

UNIVERSITY OF EDUCATION, WINNEBA
COLLEGE OF TECHNOLOGY EDUCATION-KUMASI

**EFFECTS OF SCRAP METAL MANAGEMENT ON THE PEOPLE OF THE
KASSENA NANKANA MUNICIPALITY IN THE UPPER EAST REGION OF
GHANA**



BY

ISAAC AJADANI ATOGEBANIA

SEPTEMBER, 2015

UNIVERSITY OF EDUCATION, WINNEBA
COLLEGE OF TECHNOLOGY EDUCATION-KUMASI

EFFECTS OF SCRAP METAL MANAGEMENT ON THE PEOPLE OF THE
KASSENA NANKANA MUNICIPALITY IN THE UPPER EAST REGION OF
GHANA

BY

ISAAC AJADANI ATOGEBANIA

7101190030



A Dissertation in the Department of **MECHANICAL TECHNOLOGY**
EDUCATION, Faculty of **TECHNICAL EDUCATION**, Submitted to the School of
Graduate Studies, University of Education, Winneba in Partial Fulfillment of the
Requirement for the award of Master of Technology (Mechanical) degree.

SEPTEMBER, 2015

DECLARATION

STUDENT'S DECLARATION

I, ISAAC AJADANI ATOGEBANIA, declare that this Dissertation with the exception of quotations and references in published works which have all been identified and acknowledge is entirely my own original work and that no part of it has been presented for another degree in this university or elsewhere.

SIGNATURE:

DATE:

SUPERVISORS' DECLARATION

I hereby declare that the preparation and presentation of the thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University of Education, Winneba.

NAME: MR. STEPHEN K AMOAKOHENE

SIGNATURE:

DATE:

DEDICATION

I dedicated this research work to my beloved brother; Mr. Paul Atogebania who sponsored my education and my beloved wife Mrs. Susanna Atogebania and our children who gave me the necessary support throughout my studies.



ACKNOWLEDGEMENT

I am full of praise to the Almighty God for giving me good health, financial resources, knowledge and understanding in the entire process of writing this dissertation.

I specially appreciate my Supervisor, Mr. Stephen KAmoakohene for his immense contribution, selfless sacrifice and the encouragement which made it possible for the successful completion of this project work.

To the head of department, Mr. Kenneth C. Nworu Department of Mechanical Technology Education, and all the lecturers of the department, I appreciate your support and contribution.

My supportive wife, Mrs. SusannaAtogebaniadeserves a special commendation for providing me the needed assistance and also taking good care of our lovely kids all alone during the period of my studies.

I deem it necessary to appreciate all the support and encouragement I received from friends and family members especially Mr. Isaac Apuri.

Finally, I am grateful to the farmers in the four communities who sacrificed time to answer the research questions.

ABSTRACT

This study investigated the effects of scrap metal management on the environment and residents of the KassenaNankana Municipality in the Upper East Region of Ghana. Generation of solid waste and for that matter scrap metal is inevitable and hence the urgent need to adopt prudent and sound scrap metal management strategies to deal with the situation. The main aim of the study was to assess scrap metal management strategies and their effects on the environment and the people in the KassenaNankana Municipality. The study employed mixed methodology which allows the use of questionnaires and observation to collect relevant data for the study. The study specifically explored the impacts of scrap metal on the people of the study area, methods adopted for scrap metal management and economic benefits of scrap metal. The study reveals that scrap metal is a challenge in the municipality but that some people have been able to turn the challenge into an opportunity through the management strategies. Scrap metals have created employment for the collectors, dealers and recyclers which help them to earn some income. Scrap metal management strategies adopted include, collection and storage, reuse and recycling. Therefore, the study recommends that the Municipal assembly should support the recyclers with capacity building training and finances to expand their businesses and be more effective.

TABLE OF CONTENTS

CONTENT	PAGE
DECLARATION	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
ABSTRACT.....	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES	xi
LIST OF FIGURES	xii
LIST OF PLATES	xiii
LIST OF ABBREVIATIONS	xiv
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background to the Study.....	1
1.2 Statement of the Problem.....	4
1.3 Main Objective.....	4
1.4 Specific Objectives	4
1.5 Research Questions.....	5
1.6 Significance and purpose of the Study.....	5
1.7 Limitations	6
1.8 Organization of the study.....	6



CHAPTER TWO	8
REVIEW OF RELEVANT LITERATURE	8
2.0 Introduction.....	8
2.1 Conceptual issues in scrap metals.....	8
2.1.1 Scrap metal.....	8
2.1.2 Types of scrap metals.....	9
2.1.3 Sources of Recycled Metals.....	10
2.1.4 Sorting of scrap metals.....	10
2.2 Environmental benefits and health benefits.....	11
2.3 Economic Benefits of recycling scrap metals.....	12
2.4 Adverse effects of scrap metal.....	12
2.5 Types of Metals Most Commonly Recycled	13
2.6 Management of scrap metal waste.....	13
2.7 Conceptual framework of scrap metal management.....	14
2.7.1 Reuse.....	14
2.7.2 Recycling	15
2.8 Scrap Metal Recycling Steps	17
2.8.1 Scrap collection.....	17
2.8.2 Scrap processing	17
2.8.3 Scrap smelting.....	18
2.9 Summary of literature review	19

CHAPTER THREE	20
STUDY AREA AND METHODOLOGY	20
3.0 Introduction.....	20
3.1 Background.....	20
3.2 Climatic Conditions	20
3.3 Relief and drainage	21
3.4 Vegetation.....	21
3.5 Manufacturing.....	23
3.6 Resources for development.....	23
3.7 Agro industry/processing	23
3.8 Methodology	24
3.8.1 Research Design.....	24
3.8.2 Sources of Data	25
3.8.4 Study Population and Sample Size	26
3.8.5 Sampling Techniques and Procedures	26
3.8.6 Selection of Respondents.....	26
3.8.7 Techniques of Data Collection.....	27
3.8.8 Methods of Data Analysis.....	27
CHAPTER FOUR	28
RESULTS OF THE STUDY	28
4.0 Introduction.....	28
4.1 Demographic characteristics of study respondents.....	28
4.1.1 Sex of respondents	28

4.1.2 Age of respondents	29
4.1.3 Educational status of respondents	29
4.1.4 Main occupations of study respondents	30
4.2 Types and sources of scrap metals in the study area	31
4.3 Sorting of scrap metals by type.....	32
4.4 Number of years in the scrap metal business.....	33
4.5 Reasons for engaging in scrap business.....	33
4.6 Environmental, health and economic benefits of managing scrap metal.....	33
4.7 Adverse impacts of scrap metals.....	34
4.8 Access to and utilization of scrap metals.....	35
4.9 Products manufacture during recycling	37
4.10 Equipment for smelting recyclable materials	37
4.11 Challenges encountered by scrap dealers	39
CHAPTER FIVE	41
DISCUSSIONS OF THE RESULTS.....	41
5.0 Introduction.....	41
5.1 Demographic characteristics of respondents	41
5.2 Sorting of scrap metals.....	41
5.3 Number of years in the scrap metal business.....	42
5.4 Reasons for collecting scraps.....	42
5.5 Methods and strategies adopted in managing scrap metals	43
5.5.1 Reuse.....	44
5.5.2 Recycling	44
5.6 Environmental benefits and health benefits.....	45

