treatment in the Australian Context*. PhD Dissertation. RMIT University. Tehran. Retrieved June 15, 2017 from <https://researchbank.rmit.edu.au/eserv/rmit:161901/Hedayati.pdf>
- Hickman, D.; Whiteman, A.; Soos, R. and Doychinov, N. (2009). *Model for Global Development of Recycling Linkages*. Retrieved September, 9, 2012 from <https://docslide.net/documents/model-for-global-development-of-recycling-linkages.html>
- Hilpert, H.G and Stormy-Annika, M. (Eds.). (2013). *Fragmentation or Cooperation in Global Resource Governance?*7-203 A Comparative Analysis of the Raw Materials Strategies of the G20Stiftung Wissenschaft und Politik German Institute for International and Security Affairs (SWP) Research Paper Retrieved July 19, 2015, from https://www.swp-berlin.org/fileadmin/contents/products/research_papers/2013_RP01_hlp_mdn.pdf
- Hoornweg, D. and Bhada-Tata, P. (2012).2012. *What a Waste: A Global Review of Solid Waste Management*. Urban development series; knowledge papers no. 15. World Bank, Washington, D.C. © World Bank. Retrieved June, 29, 2015 from <https://openknowledge.worldbank.org/handle/10986/17388> License: CC BY 3.0 [IGO](https://www.igo.org/).

Horward, B.C. (2008). *Your guide to figuring out what those recycling symbols codes on plastics mean*. Retrieved June, 6, 2016 from

<http://www.goodhousekeeping.com/home/g804/recycling-symbols-plastics460321/>

Hoyle, R. H., Harris, M. J. and Judd C. M. (2002). *Research Methods in Social Research*. London: Thomson Learning.

International Aluminium Institute, (2009). *Global Aluminum Recycling: A Cornerstone of Sustainable Development*. Retrieved February 21, 2014, from

http://www.worldaluminium.org/media/filer_public/2013/01/15/fl0000181.pdf

International Monetary Fund, (2013). "Namibia".

<http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/weorept.aspx?pr.x=19&pr.y=1&sy=2009&ey=2012&scsm=1&ssd=1&sort=country>

Jabareen, Y. (2009). Building a Conceptual Framework: Philosophy, Definitions, and Procedure. *International Journal of Qualitative Methods* 8(4).1-14 Retrieved July, 17, 2016, from

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.7232&rep=rep1&type=pdf>

Jacobsen, A., Kelly, M., Roche, L., White, E. (2014). *Recycling by bicycle: A green alternative to expand recycling and create jobs in Windhoek*. B A Honours Thesis.

Worcester Polytechnic Institute. Retrieved April 20, 2016, from

https://web.wpi.edu/Pubs/E-project/Available/E-project-050814-115544/unrestricted/POLYD14_IQP_Report.pdf

- Johnson, R. B., and Christensen, L. B. (2004). *Educational research: Quantitative, qualitative, and mixed approaches*. Boston. Allyn and Bacon.
- Kaakunga, E.K. and Matongela, A.M. (2012). Inflation and stock market development in Namibia: Evidence from co-integration and error correction modelling. *Journal for Studies in Humanities and Social Sciences*, (2) 2, 1-13.
- Keyter, C. (2009). *Effectiveness and efficiency of Public-Private Partnership arrangement: A case study of perceptions on the ward contractor system in the City of Windhoek, Namibia*. Article. Retrieved May 9, 2012, from [http://ir.polytechnic.edu.na/bitstream/10628/76/1/Keyter Research Project](http://ir.polytechnic.edu.na/bitstream/10628/76/1/Keyter%20Research%20Project)
- Koehn, N, S. (2011). Urban mining recycling as a key to ensure raw material supply. *Business Journal of the German Chamber of Commerce in China Beijing / Shanghai / South & Southwest China* 11-14 Retrieved July 19, 2015, from http://china.ahk.de/fileadmin/ahk_china/Dokumente/GC-Ticker/GT_11i6_1.pdf
- Komane. K. A. (2014). *Waste Reclaimers and South African Environmental Law. Masters Thesis*. North-West University. South Africa. Retrieved 24 Sept 2015 from https://repository.nwu.ac.za/bitstream/handle/10394/11180/Komane_KA.pdf?sequence=1
- Koshy, A. (2010). *What is Action Research?* Sage Publications. London.
- Kothari, C.R. (2004). *Research Methodology Methods and Techniques*. New Age International (P) Limited Publishers. New Delhi.

- Kotze, D.A. (2015). Women's Perceptions and attitudes about recycling. *International Journal of Environmental Sustainability* 10(2), 41-50 retrieved November 9, 2015 from <http://ijse.egpublisher.com/product/pub.272/prod.96>
- Kreiter, Z. (2015). *United Nations Economic Commission for Africa country profile– Namibia*. Retrieved June 15, 2016, from https://www.uneca.org/sites/default/files/uploaded-documents/CoM/com2016/Country-Profiles/namibia_cp_eng_print_5april.pdf
- Liebenberg, C. J. (2011). *Waste recycling in developing countries in Africa: Barriers to improving reclamation rates*. Concept Paper for the Eleventh International Waste Management and Landfill Symposium, Cagliari, Italy. Retrieved October 12, 2015, from <http://www.resol.com.br/textos/136.pdf>
- Lindell, A. (2012). *A case study of waste management in the Kavango region, Namibia*. Master's Thesis. University of Lund. Sweden. Retrieved February 15, 2015, from, <http://www.lup.lub.lu.se/record/3469952/file/3731902.pdf>
- Longenhoven, B. and Dyssel, M. (2007). The recycling industry and subsistence waste collectors: a case study of Mitchell's plain. *URBAN FORUM*, 18(1): 114-132. Retrieved January 3, 2014, from https://repository.uwc.ac.za/xmlui/bitstream/handle/10566/542/Langenhoven_MitchellsPlain_2007.pdf
- Luitel, K. P. and Khanal, S. N. (2010). "Study of scrap waste in Kathmandu Valley of Nepal: A quantitative and economic status". 2nd International Conference on solid waste management in developing countries. Bangladesh. 13-15 February,