5.7Economic Benefits of recycling scrap metals	45
5.8Adverse impacts of scrap metals.....	46
5.9Access to and utilization of scrap metals.....	47
5.10Challenges encountered by scrap dealers and recyclers	48
CHAPTER SIX	50
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATION	50
6.0 Introduction.....	50
6.1 Summary of key findings.....	50
6.2 Conclusion	51
6.3Recommendations.....	52
REFERENCES	53
APPENDICES	55



LIST OF TABLES

TABLE	PAGE
Table 4. 1: Sex of study respondents	28
Table 4. 2: Ages of Study respondents	29
Table 4. 3: Prices of scrap metals per kilogram.....	36



LIST OF FIGURES

FIGURES	PAGE
Figure 2. 1: showing basic recycling steps	16
Figure 4.1: Educational status of study respondents	30
Figure 4.2: Main occupational status of respondents.....	30



LIST OF PLATES

Plate 4. 1: Types of scrap metal in the study area.....	31
plate 4. 2: Scrap metal sorted for reuse.....	32
plate 4. 3: Scales use in weighing scrap metals	36
Plate 4. 4: Electricity and manually powered blower for smelting.....	37
Plate 4. 5: Manually powered blower for smelting.....	38
plate 4. 6: Recycling room	38



LIST OF ABBREVIATIONS

GSS	-	Ghana Statistical Service
ISRI	-	International Scientific Research Institute
JHS	-	Junior High School
KNM	-	Kassena Nankana Municipal
NIH	-	National Institute of Health
OSHA	-	Occupational Safety and Health Administration
SHS	-	Senior High School
UER	-	Upper East Region



CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

In recent years, the challenge of managing waste has become a global issue. All over the world, people in all walks of life are engaged in various activities for livelihood that lead to generation of solid waste of which scrap metal is a component. Solid wastes and for that matter scrap metals have some considerable environmental and socioeconomic impacts on countries worldwide (Mcorakinyo and Vershima, 2014). However, these impacts may not be the same due to differences in waste management abilities emanating from uneven technological advancement across the world. Regardless of the differences in waste management abilities globally, it is important for every country to consciously manage waste so as to reduce the adverse impacts of waste on the country's citizens and in some circumstances, to take advantage of waste materials which could be recycled for development. Recycling especially, is crucial as it concerns materials which come from non-renewable sources.

Scrap metal refers to any metallic product that has reached its end of life and it is no longer in use. Scrap metal emanates from various sources: it comes both from the steel industry as well as industries for the transformation and recycling of iron waste resulting from the manufacture of capital and consumer goods (de Sadeleer, 2012).

There are two main kinds of scrap metals, namely; ferrous and non-ferrous. The ferrous scraps were mainly steel and/or iron. The non-ferrous scraps included aluminium, copper, lead and brass (BroniI-Sefah, 2012). According to HYDRO (2012), ferrous metal refers to those that usually attract magnet while non-ferrous scrap metals are those which do not attract magnet. According to Muchová and Eder

(2010) scraps are classified as new scrap which is generated during the initial manufacturing processes or as old scrap which is collected after it has been used. Old scrap is collected after a use cycle, either separately or mixed, and it is often contaminated to a certain degree, depending highly on its origin and the collection systems used. Since the lifetime of many metal products can be longer than 10 years and sometimes longer than 50 years, for instance products for building and construction, there is an accumulation of metal in use since the beginning of the industry (Muchová& Eder, 2010). This study is interested in the management of the old scrap metal.

Scrap metals are generated from several sources. Notable among them are household sources, the market place, manufacturing industries and companies, state institutions as well as private organizations.

Scrap metals have both positive and negative consequences on the people and the environment. The extent of the impact depends largely on human attitude towards waste management in general and scrap metals in particular and also the knowledge of the benefits thereof. Some research findings suggest that scrap metal is important. Some of the positive impacts of scrap metal include the fact that it creates jobs for some people. Jobless young men engaged themselves in collection and sale of scrap to make daily living (Nkansah et al., 2015). The scrap collectors gather the scrap to appreciable quantities and sell them to those who buy in large quantities. This will go a long way to increase household income and reduce poverty. Likewise, this will reduce significantly the littering of the environment and create quality environment for healthy living.

On the other hand, scrap metal still remains one of the serious challenges of development at various levels of the economy. With rapid development due to

urbanization, there is drastic increase in the demand for products some of them are fairly used which ended up becoming scrap creating filthy conditions and environment pollution. When the scrap metal is inappropriately disposed on the land, the toxic substances leach and contaminate water bodies which have disastrous consequences in the end.

In view of the negative consequence of scrap metal, it is imperative and prudent to consider ways that will make scraps advantageous and hence the need for scrap metal management. A wide range of metals have been recycled by the scrap metal recycling industry. The scrap metals that are usually recycled include but not limited to the following iron and scrap steel, copper, aluminum, lead, zinc, and stainless steel (OSHA, 2008).

Due to the dire consequences of scrap metals on the environment and human health, there is urgent need for prudent management practices to be adopted. Recycling scrap metal means that we avoid the environmental costs of dumped rubbish and the risk of it leaching toxic chemicals into groundwater at landfill sites. An interesting observation has been by Hydro (2012:18), “In a resource constrained world, recycling is critical to sustainable development. It allows resources to be saved and waste to be reduced”. Indeed, rapid population accompanied by a corresponding demand for resources has led to over-exploitation of natural resources which is a potential threat to sustainable development. Therefore, when serious efforts are made to recycle scrap metal pressure on the limited existing natural resources will be reduced.

1.2 Statement of the Problem

The KassenaNankanaMunicipal Assembly is a growing one due to the presence of tertiary institutions such as University for Development Studies, St. John Bosco's College of Education and Community Health Nurses Training School. These and other development opportunities have attracted many people into the municipality. Increase in population has brought about increase in consumption and acquisition of metallic assets for households and institutions. The life-spine of some of the metallic items purchased by users has been exhausted making them scraps. Scrap metals in themselves do not constitute a development problem but the problem is closely linked to the management of scraps.

Scrap metals could be a curse or blessing depending on management practices. It is noted that effective scrap metal management strategies include the following recovery, reuse and recycle. It is not clear what is being done about scrap metal waste within the KassenaNankanaMunicipality. Therefore, it is imperative to find out the impacts of scrap metals on the environment and the residents of KassenaNankana Municipality in the Upper East Region of Ghana.

1.3 Main Objective

The main objective of the study was to assess scrap metal management strategies and their effects on the environment and the people in the KassenaNankana Municipality.

1.4 Specific Objectives

Specifically, the study seeks to:

- Ascertain the impacts of metal scrap waste on the people of the KassenaNankana Municipality
- Investigate methods adopted in managing scrap metals.

- Find out economic benefits of managing scrap metals in the KassenaNankana Municipality.

1.5 Research Questions

The main research question: how do scrap metals affect the environment and the lives of the people of the KassenaNankana Municipality?

- How does scrap metal affect the environment and residents of the KassenaNankana Municipality?
- What scrap metal management strategies are adopted in the study area?
- How does scrap metal benefits scrap metal dealers economically in the study area?

1.6 Significance and purpose of the Study

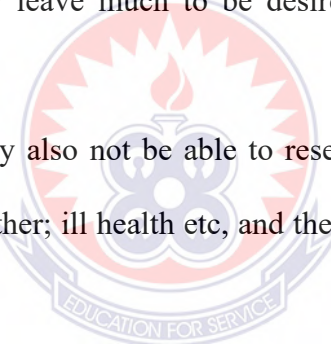
Waste management in general and scrap metal in particular constitute one of the development challenges of the KassenaNankana Municipality and hence an investigation of this sort is crucial as it will contribute towards the solution of the problem. The following are the specific significance of this study:

- The study made a contribution to enhance understanding of scrap metal management impacts on the municipality.
- Equally important is the fact that findings of this study may lead to the consideration of recycling as scrap metal management strategy in the study area.
- This research contributed to a body of knowledge on solid waste and scrap metal management.
- The findings of this study will be useful to policy-makers.

1.7 Limitations

In as much as the researcher would want to carry out this important research, the following shortcomings which were encountered and could influence the results or its generalization which the researcher has little or no control.

- Financial constraints. It will be difficult to meet all the final obligations as a student.
- Another limitation will be material and time resources which will all make the sample size very small in relation to the entire population.
- Lack of co-operation from some respondents which may narrow these numbers of persons to be interviewed smaller than anticipated and quality of the responses may leave much to be desired. This is likely to be another limiting factor.
- The researcher may also not be able to research for some reasons of lack of transport, bad weather; ill health etc, and the result of the sample may become unrepresentative.



1.8 Organization of the study

The study comprises six chapters which cover different parts of the study. To begin with, chapter one covers the following background to the study, statement of the research problem, research objectives, research questions, significance of the study and some limitations encountered in the course of the study. In chapter two, relevant literature was reviewed in order to situate the study in the context of existing literature. Literature was reviewed on scrap metal, types and sources of scrap metal, scrap metal management, methods adopted in managing scrap metals and economic benefits of scrap metal in the study area.

Chapter three takes a look at the research methodology and the study area. The research methodology covers the research design, the study population and sampling, methods of data collection and finally methods of data analysis. In the fourth chapter, results of the study are presented. These include demographic characteristics of study respondents, sorting of scrap metals, management of scrap metal among others.

A detailed discussion of the results was done in chapter five while the final chapter which is chapter six takes care of summary of findings, conclusions and relevant recommendations.



CHAPTER TWO

REVIEW OF RELEVANT LITERATURE

1.0 Introduction

This chapter is the review of relevant literature regarding scrap metal management. The chapter looks at similar studies that have been undertaken in recent times to be able to position the work within its appropriate context. Specifically, literature was reviewed on some relevant concepts of scrap metals, impacts of scrap metals, methods adopted in managing scrap metals and economic benefits of scrap metals.

2.1 Conceptual issues in scrap metals

2.1.1 Scrap metal

Products and items can turn to waste (scrap) when they are no longer useful to the owner or when they fail to fulfill their intended purpose. Similarly, according to Sadeleer (2012) scrap metal refers to any metallic product or item which reaches its end of life and it is no longer in use. As metallic products deteriorate and lose monetary value, they eventually become scraps. Scrap metal emanates from various sources: it comes from both the steel industry as well as industries for the transformation and recycling of iron waste resulting from the manufacture of capital and consumer goods (de Sadeleer, 2012). Types of scrap metal include but are not limited to the following; iron, steel, aluminium and copper. Every locality, whatever metallic products that are used will eventually lead to the generation of waste of that product.

2.1.2 Types of scrap metals

There are two main types of waste which include scrap metal in the waste stream namely; pre-consumer and postconsumer waste. Scraps that are generated during production process constitute pre-consumer waste. However, when the consumer use the product till the end of its life span, then postconsumer waste is generated (Miller, 2006). The pre-consumer scrap metal waste is not of concerned to this study as the focus of the study is on the postconsumer scrap metal because pre-consumer scraps are managed at the production site.

Similarly, scraps can be described as new and old scraps. New scrap generated during the production process is completely recycled either circulated onsite or as steelwork. Since the composition of the scrap is known, in principle it does not need any treatment process, although sometimes cutting and shredding might be necessary. The total quantity of the new scrap can be estimated by input to output ratio at the plants for different products. In a recent communication on waste and by-product, “an example is given as non-waste for off-cut and other similar material. Following this guidance, most of the clean off-cuts from, for instance, extrusions, which can be directly fed into furnace, can be argued as non-waste. However, there is still room for interpretation for off-cuts such as painted or coated profile, sheets, etc. What are the common contaminants in new scraps, and when is the recovery operation considered complete?

On the other hand, old scrap is collected after consumption, either separately or mixed, and it is often contaminated to a certain degree, depending highly on its origin and collection system. Since the life time of many metal products are more than ten years and some can be as long as more than 50 years. For instance product for

building and construction, there has been an accumulation of metal in use since the beginning of the industry.

2.1.3 Sources of Recycled Metals

According to OSHA (2000), scrap metals can be obtained from numerous sources which include mill scrap from primary processing, used construction beams, plates, pipes, tubes, wiring, and shot. The author went on to indicate that old automobiles and other automotive scraps, boat scrap, railroad scrap, and railcar scrap are among the sources of scrap. Nkansah et al. (2015) noted that sources of scrap metals include the following refuse dumps, companies and the households. This implies that sources scrap metals varies across geographical space.

2.1.4 Sorting of scrap metals

There are various kinds of scraps which are brought to the point of reception by the heavy-duty trucks. There are two ways of sorting scrap metal, namely, magnetic and manual separation which can either be done at the point of collection or at destination point. Non-ferrous metal is separated from the ferrous metal using magnetic separation devices. Manual separation is used to separate the ferrous metals into two phases, the low carbon iron and the high carbon Iron (Ohimain, 2013). The researcher believes that manual sorting will be applicable in the study area because the people do not have the needed technology to deal with the sorting.

2.2 Environmental benefits and health benefits

Recycling of scrap metal comes with some socioeconomic and environmental benefits. In the first instance, recycling scrap metal will conserve valuable natural resources and raw materials for future use which will engender sustainable development in the long run (Hydro, 2012). Industries and manufacturing companies usually need raw material from the natural resources to be able create goods to meet human needs. Recycling will reduce the need to dig for virgin materials conserves soil integrity and wildlife habitats. Therefore, recycling of scrap metal will reduce the amount of natural resources and for that matter raw material need to produce.