2011. *Science, Engineering and Technology*, 6 (1), 116-122 retrieved June 12, 2015, from http://new.ku.edu.np/kuset/vol6_no1/14_Kisho.pdf
- Magen, Y. (2010). *Waste management and recycling study in Namibia: Case of Keetmanshoop and Ondangwa*. Bachelor Thesis. Retrieved February 5, 2013, from http://www.theseus.fi/bitstream/handle/10024/13310/Magen_Yoav.pdf
- Mahajan, N. (2016). Solid waste management in Chennai. India. *The Public Sector Innovation Journal* 2(2.)Article 4.1-26 Retrieved November 25, 2016 from https://www.innovation.cc/case-studies/21_1_4_mahajan_exnora-lessons4-22rev.pdf
- Makwara, E.C. and Magudu, S. (2013). Confronting the Reckless Gambling with People's Health and Lives: Urban Solid Waste Management in Zimbabwe. *European Journal of Sustainable Development* (2013), (2)1, 67-98. Retrieved August 17, 2015, from <https://ecsdev.org/images/V2N1/makwara%2067-98.pdf>
- Malmberg, A. (1996). Industrial geography agglomeration and local milieu. *Progress in Human Geography* 20 (3). 392-403. Retrieved July 5, 2015, from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.866.7466&rep=rep1&type=pdf>
- Mamphitha, D. (2011). *The role played by subsistence waste pickers in recycling*. Master's Thesis Retrieved September 15, 2015, from <https://repository.up.ac.za/bitstream/handle/2263/26322/dissertation.pdf;sequence=1>
- Manhart, A. et al., (2011). Informal e- waste management in Lagos, Nigeria- socio-economic impacts and feasibility of international recycling cooperation. Final Report

Retrieved September 8, 2015, from

<http://www.basel.int/Portals.4/Basel%20Convention/docs/eWaste/E->

Marmolejo, L.F., Diaz, L.F., Patricia Torres, P. and García, M. (2012). *Perspectives for Sustainable Resource Recovery from Municipal Solid Waste in Developing Countries: Applications and Alternatives*. PhD Dissertation. Università di Bologna.

Retrieved July, 5, 2014 from

http://amsdottorato.unibo.it/4496/1/santini_alessandro_tesi.pdf

Mayell, H. (2004). As consumerism spreads, earth suffers. *National Geographic News*.

Retrieved July 19, 2012, from <http://news.nationalgeographic.com/>

news/2004/01/0111_040112_consumerism.html

Mbeng, L.O. (2013). Informal Waste Recovery and Recycling: Alleviating Poverty, Environmental Pollution and Unemployment in Douala, Cameroon. *Journal of Scientific Research & Reports* 2 (1): 474-490, 2013; Article no. JSRR.2013.033.

Retrieved March 13, 2014, from

http://www.journalrepository.org/media/journals/JSRR_22/2013/Jul/1373980949-Mbeng212013JSRR4436.pdf

McGaghie et al. (2001)

Medina, M. (2008). *The informal recycling sector in developing countries:*

Michigan Technological University. Retrieved July, 5, 2016 from

<https://www.mtu.edu/social-sciences/research/reports/waste-and-recycling-full-report.pdf>

- Miller, A. P., A.P., Hang T. Nguyen, H.T. D. and Sifleet. S. D. (2007). *The economic benefits of recycling in Virginia*. Retrieved September 16, 2015, from <https://www.wm.edu/as/publicpolicy/documents/prs/deq.pdf>
- Mills, R. Ag. (2012) *What It Means to Go Green: Reduce, Reuse, Repurpose, and Recycle*. Retrieved November 21, 2016 from <https://digitalcommons.usu.edu/cgi?article=26908&context+extension.curall>
- Ministry of Trade and Industry (2015). *Namibia Public Private Partnership Policy*. Windhoek, Namibia: Retrieved July, 16, 2017, from <http://www.mof.gov.na/documents/27827/321365/Namibia+Public+Private+Partnership+Policy.pdf/e63c1488-ed76-4a7c-b8d8-ab74cdc2b38e>
- Modak, P. (2011) *Waste investing in energy and resource efficiency*. Chapter 5. Retrieved April 24, 2012, from http://www.unep.org/green_economy/Portals/88/documents/ger/GER_12_Cities.pdf
- Modak, P., Wilson, D.C. and Velis, C. (2015). *Waste Management Global Status*. Chapter 3: In T. Cannon (Ed.), *Global Waste management Outlook* (pp.51-120). Retrieved March 4, 2016 from <http://www.greenreport.it/wp-content/uploads/2015/09/Global-Waste-Management-Outlook-2015.pdf>
- Momoh, J. J. and Oladebeye, O. (2010). *Assessment of awareness attitude and willingness of people to participate in household solid waste recycling programme in Ado-Ekiti, Nigeria*. *Journal of Applied Sciences in Environmental Sanitation* 5(1).p.93-105 Retrieved April 27, 2012 from https://www.researchgate.net/publication/44024724_Assessmentof_awareness_attit

[ude and willingness of people-to-participate-in-household-solid-waste-recycling-program-in-Ado-Ekiti-Nigeria](#)

Monfardini, E., Probst, L., Szenci, K., Benoit Cambier, B. and Laurent Frideres, L. (2012). *“Emerging industries” : report on the methodology for their classification and on the most active, significant and relevant new emerging industrial sectors Version 1.3* Retrieved July 19, 2015 from https://ec.europa.eu/research/industrial_technologies/pdf/emerging-industries-report_en.pdf

Mosia, D. (2014). *Waste management and recycling in Mangaung Metro Municipality*, Retrieved September 9, 2016, from <https://www.ufs.ac.za/docs/librariesprovider43/health-and-wellness-centre-documents/wellness-documents/events-2014-documents/waste-management-and-recycling---27-may-2014-4626-eng.pdf>

Mugano, G. (2016, May 6). The New Growth Path on value addition Zimbabwe. *Sunday Mail*, p.10. Retrieved October 17, 2017 from <https://www.herald.co.zw/value-addition-strategies/>

Mughal, M. I. (2014). *Waste management in northern towns of Namibia*. Bachelor's Degree. Tampere University of Applied Sciences. Finland. Retrieved July 23, 2015, from http://www.theseus.fi/bitstream/handle/10024/83447/Mughal_Irfan.pdf?sequence=2&isAllowed=y