Again, recycling of scrap metal will avoid or reduce to the minimum level of air and water pollution. It is noted that using recycled materials generally creates less pollution. In addition, recycling will reduce leaching into the soil which could result in soil degradation (Miller, 2006).

Metal recycling conserves natural resources by reducing greenhouse gas emissions and using less energy than making metal from virgin ore. The production of new metal releases a far greater amount of greenhouse gas emissions compared with making products from recycled metal. These emissions may influence climate change and may also cause harmful levels of air pollution in cities, resulting in potential respiratory health problems for you and other residents (ISRI, 2012).

Finally, according to Miller (2006), recycling of scrap metal saves significant amount of energy because recycled products require less energy to manufacture thus conserving oil and reducing greenhouse gas emissions. This is quite important because efforts are being to mitigate the impacts of globally. A study conducted by Areo and Ogungbile (2014) noted that recycling contribute significantly towards

emission of greenhouse gases. It is noted that emission of greenhouse gas is one of the causal factors of climate change.

2.3 Economic Benefits of recycling scrap metals

Recycling metal creates 36 times more jobs than sending the same amount of metal waste to the incinerator, and six times more than sending the metal to a landfill, according to the National Institute of Health. The National Recycling Coalition says the recycling industry in general generates \$236 billion annually and employs more than a million workers across America (ISRI, 2012). Recycling which serves as a source of employment also ensures materials do not litter the environment (Nkansa et al., 2015). According to Areo&Ogungbile (2014), scrap metal scavenging creates jobs for reasonable number of young persons in Africa. Once people's efforts are rewarded in the form of cash they will leave no stone unturned to gather all the scrap to make more money. By so doing, it will reduce drastically human and environmental problems associate with waste.

2.4 Adverse effects of scrap metal

On the other hand scrap metal activities have some negative consequences.

According to Areo&Ogungbile (2014:12) "Scrap metal scavenging was observed to cause infections due to injuries, water-borne diseases such as diarrhea, typhoid, anthrax, etc. Scavengers do not wear protective materials as hand gloves, boots, goggles, overall raincoats and umbrella. Consequently, they are exposed to all forms of dangers".

2.5 Types of Metals Most Commonly Recycled

Scrap metal recycling industry deals with a variety of scrap metals obtained from municipal solid waste and other sources. The most commonly recycled scrap metals includes but not limited to iron and scrap steel, copper, aluminum, lead, zinc, and stainless steel. In general, scrap metals have been classified into two main categories, namely ferrous and nonferrous. Ferrous scrap metal refers to those that contains iron and can be processed and remelted many times to form new desirable objects for house use and for commercial purpose. On the other hand, common nonferrous metals include copper, brass, aluminum, zinc, magnesium, tin, nickel, and lead. Precious and exotic metals are key components of nonferrous metals (OSHA, 2000; Ohimain, 2013). According to literature, precious metals refer to metals with a high market value in any form, such as gold, silver, and platinum. While, exotic metals are those that contain rare elements such as cobalt, mercury, titanium, tungsten, arsenic, beryllium, bismuth, cerium, cadmium, niobium, indium, gallium, germanium, lithium, selenium, tantalum, tellurium, vanadium, and zirconium. Apart from that, some types of metals are radioactive. These include naturally-occurring and/or those formed as by-products of nuclear reactions.

2.6 Management of scrap metal waste

A process whereby strategic combination of methods are employed to efficiently regulate waste from source of generation up to the final disposal point is referred to as waste management, and the aim is to maintain a perpetually safe and healthy environment at minimal cost (Igbinomwanhia, 2011 cited in Agbesola, 2013). The main focus of scrap metal management is to create safe and healthy environment for human habitation and this must be done at the least cost possible. In doing so, people

adopt cost effective strategies that are environmentally friendly in order to create quality environment.

2.7 Conceptual framework of scrap metal management

Effective control and management of waste hinges on the following key actions reduction, reuse and recycling. When these are consciously and continuously done, it will go a long way to reduce the impact of waste of which scrap metal is a fraction.

First and foremost, any effective and results oriented waste management and hence scrap metal management strategy should strive to reduce the volume of scraps generation. According to Brennan and Withgott (2005:599), “reducing the amount of material that enters the waste stream is the best solution to the solid waste problem because it avoids the cost of disposal and recycling, helps conserve resources, minimizes and pollution”. The waste reduction strategy has enormous benefits for the environment and human lives which is quite important for sustainable development. The authors note that waste reduction will take the combined efforts of manufacturers and consumers to achieve the needed results. While manufacturers are admonished to produce durable goods, consumers are expected to take good care of products of increase their longevity.

2.7.1 Reuse

Some usable products and goods find their way into the waste stream. It is prudent economically and environmentally to recover such items and reuse them. In the words of Brennan and Withgott (2005:600), “using already-used goods is one major way to reduce waste and there are many ways to reuse items, including saving them to use again or substituting disposal goods with durable ones”. Some people throw away

some items because they can afford to buy new ones not because the item is no longer usable or useful. For such persons, reuse requires attitudinal change and discipline. Scientific research indicated that 2-5% of the waste stream in the United States is reusable (Brennan and Withgott, 2005).

2.7.2 Recycling

Recycling has become increasingly important to society and industry to meet the goals of cost reduction, efficient management of limited resources, and reduced landfill utilization. Recycling metal reduces pollution, saves resources, reduces waste going to landfills and prevents the destruction of habitats from mining new ore (ISRI, 2012).

In the words of Miller (2006:396), “recycling is an important way to collect waste materials and turn them into useful products that can be sold in the marketplace”. The author noted that households and marketplace generate five types of recyclable waste materials which include but not limited the following paper products, glass, scrap metal (aluminum, steel etc.) and some plastic products. Brennan and Withgott (2005:601) stated that “recycling consists of collecting materials that can be broken down and reprocessed in order to manufacture new items”.

Waste materials and for that matter scrap metals can be recycled in two distinct ways. In the first place, there is primary or closed-loop recycling which entails recycling scrap metals into new productions of the same kind. For instance, turning used aluminum cans into new aluminum cans. Then there is secondary or down-cycling, in this method, scrap metals and other waste materials are consciously converted into entirely new different products (Miller, 2006). What is common in both processes however is that it involves turning old scrap into new product. According to Brennan

and Withgott (2005), in the face of recycling, waste products and for that matter scrap metals are considered as raw materials for new manufacturing processes.

There are basic recycling steps as shown in (figure2.1). In the initial stages, municipalities as well as businesses engaged in the collection of recyclable materials till the quantities needed for recycling are gathered. Thereafter, businesses spent time processing the recyclable materials gathered for recycling to take place. After the processing stage, the next stage is the use of the materials by industries to manufacture desirable products for sale. Manufacture will use the recyclable materials to manufacture what is needed in the market in order to make profit. The last stage from (Figure 2.1) is the sale of the products manufactured by industries.