- Muhammad, M. N. and Manu, H. I. (2013). Gender roles in informal solid waste management in cities of northern Nigeria: A Case study of Kaduna Metropolis. *Academic Research International* (4) 5, 142-153. Retrieved July 19, 2015, from [http://www.savap.org.pk/journals/ARInt./Vol.4\(5\)/2013\(4.5-16\).pdf](http://www.savap.org.pk/journals/ARInt./Vol.4(5)/2013(4.5-16).pdf)
- Mutumba, H. Z. (2005). *Solid waste management in informal settlements of Windhoek*. Master's Thesis. University of Namibia. Windhoek.
- Muzenda, E. (2013). Recycling situation in South Africa. A Discussion Paper. *International Journal* Retrieved November 9, 2015, from <https://ujdigispace.uj.ac.za/bitstream/handle/10210?12591/1JBEESSO24065.pdf>
- Nagabooshnam, J.K. (2011). *Solid waste generation and composition in Gaborone, Botswana, potential for resource recovery*. Master's Thesis. Linkoping University, Sweden. Retrieved July 22, 2014 from <https://www.diva-portal.org/smash/get/diva2:488964/FULLTEXT01.pdf>
- Nahman, A. (2009). Extended producer responsibility for packaging waste in South Africa: Current approaches and lessons learned. *Resources, Conservation and Recycling*. 54. 155–162. Retrieved February 21, 2016, from
- Nakatani, J. (2014). Life Cycle Inventory Analysis of Recycling: Mathematical and Graphical Frameworks. *Sustainability*. (6), 6158-6169; doi: 10. 3390/su 6096158. Retrieved June, 3, 2015 from https://www.mdpi.com/2071-1050/6/9/6158/pdf&rct=j&frm=1&q=&esrc=s&sa=U&ved=0ahUKEwjN6syqm7fbAhXILMAKHZXfAhcQFggTMAA&usg=AOvVaw2xDIdvbr6_fKb6EW5kenR

- Namias, J. (2013). *The Future of Electronic Waste Recycling in the United States of America: Obstacles and Domestic Solutions*. Master's Thesis. Columbia University. Retrieved April 7, 2017, from http://www.seas.columbia.edu/earth/wtert/sofos/Namias_Thesis_07-08-13.pdf
- Namibia Institute for Democracy. (2000). *Affirmative Action/ Employment Act 1998*, Number. 29. Windhoek. Namibia. Retrieved November, 1, 2016 from <http://www.mol.gov.na/documents/432260/1685800/AFFIRMATIVE+ACTION+ACT+29+OF+1998.pdf/7fe6e92d-eb75-4eec-b910-aa3f2055e869>
- Nash, J. and Bosso, C. (2013). Extended producer responsibility in the United States: Full Speed Ahead? *Journal of Industrial Ecology*.17 (2) 175-18. Retrieved February 8, 2015, from http://www.hks.harvard.edu/var/ezp_site/storage/fckeditor/file/pdfs/centers-programs/centers/mrcbg/publications/awp/Nash_Bosso_2013-10.pdf
- Nathanson, J. (2015). Solid-waste management. Retrieved February 10, 2015. <http://www.britannica.com/EBchecked/topic/553362/solid-waste-management>.
- Ndum, E. (2013). *Bottom-up approach to sustainable solid waste management in African countries*. PhD Dissertation. Cottbus. Brandenburg University of Technology. Retrieved July 19, 2015, from https://opus4.kobv.de/opus4-btu/files/2753/Asi_PhD_Thesis02_04_12_Final2_new.pdf
- Nengomasha, C.T. (2009). *A Study of electronic records management in the Namibia Public Service in the context of E-Government*. PhD Dissertation. University of Namibia. Windhoek.

- Neuman, W. L. (2014). *Social Research Methods: Qualitative and Quantitative Approaches*. 7th ed. Harlow: Pearson Education Limited. Retrieved October, 28, 2015 from <https://cleavermonkey.files.wordpress.com/2015/10/w-lawrence-neuman-social-research-methods-qualitative-and-quantitative-approaches-pearson-education-limited-2013.pdf>
- Njoroge, K.S.; Wokabi, M.S.; Ngetich, K.; Kathuri, N.M. (2013). Influence of Informal Solid Waste Management on Livelihoods of Urban Solid Waste Collectors: A Case Study of Nakuru Municipality, Kenya. *International Journal of Humanities and Social Science*. 3(13). 95-108. Retrieved November 2, 2015, from http://www.ijhssnet.com/journals/Vol_3_No_13_July_2013/12.pdf
- No author, *Recovery and Recycling of Municipal Solid Waste in Hong Kong* (2010) Retrieved July, 5, 2015, from https://www.wastereduction.gov.hk/sites/default/files/wr_msw.pdf
- Ochieng, O. G. (2010). *Effect of value addition on price: A hedonic analysis of peanut in retail supermarkets in Nairobi, Kenya*. Master's Thesis. Retrieved July, 18, 2015, from <https://ideas.repec.org/p/ags/cmpart/134495.html>
- Oelofse, S. H. H. and Strydom, W.F. (2010). *The trigger to recycling in a developing country in –in the absence of command-and-control instruments*. Retrieved October 12, 2015, from https://researchspace.csir.co.za/dspace/bitstream/handle/10204/4702/Oelofse5_2010.pdf

Olivetti, E., Nicholson, A., Field, F., Gregory, J. and Kirchain, R. (2009). *The impact of end-of-life allocation methods on materials selection decisions in cases of open loop recycling*. Retrieved June 11, 2012, from <http://www.cacentre.org/CCAG/session/recycling.html>

Okot-Okumu, J. (2010). *Waste Management - An Integrated Vision*. Retrieved April 10, 2012 from <http://www.intechopen.com/books/waste-management-anintegrated-Vision>

Omran, A. (2008). *Attitude of Malaysian on recycling of municipal solid waste: case studies in the major towns of the east coast and north Malaysian*. PhD Dissertation. University Saints. Malaysia. Retrieved August 3, 2012 from http://eprints.usm.my/9006/1/ATTITUDE_OF_MALAYSIAN_ON_RECYCLING_OF_MUNICIPAL_SOLID_WASTE.pdf

Organizing waste pickers to enhance their impact. Retrieved July 19, 2015, from http://www.indiaenvironmentportal.org.in/files/44informal_recycling_sectors.pdf

Oteng-Ababio, M. (2012). Paper 'When necessity begets ingenuity: E-waste scavenging as a livelihood strategy in Accra, Ghana' Retrieved 8 September, 2015, from <http://asq.africa.ufl.edu/files/VI3il-2.pdf>

Otiene, F. and Taiwo, O. (2007). Integrated solid waste management: an innovative and pragmatic approach to solving dwindling landfill capacity in Johannesburg. *Journal Environmental Engineering*, Retrieved March 9, 2013 from <http://www.idc->

online.com/technical_references/pdfs/civil_engineering/Integrated_solid_waste_management.pdf

Palander, D. (2015). *An economic value chain analysis of Namibian diamonds. Economics*. Master's thesis. Aalto University. Finland. Retrieved from retrieved September 25, 2016 from Paper is part of the Proceedings of the 8 International Conferences on Waste Management and The Environment, Johannesburg, South Africa. Retrieved October 12, 2017, from <https://www.witpress.com/Secure/elibrary/papers/WM16/WM16002FU1.pdf>

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. 2nd ed. London: Sage Publications.

Patton, M. Q. (2002). *Qualitative research and evaluation methods*. 3rd ed. London: Sage Publications.

Pazvakawambwa, L. (2015). *Multivariate statistical modeling of family formation processes among women in Namibia*. PhD dissertation. University of Namibia. Windhoek. Recycle Namibia Forum, (2013). *Paving the Way for Recycling*. Windhoek. Namibia

Phillips. J. and Pittman, E. (2009). *An introduction to community development*. 2nd ed. Retrieved July, 4, 2015, from <https://www.researchgate.net/publication/291904440>

Pieter J.H. van Beukering, and Jeroen, C.J.M. van den Bergh. (2005). Modelling and analysis of international recycling between developed and developing countries.

- Resources, Conservation and Recycling Journal* 46 1–26. Retrieved March 20, 2012 from <http://www.bvsde.paho.org/bvsacd/cd43/pieter.pdf>
- Priestley, S. (2016). Briefing Paper. *Household recycling in the UK*. Retrieved July, 5, 2017 from https://www.legco.gov.hk/general/english/library/stay_informed_overseas_policy_updates/household_recycling.pdf
- Recycle Namibia Forum. (2013). *Paving the Way for Recycling*. Pamphlet.
- Republic of Namibia. *Namibia's Industrial Policy*. Namibia. Retrieved October 12, 2015, from http://www.mti.gov.na/downloads/namibian_industriapolicy.pdf
- Republic of Namibia. Parliament. *Companies Act, No. 28. 2004*. Retrieved November 1, 2016 from <http://www.wipo.int/edocs/lexdocs/laws/en/na/na012en.pdf>
- Republic of Namibia, (1998). *The Constitution of the Republic of Namibia*. Windhoek
- Republic of Namibia. Parliament. *Environmental Management Act, 2007*, Namibia. Retrieved March 30, 2016, from <http://www.lac.org.na/laws/pdf/environmentalact.pdf>
- Republic of Namibia. Parliament. *Labour Act No-2004*. Retrieved November, 1, 2016 from <http://www.mol.gov.na/documents/432260/4010291/Labour+Act+%28No+11+of+2007%29.pdf/c8f1d7ff-8a88-4547-8d65-e8540c6dcb6d>

Republic of Namibia. Parliament. *Local Authorities Act, Number 23. 1992*. Government of Namibia. Namibia. Retrieved October, 11, 2016, from

<http://extwprlegs1.fao.org/docs/pdf/nam82645.pdf>

Republic of Namibia. Parliament. *Affirmative Action (Employment) Act 29 of 1998*,

Republic of Namibia. Parliament. *Public and Environmental Health Act, 2015* (Act No. 1 of 2015). Retrieved November 1, 2016, from

<http://www.mhss.gov.na/documents/119527/359999/Public+and+Environment+Health+Act%2C+2015.pdf/201362ea-d4cc-4042-91a1-0af54044ac9c>

Republic of Namibia. Parliament. *Standards Act, No. 18 of 2005. Namibia*. Retrieved November 1, 2016 from

<http://www.nsi.com.na/files/downloads/Standards%20Act%2018%20of%202005.pdf>

Republic of Namibia. Parliament. *Water Resources Management Act, No. 11 of 2013*. Namibia. Retrieved November, 1, 2016 from

<http://www.lac.org.na/laws/2013/5367.pdf>

Republic of Namibia. Parliament. *Wreck and Salvage Act, 2004. Number 5*. Namibia. Retrieved November, 1, 2016. Retrieved June 15, 2017 from

<https://www.ilo.org/dyn/natlex/docs/ELECTRONIC/85760/96204/F42112663/NAM85760.pdf>

Republic of Namibia. *Performance audit report of the Auditor- General on the Ministry of Regional and Local Government , Housing and Rural Development- Solid Waste Management for the Financial Years 2010/11 to 2012/13*. Retrieved, November 4,

2016, from http://www.oag.gov.na/financial-audit-reports-for-ministry-of-regional-and-local-government-housing-and-rural-development?p_p_id=110_INSTANCE_ZHIBoICBgruY&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_count=1&_110_INSTANCE_ZHIBoICBgruY_struts_action=%2Fdocument_library_display%2Fview_file_entry&_110_INSTANCE_ZHIBoICBgruY_fileEntryId=46543

Ribeiro, H. and Buque, L.I.B. (2015). Overview of the selective waste collection with pickers in Maputo municipality, Mozambique: challenges and perspectives. *Saude soc.* 24(1). São Paulo Jan./Mar. 2015. Retrieved October 12, 2017, from <http://dx.doi.org/10.1590/S0104-12902015000100023>

Rodic, L. Waste governance. (2015). Chapter 4. In T. Cannon (Ed.), *Global Waste management Outlook* (pp. 51-120). Retrieved March 4, 2016 from <http://www.greenreport.it/wp-content/uploads/2015/09/Global-Waste-Management-Outlook-2015.pdf>

Rugg, G. and Marian Petre, M. A. (2007) *Gentle Guide to Research Methods*. Open University Press. Berkshire.

Ruppel-Schlichting, K. (2013). Introducing Environmental Law. In K. Ruppel, O. C. & Ruppel-Schlichting, K. (Eds.). *Environmental law and policy in Namibia*. (pp.13-32). Windhoek. Orumbonde Press.

Sakala, W.D. and Moyo, S. (2017). Solid waste recycling and job market in Zambia.

- Sustainable Resources Management Journal* 2017, 2 (6) 01-09. Retrieved October 12, 2017, from <http://doi.org/10.5281/zenodo.846712>
- Santini, A. (2012). *Industrial ecology applied to ELV management. Material and energy recovery from ASR*, Alma Mater Studio rum – Università di Bologna DOTTORATO DI RICERCA IN SCIENZE CHIMICHE. Retrieved July, 5, 2014 from http://amsdottorato.unibo.it/4496/1/santini_alessandro_tesi.pdf
- Sarantakos, S. (2005) *Social Research*. 3rd Edition, Palgrave Mac-Millan, New York.
- Sarema, B., Goriwondo W. M., Mhlanga M., Zimwara D. (2015). *Scrap metal supply chain modelling for economic and environmental sustainability in Zimbabwe using the case for Bulawayo metal industries*. Paper for 6th International Conference on manufacturing processes, systems and operations management (MPSOM) Proceedings, Victoria Falls. Retrieved October 12, 2016, from <http://ir.nust.ac.zw/xmlui/handle/123456789/603>
- Saunders, M., Lewis, P. and Thornhill, A. (2013). *Research Methods for Business Students* (5th Ed.). England: Prentice Hall.
- Scheinberg, A. (2012). *Women in informal employment globalizing and organizing*. WIEGO working paper (Urban Policies) no. 23. Report. Retrieved July 19, 2015, from http://wiego.org/sites/wiego.org/files/publications/files/Dias_WIEGO_PB6.pdf
- Scheinberg, A. Sophie van den Berg, S. Abarca, L. (2012).