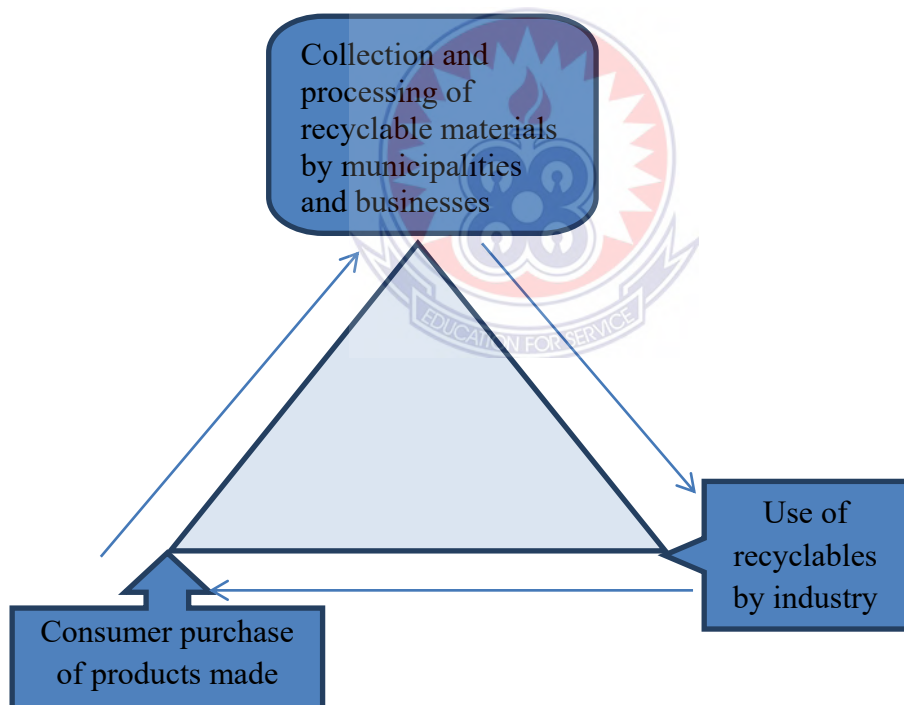


Figure 2.1: showing basic recycling processes

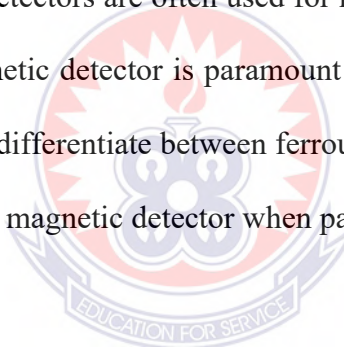
Source: Adapted from Brennan and Withgott, 2005

2.8 Scrap Metal Recycling Steps

2.8.1 Scrap collection

Scrap collection is the first step in recycling of metals. Scrap metal collection is largely performed by young men in their teens and twenties. Collection usually spans from early hours of the morning to late in the afternoon lasting about eight hours daily. Scrap metal collectors may usually go as individuals or in groups of two. The method of scrap collection varies from the use of simple technological tools to the use of the hands. Scrap metals are usually collected from the land surface with the hand and stored in the houses after collection for sale later depending on the situation in the local area (Moyes, 2005).

Simple tools like metal detectors are often used for metals hidden underneath the land surface. The use of magnetic detector is paramount in the collection of scraps in that the collectors are able to differentiate between ferrous and non-ferrous scraps. Ferrous scraps are attracted to the magnetic detector when passed over a stockpile of scraps.



2.8.2 Scrap processing

According to (Moyes, 2008), the second step in recycling of metals is the processing of the scrap metals. Scraps dealers and recyclers obtain scraps from many sources in many different forms and must be processed to facilitate efficient use. The primary roles of the scrap processor are to collect, sort, grade, prepare, market and distribute scrap.

Sorting is carried out following identification of the scrap. Sorting of scraps is done at the point of sale to the scrap dealers. Scraps are usually sorted based on the metal types. However, the sorting of scraps is done, a lot of the time, by visual inspection and not with any special devices. This requires a lot of skill and expertise especially in

cases where the metals have degraded beyond recognition. In some cases, chemical processes are used in a wide range of metal scrap recycling industries as a means to separate scrap into its component metals. The chemical processes clean the scraps prior to using physical processes and also remove contaminants (such as paint) from scrap material. It also extracts selected metals from a batch of scrap containing many metal types. Chemical processes may include high-temperature chlorination, electro refining, plating, leaching, chemical separation, dissolution, reduction, or galvanizing (OSHA, 2008).

The type and size of equipment they use depend on the types and volume of scrap available in the area and the requirements of their customers (OSHA, 2008). The large stand most expensive piece of equipment is the shredder. The shredder can fragment vehicles and other discarded steel objects into fist-size pieces of various metals, glass, rubber, and plastic. These materials are segregated before shipment by using fans, magnets, air ducts, hand pickers, and flotation equipment. Hydraulic shears, which have cutting knives of chromium-nickel-molybdenum alloy steel for hardness, slice heavy pieces of ship plate, railroad car sides, and structural steel into chargeable pieces are also used. Baling presses are used to compact scrap into manageable bundles thereby reducing scrap volume and shipping costs. Ferrous scrap metals are magnetic and are often collected in scrap yards by a large electromagnet attached to a crane, sweeping across piles of scrap to grab magnetic objects (OSHA, 2008).

2.8.3 Scrap smelting

Scrap processing is followed by scrap smelting. Smelting is done in a furnace at high temperatures. Smelting is done to fit manufactured metals to specifications of the industry.

Scrap metal of lower grade, which may be contaminated or in a form that is not easily used, tends to be bought and used as feed by primary metal producers (and possibly transported to large smelters located near or at mining operations), where they pay a much lower price per unit of metal than for high grade material. The amount of scrap metal smelted is dependent on end-of-life (old) scrap recovery which is hampered in two ways:

Products become physically distributed regionally and globally, making collection costly.

There may be many different metals embedded in a single product, wherein a specific type of metal may be dispersed or mixed throughout a single product, making separation and cleaning difficult.

2.9 Summary of literature review

The review discovered that scholars have written extensively on the concepts of scrap metal. The concepts of scrap metals includes types and sources of scrap metal, sorting of scrap metals, types of scrap metals that are commonly recycled among others.

Again, the literature review revealed scrap metal management strategies which include collection and storage, reduction of scrap metals, reuse and recycling. The benefits of scrap metal management are reduction in pollution and creation of employment.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

3.1 Background

The KassenaNankana Municipal was upgraded by LI 2106 from the KassenaNankana District which was established in 1988 by LI 1855. It is one of the thirteen (13) districts municipalities in the Upper East Region of the Republic of Ghana. The municipality has Navrongo as its political and administrative capital. The municipality lies approximately between latitude $11^{\circ}10'$ and $10^{\circ}3'$ North and longitude $10^{\circ}1'$ West (GSS, 2014).

The municipality shares boundaries to the north with Kassena-Nankana-West District and Burkina Faso. To the east, it shares boundary with Kassena-Nankana West District and Bolgatanga Municipal, to the west with Builsa District and to the south with the West Mamprusi District in the Northern Region.