The Botswana Recycling Guidelines Advice on Valorisation for Middle-Income Countries Volume 1 plus Annexes 1 &2. Retrieved November 10, 2015 from http://www.waste.nl/sites/waste.nl/files/product/files/rgd_botswana_vol_1_final.pdf

Schioldborg, C. (2014). *Livelihood impacts of solid waste management in informal settlements of Windhoek, Namibia.* Master's Thesis. University of Agder. Norway. Retrieved July, 17, 2015 from <https://brage.bibsys.no/xmlui/bitstream/handle/11250/2378832/UT-503%202014%20spring%20Master%27s%20thesis%20Alexandra%20Aga%20Schioldborg.pdf>

Schluep, M.; Hagelueken, C.; Kuehr, R.; Magalani, F.; Murer, C.; Meskers, C.; Mueller, E.; Wang, F.(2009). *E-waste to Resources* Retrieved September 8, 2015 from [http://www.unep.org/pdf/Recycling From e- waste to resources.pdf](http://www.unep.org/pdf/Recycling%20From%20e-waste%20to%20resources.pdf)

Scriba, A. (2015). *Recycling industry in Europe.* Presentation Paper. Retrieved July, 5, 2016, from https://www.mtm-plastics.eu/fileadmin/fuerRedakteur/pdf/150429_Sc_identiplast2015finalfinal.pdf

Senzige, J. P., Nkansah-Gyeke, Y., Makinde, D.O., Njau K. N. (2014). The potential for solid waste recycling in urban area of Tanzania: The case of Dar es Salaam. *International Journal of Environmental Protection and Policy.* Vol. 2, No. 5, 147-152. doi: .11648/j.ijcpp.20140205.11 Retrieved July, 19 2015, from <http://article.sciencepublishinggroup.com/pdf/10.11648.j.ijcpp.20140205.11.pdf>

Sharpe, S., and Agarwal, R. (2014). Strengthening industrial ecology's links with business studies: insights and potential contributions from the innovation and

business models literature. *Resources*, 3(2), 362-382. Retrieved August 11, 2015 from <http://www.mdpi.com/2079-9276/3/2/362>

Sidique, S. F., Joshi, S.V., and Lupi, F. (2010). Factors influencing the rate of recycling: An analysis of Minnesota Counties. *Resources, Conservation and Recycling*. (54). 4, 242-249. Retrieved September 13, 2013.

<https://www.sciencedirect.com/science/article/pii/S0921344909001839>

Sikongo, N.M.E. (2006). The laws governing waste management in Namibia in terms of the Bamako Convention of 1989-A legal perspective. Bachelors Thesis. University of Namibia. Windhoek.

Simelane, T. and R. Mohee, R. (2012). *Future Directions of Municipal Solid Waste Management in Africa*. Policy Brief. Briefing No. 81 Retrieved May 26, 2015 from <http://www.ai.org.za/wp-content/uploads/downloads/2012/10/No.-81.-Future-Directions-of-Municipal-Solid-waste-Management-in-Africa.pdf>

Smith, V. (2012, June 8). Urban Wasteland. *The Namibian*, p. 31.

Standards Act, No. 18 of 2005. Namibia. Retrieved November 1, 2016 from <http://www.nsi.com.na/files/downloads/Standards%20Act%2018%20of%202005.pdf>

Stephen, M. and Wheeler, S. M. (2009). *Sustainability in community Development*. In R. Phillips & R. H. Pittman (Eds.). An introduction to community development (2nd ed. p.339-348). London, Routledge. Retrieved March, 15, 2016, from <https://loomio-uploads.s3.amazonaws.com/uploads/a857276f9762676b869e7112c396824c/An%20Introduction%20to%20Community%20Development.pdf>

Stewart, F. A. (2011). *Scotland's rubbish: Domestic recycling, Policy and practice in everyday life*. Doctoral Dissertation. University of Edinburgh. United Kingdom, Retrieved November 8, 2014, from

<https://www.era.lib.ed.ac.uk/bitstream/handle/1842/5930/Stewart2011.pdf>

Strategic Research and Innovation Agenda (Strategic Innovation and Technology Roadmap, 2013). Document. Retrieved February, 26, 2017 from

<http://www.etpsmr.org/wp-content/uploads/2015/02/ETP-SMR-Strategic-Research-and-Innovation-Agenda.pdf>

Sukholthaman, P. (2012). *Bangkok Recycling Program: An Empirical Study of an Incentive-Based Recycling Program*. Master's Thesis. University of Pennsylvania. Philadelphia. Retrieved date September 6, 2015, from

https://repository.upenn.edu/cgi/viewcontent.cgi?article=1064&context=mes_capstones

Swapan, M.H.S. (2009). Socio-economic aspects of solid waste recovery and recycling in Bangladesh: A case study of Khulna city. Proceedings. The Annual Conference of Australian Sociological Association, 1-4 December, The Australian National University, Canberra, Australia, 1-14. Retrieved October, 21, 2015, from

<https://www.tasa.org.au/wp-content/uploads/2015/03/Swapan-Mohammad.pdf>

Taderera, D. (2010). *Large-scale recycling in South Africa*. Briefing Paper 239. Polystyrene Packaging Council Rose Foundation. Retrieved July 5, 2014, from

<http://noelimits.co.za/staging/CPLO2/images/BP%20239%20Large-scale%20Recycling%20in%20South%20Africapdf>

- Tanner, A.N. (2012) *The Geography of Emerging Industry: Regional Knowledge Dynamics in the Emerging Fuel Cell Industry*. PhD Thesis: Retrieved March, 21, 2015. from http://orbit.dtu.dk/ws/files/10427828/The_Geography_of_Emerging_Industry_Tanner.pdf
- Tas, A. and Belon, A. (2014). *A Comprehensive Review of the Municipal Solid Waste Sector in Mozambique*. Nairobi, Kenya. Retrieved October 12, 2015, from Retrieved July, 5, 2018 from <http://www.associacao-mocambicana-reciclagem.org/wp-content/uploads/2017/08/2014-08-05-A-Comprehensive-Review-of-the-Waste-Sector-in-Mozambique-FINAL.pdf>
- Tischler, J. (2013) Alliances and partnerships in recycling in Cape Town, South Africa. The recycling system in Cape Town, working towards sustainability? *Global Studies Working Papers Institute of Geography* Retrieved July, 19, 2015 from https://publikationen.uni-tuebingen.de/xmlui/bitstream/handle/10900/49883/pdf/GSWP_DA_Jeannine_Tischler.pdf
- Trommer, J. (2011). Challenges in China's waste management. Ticker German Chamber 6 | 2011/2012 *December – January Business Journal of the German Chamber of Commerce in China Beijing | Shanghai | South & Southwest China*. 18-24.
- Ukoje, J. E. (2012). Informal sector solid waste collection and recycling in Zaria Nigeria. *Journal of Environmental Science and Engineering* Vol. 1B. (6) 649-655 Retrieved April 17, 2015, from