3.2 Climatic Conditions

The climatic conditions of the KassenaNankana Municipality is characterized by the dry and wet seasons, which are influenced mainly by two (2) air masses – the North-East Trade winds and the South-Westerly's (Tropical Maritime). The harmattan air mass (North-East Trade Winds) is usually dry and dusty as it originates from the Sahara Desert. During such periods, rainfall is virtually absent due to low relative humidity, which rarely exceeds 20 percent and low vapour pressure less than 10mb. Day temperatures are high, recording 42° Celsius (especially between February and March) and night temperatures could be as low as 18° Celsius (GSS, 2014).

The Municipality experiences the tropical maritime air mass between May and October with the average annual rainfall of 950mmraingage.

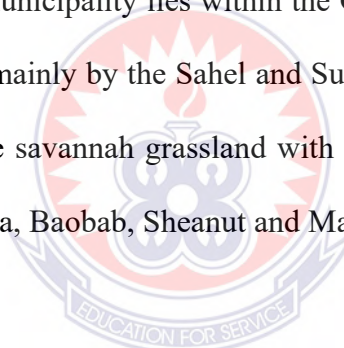
3.3 Relief and drainage

The Municipality is generally low-lying. The landscape is generally undulating with isolated hills rising up to about 300 metres above sea level in the western parts of the municipality. Notably among these hills include Fie (280 metres), Busono (350 metres) and Zambao (360 metres) above sea level.

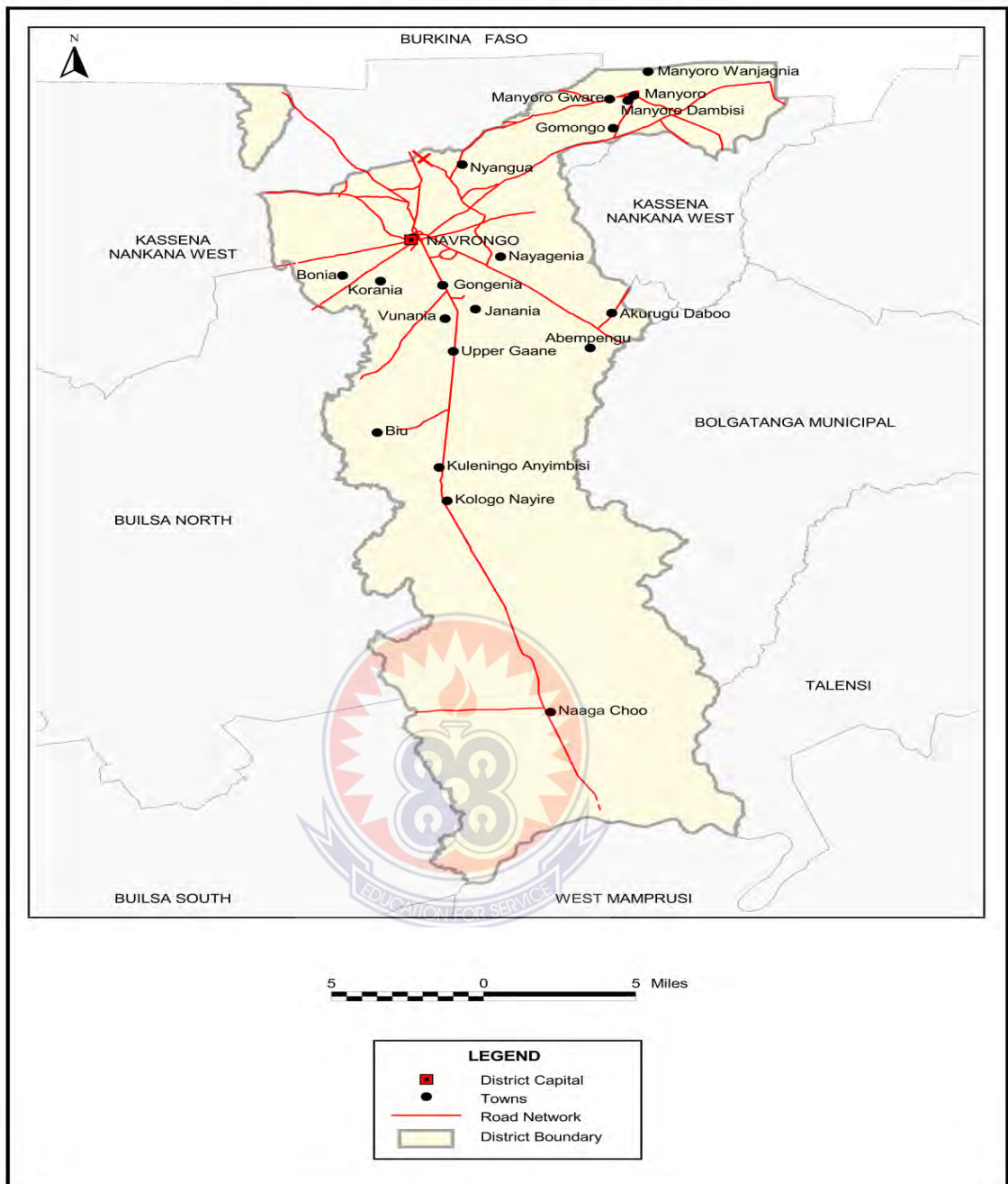
The drainage system of the municipality is constituted mainly around the tributaries of the Sissili River – Asibelika, Afumbeli, Bukpegi and Beeyi. A tributary of the Asibelika River (Tono River) has been dammed to provide irrigation facilities.

3.4 Vegetation

The Kassena-Nankana Municipality lies within the Guinea Savannah woodlands. The Municipality is covered mainly by the Sahel and Sudan-Savannah types of vegetation comprising mainly of the savannah grassland with short trees and thumps. Common trees found are Dawadawa, Baobab, Sheanut and Mango.



DISTRICT MAP OF KASSENA NANKANA EAST



DISTRICT MAP OF KESENA NANKANA EAST

3.5 Manufacturing

The Kassena-Nankana Municipality has not much large scale manufacturing industries. It is mostly characterized by small scale food processing, craft and manufacturing industries, examples of which include smock weaving, pottery and blacksmithing.

3.6 Resources for development

The municipality is endowed with both human and natural resources. The siting of one of the campuses of the University for Development Studies in the municipality has also enhanced the easy access to tertiary education to the youth thereby enhancing human capital in the municipality. Sand and clay are the major natural minerals mined in the municipality for construction purposes. The special weather condition has also made it possible for the generation of electricity for national use through a solar plant in Pungu, a suburb of Navrongo. The Tono irrigation facility has also made it possible for all-year round cultivation of crops especially vegetables such as tomato, pepper, cabbage and onion.