<http://connection.ebscohost.com/c/articles/86219401/informal-sector-solid-waste-collection-recycling-zaria-nigeria>

UN-Habitat, United Nations Human Settlements Programme (2010). Solid waste management in the world's cities. Water and sanitation in the world's cities. London, Earthscan, Retrieved April 3, 2015, from https://thecitywasteproject.files.wordpress.com/2013/03/solid_waste_management_in_the_worlds-cities.pdf

UNEP (2013) *Metal Recycling: Opportunities, Limits, Infrastructure*. Report of the working group on the global metal flows to the international resource panel, Retrieved October 16, 2016, [from https://wedocs.unep.org/bitstream/handle/20.500.11822/8850/Metal-recycling-opportunities-limited-infrastructure-Summary.pdf](https://wedocs.unep.org/bitstream/handle/20.500.11822/8850/Metal-recycling-opportunities-limited-infrastructure-Summary.pdf)

UNEP, (2015). *Global waste management outlook*. Retrieved October, 16, 2016 from https://www.iswa.org/fileadmin/galleries/Publications/ISWA_Reports/GWMO_summary_web.pdf

United Nations Economic Commission for Africa. (2015). *Country Profile- Namibia*. Retrieved August 15, 2017 from <http://www.un.org/en/africa/osaa/pdf/pubs/2012era-unececa.pdf>

Velis, C.A., Wilson, D.C., Rocca, O., Smith, S.R., Mavropoulos, A., and Cheeseman, C.R. (2012). An analytical framework and tool ('InteRa') for integrating the informal recycling sector in waste and resource management systems in developing countries. *Waste Management and Research Journal*, September. *Supplement*. 43– 66.

- Retrieved September 12, 2015 from
https://spiral.imperial.ac.uk/bitstream/10044/1/14420/2/Waste%20Management%20%26%20Research_30_9_2012.pdf
- Venkatesh, K.B. (2010). *Value chain analysis for coffee in Karnataka, India*. Masters Thesis. Ghent University. Belgium. Retrieved July, 18, 2015 from
https://lib.ugent.be/fulltxt/RUG01/001/789/918/RUG01-001789918_2012_0001_AC.pdf
- Viljoen, J.M.M., Schenck, C. J. and Blaauw, P. F. (2012). *The role and linkages of buy-back centers in the recycling industry: Pretoria and Bloemfontein (South Africa)*. Research Paper Retrieved September 16, 2015 from
<http://www.actacommerci.co.za/index.php/acta/article/viewFile/125/125>
- Visser, T. (2015). Namibian Manufacturing and Processing Directory Volume 1 (2014/15). Virtual Marketing Retrieved March 26, @ www.whonamibia.com
- Walter, M. (2013). *The Nature of Social Science Research*. Oxford. Oxford University Press.
- Waste Reduction and Recycling Act 2011. Queensland. Australia. Retrieved December 5, 2017 from <https://www.legislation.qld.gov.au/pdf>
- Wheeler, S. *Sustainability in community development*. (2009). In R. Phillips and R. H. Pittman (Eds.). *An introduction to community development* (2nd ed. p.339-348). London, Routledge. Retrieved March, 15, 2016, from <https://loomio-uploads.s3.amazonaws.com/uploads/a857276f9762676b869e7112c396824c/An%20Introduction%20to%20Community%20Development.pdf>

Westphal, N. and Pfeffer, K. (2013). *A Baseline study on the ward contractor system in the City of Windhoek*. Retrieved April, 20, 2016 from http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_242573.pdf

Williams, E., Kahhat, R., Allenby, B., Kavazanjian, E., Kim, J. and Xu, M. (2009). Environmental, social and economic implications of global reuse and recycling of personal computers. *Environmental Science. Technology*. 42 (17), 6446- 6454 doi. 10.1021/es702255z. 2008.06. 008

Wilson, D.C., Costas, C., Cheeseman, C. (2006). Role of informal sector recycling in waste management in developing countries. *Habitat International*, 30 (4), December, 2006, 797-808 Retrieved May 5, 2014 from <https://www.sciencedirect.com/science/article/pii/S0197397505000482>

World Bank (2014). *Namibia Country Strategy*. [https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/2014-2018 - Namibia Country Strategy Paper.pdf](https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/2014-2018_-_Namibia_Country_Strategy_Paper.pdf)

World Bank (2007). Needs Assessment Knowledge Base: Fish bone Diagrams. Paper Article. Retrieved 30 March, 2017 @ <https://siteresources.worldbank.org/WBI/Resources/213798-1194538727144/9Final-Fishbone.pdf>

World Business Council for Sustainable development (WBCSD) (2011). *The global value chain initiative*. Retrieved July 17, 2016 from <https://www.cisl.cam.ac.uk/graduate-study/pgcerts/value-chain-defs>

- Yamoah, S.B. (2014). *E-waste in developing country context-Issues, challenges, practices, opportunities: Addressing the WEEE Challenge in Ghana*. Master's Thesis. Aalborg University. Aalborg. Retrieved July, 18, 2016 from http://vbn.aau.dk/ws/files/184682818/Thesis_Report_Samuel_Baah_Yamoah_PDF.pdf
- Yang V. and Innes, A. (2012). *Handout 1 Workshop Materials on WEEE Management in Taiwan: Recycling Regulations in Taiwan and the 4-in-1 Recycling Program* Retrieved July 5, 2015, from <https://www.epa.gov/sites/production/files/2014-05/documents/handout-1a-regulations.pdf>
- Yin, R. K. (2009). *Case study research: Design and methods*. 4th ed. CA: Sage Publications.
- Yin, R. K. 2003. *Case study research: Design and methods*. 3rd ed. London: Sage Publications.
- Zikmund, W. G., and Stanton, W. J. (1971). Recycling Solid Wastes: A Channel- of – Distribution Problem. *Journal of Marketing*, 35 (3), 34-39.

APPENDICES

APPENDIX A: Application for Ethical Clearance Certificate

P.O. BOX 98440

Windhoek

Namibia

7 May 2015

Mobile: 081 399 2648

19 NOVEMBER 2014

Mr. Simon Lumbu

Chairperson

FHSS-Research & Publication Committee

UNAM

SUBJECT: ETHICAL CLEARANCE CERTIFICATE: TANDIWE P. MUTEDE

Dear Mr. Lumbu

Herewith, the undersigned is kindly applying for the *Ethical Clearance Certificate* pertaining to her doctoral proposal titled: Recycling solid waste: A Geographic study on an emerging raw material industry in Namibia.

The proposal has been noted by the Unam PGSC meeting of 18 November 2014. At the same meeting, the co-supervisor, Prof. D.S. Tevera, UWC, has been approved.

Please find attached a copy of the proposal's full text and summary.

Looking forward to your response, please inform me whether I could be of any further assistance in this matter.

Yours sincerely

T.P. Mutede

Cc: Prof. C. Nengomasha, FHSS-PGSC

Prof. Dr. F. Becker, DGHES

APPENDIX B: Permission letter from the Windhoek City Council

Department of Human Resources

☒ 59

Corner of 5378 Independence Avenue and Garten Street

WINDHOEK, NAMIBIA

Tel: (+264) 61 290 2911 • Fax: (+264) 61 290 3212 • www.cityofwindhoek.org.na



ENQ: Mr A. Nikanor

DATE: 08 May 2015

PHONE: 09 264 61 290 2630

FAX: 09 264 61 290 3212

EMAIL: ark@windhoekcc.org.na

P.O Box 98440
Pelican Square
WINDHOEK

ATT: tawanaumwe@yahoo.com

Dear Ms. Mutede,

**RE: REQUEST FOR PERMISSION TO CARRY OUT SOLID WASTE RECYCLING
RESEARCH IN THE CITY OF WINDHOEK**

Your letter to the City of Windhoek dated 07 May 2015 bears reference.

This letter hereby confirms the City of Windhoek's willingness to accommodate your research topic and efforts in principle. You would be required to ensure that information is used only for the intended purposes of the research and treated in a confidential manner; as well as ensure that your research efforts do not impede or affect Councils operations.

Please do not hesitate to contact the Human Resources Development office should you require additional information.

Yours sincerely,


Mr Archie Nikanor
Manager: Human Resources Development (HRD)

All official correspondence must be addressed to the Chief Executive Officer

APPENDIX C: UNAM RESEARCH PERMISSION LETTER

(+264 61) 206 3111
Website: www.unam.na



340 Mandume Ndemufayo Avenue
Private Bag 13301
Windhoek
NAMIBIA

Inspiring minds & shaping the future

27 February 2015

TO WHOM IT MAY CONCERN

RE: RESEARCH PERMISSION LETTER

1. This letter serves to inform that student Mrs Tandiwe P. Mutede (Student number: 201202222) is a registered student in the Department of Geography, History and Environmental Studies at the University of Namibia. Her research proposal was reviewed and successfully met the University of Namibia requirements.
2. The purpose of this letter is to kindly notify you that the student has been granted permission to carry out postgraduate studies research. The School of Postgraduate Studies has approved the research to be carried out by the student for purposes of fulfilling the requirements of the degree being pursued.
3. The proposal adheres to ethical principles.

Thank you so much in advance and many regards.

Yours truly,

Name of Main Supervisor: Prof. Dr. Fritz Becker

Signed:

Dr. C. N.S. Shaimemanya

Signed: _____

Director: School of Postgraduate Studies

Tel: 2063523

E-mail: cshaimemanya@unam.na

APPENDIX D: UNAM ETHICAL CLEARANCE CERTIFICATE



ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: FHSS/2/2015

Date: 3 February, 2015

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: RECYCLING SOLID WASTE: A GEOGRAPHIC STUDY ON AN EMERGING RAW MATERIAL INDUSTRY IN NAMIBIA

Nature/Level of Project: Doctorate

Principal Researcher: Tandiwe P. Mutede

Student Number : 201202222


Host Department & Faculty: Geography, Faculty of Humanities and Social Sciences

Main Supervisor : Prof. F.O. Becker (Main) Prof. D.S. Tevera (Co)

Take note of the following:

- (a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the UREC. An application to make amendments may be necessary.
- (b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the UREC.
- (c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by UREC.
- (d) The UREC retains the right to:
 - (i). withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,
 - (ii). request for an ethical compliance report at any point during the course of the research.

UREC wishes you the best in your research.


Prof. I. Mapaure
UNAM Research Coordinator
ON BEHALF OF UREC

**APPENDIX E: LETTER SEEKING PERMISSION TO CARRY OUT
RESEARCH**

Box 98440

Windhoek

Namibia

7 May 2015

The Human Resources Manager

City of Windhoek

Windhoek

Dear Sir/Madam

**REQUEST TO CARRY OUT SOLID WASTE RECYCLING RESEARCH IN
THE CITY OF WINDHOEK**

I am a Doctor of Philosophy (PhD) student conducting research on solid waste recycling and studying with the University of Namibia. The major aim of this research is to carry-out an investigation into the recycling industry in Namibia with a view of coming up with recommendations for the improvement of solid waste management in Namibia. The research will involve interviewing relevant authorities of identified recycling companies regarding recycling motives, policies and legal frame work and recycling operations. All research data gathered will be used solely for academic purposes.

I therefore seek authorization to **(1) carry out interviews; (2) make observations on recycling operations and facilities; and (3) consult relevant record-keeping documents** within your department. Once permission is granted, I will make

appointments with the relevant officers for the interviews. I shall be available for six months to carry out the research or any other time suitable.

The University of Namibia is aware of this research and I attach a copy of their letters of support.

I look forward to your consideration of my request.

Yours Faithfully,

TADIWE MUTEDE

Tel: +264 81 399 2648 E-mail: tawanaumwe@yahoo.com

**APPENDIX F: REQUEST TO RESEARCH IN THE MINISTRY OF
ENVIRONMENT AND TOURISM**

Box 98440

Windhoek

Namibia

Ministry of Environment and Tourism

Windhoek

Dear Sir/Madam

**RE: REQUEST TO CARRY OUT RECYCLING RESEARCH IN THE
MINISTRY OF ENVIRONMENT AND TOURISM**

I am a Doctor of Philosophy (PhD) student conducting research on solid waste recycling and studying with the University of Namibia. The major aim of this research is to carry-out an investigation into the recycling industry in Namibia with a view of coming up with recommendations for the improvement of solid waste management in Namibia. The research will involve interviewing relevant authorities within your Ministry regarding involvement in recycling initiatives. All research data gathered will be used solely for academic purposes.