3.7 Agro industry/processing

Processing of foodstuffs, cash crops and other goods are common features of the local economy. The major small scale industrial activities includes, sheabutter extraction, pito brewing, milling or grinding of millet for domestic use, dawadawa processing, weaving and dressmaking, pottery, rice milling and soap making. Most of these small scale industries are one-man businesses and hardly employ people outside the household and pay salaries. The sector is dominated by females and needs to be organized into groups and their capacities built to enhance their businesses. There are

also varied business types in the municipality which needs to be developed in order to boost the local economy (GSS, 2014).

3.8 Methodology

This study adopted mixed methodology to explore scrap metal management in the KassenaNankana Municipality of the Upper East Region. Mixed method refers to a research strategy in which the use of quantitative and qualitative methods for data collection is permissible (Creswell, 2003). The quantitative data in this study has to do with the prices of scrap metals and the amounts people earn in the business.

3.8.1 Research Design

Case study approach was employed in this research to assess and explain people's perspectives on scrap metal management in the KassenaNankana Municipality of the Upper East Region. It is argued that research questions contribute significantly in the determination of the research design. According to Onwuegbuzie and Leech, (2006:475) "research questions in mixed methods studies are important because they, in large part, dictate the type of research design used, the sample size and sampling scheme employed, and the type of instruments administered as well as the data analysis techniques (i.e., statistical or qualitative) used".

Case study method is suitable to this study as it focuses on management of scrap metal in a specific geographical space. KassenaNankana Municipality was chosen as a case study in this research because it is fast growing Municipality where generation of waste in general and scrap metal in particular is inevitable from implements, domestic gadgets, old which parts. This is as result of the presence of some important tertiary educational institutions such St. John Bosco's College of education, Community

Nurses Training School and University for Development Studies. Another reason informing the choice of the study is that researcher was born in the Municipality.

In addition, this approach creates room for the use of several methods to collect data from respondents in natural settings (Bhattacharjee, 2012). The varied methods ensure method triangulation which was crucial in order to minimize biases in data collection and ensure validity and reliability. The study considered the case study approach as the most appropriate strategy of collecting, documenting and analysing relevant data and reporting the research findings scrap metal within the study area. The study further saw this design as appropriate for providing clear understanding of the issues being studied in the UER.

However, the case study is not without weaknesses. One major criticism leveled against the case study approach is that it does not allow generalization of the research findings beyond what pertains in the study area.

3.8.2 Sources of Data

The study gathered primary data for analysis from study respondents such as scrap metal dealers and those who recycle scrap metal. Respondents provided first-hand information regarding scrap metal activities within the municipality.

Secondary data were obtained from relevant journal articles, books and other relevant publications were the useful sources of secondary data.

3.8.4 Study Population and Sample Size

Scrap dealers and people who were doing recycling in the KassenaNankanaMunicipalityconstituted the study population. The study targeted these persons because they possess useful information and experiences on scrap metal activities in the study area. The researcher did a census and identified a total of ten (6 scrap dealers and 4 recyclers)in the municipality.

3.8.5 Sampling Techniques and Procedures

The KassenaNankana Municipality was purposively chosen because of the activities of scrap metals. The Municipality is a fast growing one with corresponding increase in population which comes with high consumption. In the end, products and items that are being used turn scrap metals.

3.8.6 Selection of Respondents

The researcher selected carefully and purposively respondents who have relevant knowledge and experience on the topic in order to elicit the right information for the study. Scrap metal dealers and scrap metal recycling entities were selected to participate in the study. Scrap metal dealers are important in accessing information on the types of scraps that are collected and sold in the scrap market. Scrap metal dealers also provided relevant information on the sources of scrap metal which include households, institutions, bicycle repairers, motorbike and vehicle mechanists. Those who engaged in recycling were also selected in order to gather data concerning recycling activities with the study jurisdiction.

3.8.7 Techniques of Data Collection

Semi-structured interview was one of the appropriate data collection methods employed in this study. In the semi-structured interviews, the questions were pre-determined by the investigator covering various issues to be studied. Both open-ended and close-ended questions are permissible when using this technique for data collection (Kusi, 2012). In this study the researcher used both open-ended and close-ended questions.

Observation helped the researcher to see the evidence on the ground through visits to scrap metal sites and recycling enterprises. For instance, the procedures, processes and equipment involved in recycling were observed. Similarly, the researcher also observed the scrap metal and recycled products and took photograph which was helpful in the analysis. Observation guide was used to obtain relevant data from the study area.

3.8.8 Methods of Data Analysis

Data obtained from the field and secondary sources were processed and analysed manually to make meaning out of it. The data was analysed manually since the questionnaires were few. The data were presented using tables, charts and percentages. Micro soft excel was used to construct tables as well as the charts.

CHAPTER FOUR

RESULTS OF THE STUDY

4.0 Introduction

This chapter contains the findings of the study. Specifically, the chapter covers the demographic characteristics of study respondents, activities of scrap dealers, impacts of scrap metal in the study, methods adopted in managing scrap metal and the economic benefits of scrap metal.

4.1 Demographic characteristics of study respondents

Demographic characteristics of respondents are quite essential as they help the researcher to know the sex, ages and educational background of respondents in the KassenaNankana Municipality who are active players in the scrap metal industry.

4.1.1 Sex of respondents

In the course of the study, the researcher finds it appropriated to find out the sex of the people involved in the scrap metal activities in the local economy. Table 4.1 shows sex of study respondents.

Table 4.1: Sex of study respondents

Sex	Frequency	Percentage
Male	10	100
Female	0	0
Total	10	100

Source: Field Survey, 2016

From Table 4.1 scrap metal in the KassenaNankana Municipality is purely male affair. According to the respondents, it is purely male activity because of the risk involved and also the heavy loads of the metals.

4.1.2 Age of respondents

The study was also interested in finding out the ages of respondents who engaged in scrap metal activities in the study area (table 4.2).

Table 4.2: Ages of Study respondents

Age (Years)	Frequency	Percentages
20-29	2	20
30-39	1	10
40-49	2	20
50-59	3	30
60+	2	20
Total	10	100

From Table 4.2, 30% of the respondents were within 50-59 age group followed by 20% for the following age groups 20-29; 40-49; 60+ while 10% which is the least fell within 30-39 age bracket.

4.1.3 Educational status of respondents

In the course of the study, the researcher interviewed respondents on their educational background in order to find out whether education plays a role in one's involvement in the scrap business. Figure 4.1 captures the educational status of people who participated in the study.