I therefore seek authorization to **(1) carry out interviews; (2); and consult relevant record-keeping documents** at your ministry. Once permission is granted, I will make appointments with the relevant officers as mentioned above at your ministry. I shall be available for six months to carry out the research or any other time suitable.

The University of Namibia is aware of this research and I attach a copy of their letter of support.

I look forward to your consideration of my request.

Yours Faithfully,

TADIWE MUTEDE

Tel: +26481 399 2648

E-mail: tawanaumwe@yahoo.com

**APPENDIX G: REQUEST TO CARRY OUT RECYCLING SOLID WASTE
RESEARCH**

Box 98440

Windhoek

Namibia

The Director

Company Name

Windhoek

Dear Sir/Madam

**REQUEST TO CARRY OUT RECYCLING SOLID WASTE RESEARCH AT
YOUR COMPANY**

I am a Doctor of Philosophy (PhD) student conducting research on solid waste recycling and studying with the University of Namibia. The major aim of this research is to carry-out an investigation into the recycling industry in Namibia with a view of coming up with recommendations for the improvement of solid waste management in Namibia. The research will involve interviewing relevant authorities within your company regarding recycling motives, policies and legal frame work and recycling operations. All research data gathered will be used solely for academic purposes.

I therefore seek authorization to I therefore seek authorization to **(1) carry out interviews; (2) make observations on recycling operations and facilities;** and **(3) consult relevant record-keeping documents** at your company. Once permission is granted, I will make appointments with the relevant officers as mentioned above at your

company. I shall be available for the months of May, June and July 2015 to carry out the research or any other time suitable.

The University of Namibia and the City of Windhoek Municipality is aware of this research and I attach a copy of their letters of support.

I look forward to your consideration of my request.

Yours Faithfully,

TADIWE MUTEDE

Tel: +264 81 399 2648 E-mail: tawanaumwe@yahoo.com

APPENDIX H: CONSENT LETTER

Informed Consent Letter

TITLE OF RESEARCH: RECYCLING SOLID WASTE: A GEOGRAPHIC STUDY
ON AN EMERGING RAW MATERIAL INDUSTRY IN NAMIBIA

RESEARCHER: Tandiwe P. Mutede
Department of Geography, History and Environmental
Studies University of Namibia
Tel: +264 81 399 2648
E-mail: tawanaumwe@yahoo.com

Research Information

This research study seeks to carry-out an investigation into the recycling industry in Namibia. You have been selected for this research in your official capacity as an authority in this company. All responses are confidential and your privacy will be protected. It is expected that the interview will take about 45.

Please note that participation is voluntary and you may choose to withdraw at any point. However, your participation in this research will be greatly appreciated in order to make contribution to recycling and waste management processes in Namibia as a whole. All interactions, responses, and feedback will be treated with utmost **CONFIDENTIALITY** and **ANONYMITY** at all times. The research will benefit stakeholders involved in solid waste recycling and individuals as it will contribute to improved solid waste management and in particular recycling in Namibia.

For any questions or further clarifications with any aspect of this research, you may contact my research supervisor, in the Department of Geography, History and Environmental Studies, University of Namibia: Prof. Dr Fritz Becker Tel: +264612063738, e-mail: fobecker@unam.na

If you voluntarily agree to participate in this research, kindly indicate your consent by signing below:

Tick selection:

○ Agree to be **interviewed**: YES NO

○ Agree to be **tape-recorded**: YES NO

NAME:

SIGNATURE:

DATE:

APPENDIX I: INTERVIEW GUIDE FOR COMPANIES

**RESEARCH TITLE: RECYCLING SOLID WASTE: A GEOGRAPHIC STUDY
ON AN EMERGING RAW MATERIAL INDUSTRY IN NAMIBIA**

<p>FOR OFFICIAL USE (DO NOT FILL IN THIS SECTION)</p> <p>Field Researcher.....</p> <p>Research Company</p> <p>Interview Number.....</p> <p>Date</p>
--

PREAMBLE: This research is being undertaken by Tandiwe P. Mutede as part of the requirements for the Doctoral Degree in Geography and Environmental Studies Geography (University of Namibia).The aim of the study is to carry-out an investigation into the recycling industry in Namibia in order to come up with a model on how the industry can guide waste management in Namibia.

Your cooperation towards the fulfilment of this objective is sincerely appreciated. Your responses will go a long way in the conclusion of this study as well as assisting Namibia in as far as waste management is concerned. You are assured that your responses will be treated with utmost confidentiality and any information identifying the respondent will not be disclosed to anyone under any circumstance. Your role will be acknowledged in this study.

A consent form was handed to participants to ensure that they answered questions voluntarily, and where possible, did not respond to questions they were uncomfortable with.

Background Information

Gender of respondent	
Department	
Designation of respondent	
Number of years in the current position	
Date	

Interview Questions

A: Motives and extent of involvement

What line of business are you involved in?

.....

Please may you elaborate on what you do in this business?

.....

When did you start this business and what motivated you?

.....

Is there anything that has changed since you started e.g. location of the business, operations of business, growth of business, workforce etc.

.....

If there are some changes, please elaborate and give some insight to why the changes.

.....

What are some of the challenges you face as an industry or in your activities?

.....

B. Regulatory Framework

Are there any specific policies that govern your activities?

.....

Are you required to follow any standards in carrying out your work?

.....

If yes, please elaborate on them.

.....

Is there any legislation that governs your activities?

.....

If any, please elaborate on them.

.....

Is there any law that specifically regulates recycling in Namibia?

.....

Is there anyone who monitors your activities to check on compliance issues?

.....

C. Recycling trends, value addition and benefit chains

Since you started, are there any changing patterns that have occurred in your business in terms of say material recovery, growth of business, which you are doing business with and areal coverage?

.....

What processes are involved in recycling of the products that you handle?

.....

Do you have any figures of how much you produce, per week or month for each of the products?

.....

Where do you sell your products?

.....

What benefits are coming up under your business, say to the company and the environment at large?

.....

D. Networking

Do you have any partners in doing your business e.g. with the council, government, institutions, customers, suppliers?

.....

If any, who are these and what is the nature of linkage with them?

.....

E. Benefit chains

What benefits are coming up under your business?

.....

Last Question:

Are there any comments you would like to make regarding recycling in Namibia?

This is all I had to ask you. Is there anything you would like to ask me or comment about this interview?

Thank you for your time and contribution to this research.

APPENDIX J: OBSERVATION SCHEDULE

OBSERVATION SCHEDULE

Date & Time	Place of Activity	Elements for Observation	Observations	Comments
		Activities done at the company	Collection- Recovery- Manufacturing- Selling- Any other-	
		Processing activities		
		Products produced		
		Workforce		
		Infrastructure		
		Records		