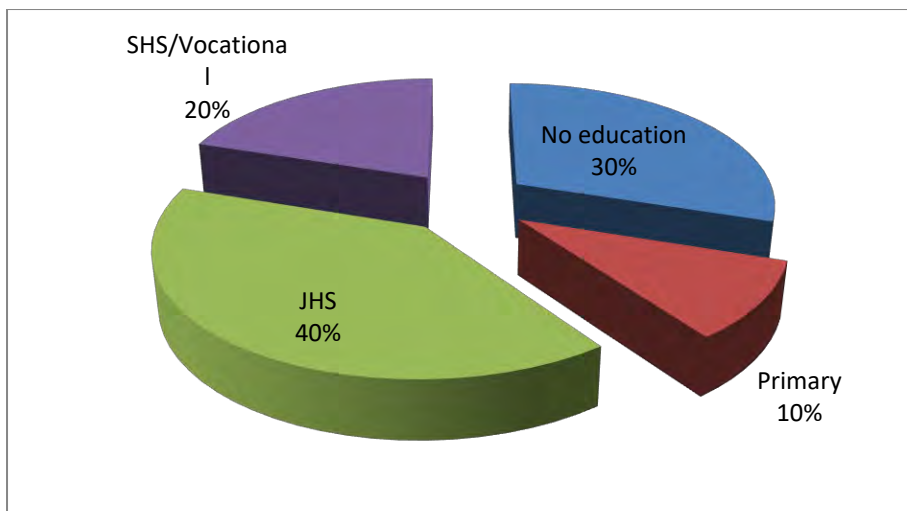


Figure 4.1: Educational status of study respondents

Forty percent of respondents attended school up to JHS level, 30% of respondents had no formal education, and 20% attended school up to SHS/Vocational level while 10% ended their education at the primary level.

4.1.4 Main occupations of study respondents

In this study, it was prudent to ascertain the occupational status of respondents as far as their main occupational status was concerned. Main occupation of study respondents are shown in Figure 4.2.

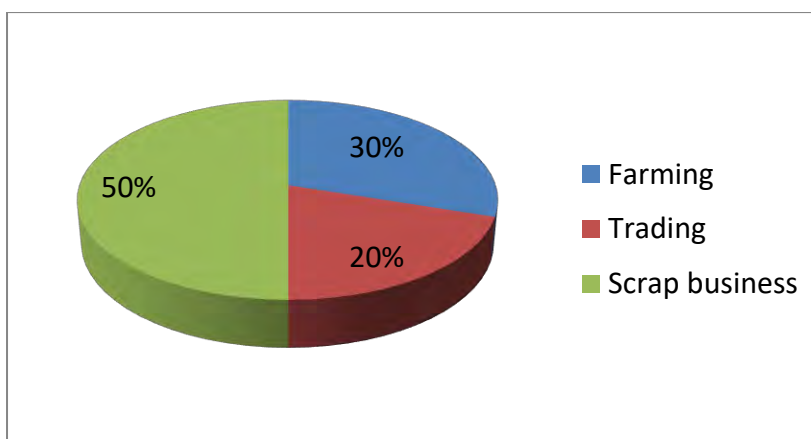


Figure 4.2: Main occupational status of respondents

Scrap business was the main occupation for half of the respondents (50%), 30% of respondents engaged in farming as the main occupation while 20% were trading to make a living.

4.2 Types and sources of scrap metals in the study area

From the interviews with the study respondents, it emerged that there are variety of scrap metals that to come to the scrap dealers' sites. Scrap dealers and recyclers reported that types of scrap metal include items made of iron, aluminium, copper, brass and zinc. During field observation a photograph of scrap metals was taken (Plate 4.1). Sources of scrap metals include households, other collectors, market place, etc. Scrap metals are transported through the use of motor king, and long vehicles.

Plate 4.1: Types of scrap metal in the study area



Source: Field survey, 2016

From Plate 4.1, scrap items in the study area include the following old aluminium zinc, household appliances, motorbike parts, vehicle parts, old iron rods and farm implements. Plate 4.1 is a point of sale for scrap metals.

4.3 Sorting of scrap metals by type

Collectors and users of scrap metals were interviewed in the course of the study to find out whether sorting is considered important in the scrap metal business. Some of the respondents noted that sorting was important to segregate the scraps by type. It helps to take out the scraps that are fairly good and hence useful. For instance, a dealer said that, *“I spend time sorting out the good ones so that I can sell them to people for reuse. When I do that, I usually depend on that money till it is time to convey my scraps to Tema for sale”* However, some of the respondents maintained that they do not sort because they collect scraps in small quantities and sell to other collectors and users of scraps and hence they did not see the importance of sorting.

Plate 4.2: Scrap metal sorted for reuse



Source: Field survey, 2016

4.4 Number of years in the scrap metal business

The study sought to find out how long people have engaged themselves in the scrap collection and recycling activities within the municipality. It emerged from the findings that people started this income generation activity for about two decades ago. However, majority of scrap dealers and recyclers have spent between six and ten years.

4.5 Reasons for engaging in scrap business

From the interviews, it came out clearly that people are collecting scrap metals for a number of reasons. To begin with, some of the collectors earn income daily for themselves and their families and hence it is the main occupation of such people. Others saw scrap metals business as means of getting additional income to augment family income. Yet others considered it an opportunity to use scrap metals as raw material to manufacture new items and putting their creativity into action for the benefit of society. The common factor is that all of them entered into this business because it has some financial gains and rewards.

4.6 Environmental, health and economic benefits of managing scrap metal

Scrap metals have some socioeconomic and environmental benefits to the local economy in diverse ways which include generation of income for households, scrap metals collectors and those who recycle scrap metals to manufacture other items. To begin with it was discovered that households were aware of the economic benefit and so the scrap metals were gathered and stored waiting for an opportunity for a buyer to purchase the scrap metals. According to the respondents, this makes it possible for households to earn additional income on things they did not find use. Due to the

awareness of households that scrap metal has monetary value, it is not every scrap that is thrown away.

Secondly, the scrap dealer, mentioned that scrap metal collectors including school children and under privileged in the Municipality earn some reasonable income from the business to meet personal and family needs. Likewise, those who recycle scrap metals use the raw material produced through the recycling process to produce other valuable items for sale. From the finding of the research, this group of people make more money than the collectors because they have been able to transform the scrap to a new product?

Consequently, the activities of scrap dealers have positive and desirable outcomes on the environment and create economic fortunes for people. It is noted that the actions of scrap dealers contribute immensely to environmental cleanliness and sanitation. The long time cumulative impact is that the environment will be freed of filth, disease will be minimized and the health of the people will be improved tremendously. Hence, the recycling is a strategy for waste and for that matter scrap metal management is quite an important one as it transforms products in the form of scraps into productive resources which are then transformed into completely new products to meet the needs of society. From the study results, scrap dealers earn monthly income between GHS250.00 and GHS800.00.

4.7 Adverse impacts of scrap metals

In the course of the study, respondents were asked to point out the negative impacts of scrap metals on the environment as well as human health. Respondents noticed that indiscriminate disposal of scrap metals make the environment filthy leading to contamination of water bodies and food crops grown on the land. Apart from that, the

research also revealed that scrap metals occupy farm lands making it very difficult to plough and weed. It was argued by respondents that scrap metals injure farmers during the farming season which have negative health implications. Inappropriate disposal of scrap metals equally serves as breeding grounds for mosquitoes and reptiles which also pose a serious threat to human safety and health. Consequently, people fall sick due to mosquito bite and through direct exposure to diseases. From this perspective, one can draw the conclusion that, scrap metals are destructive and inimical to the development within the KassenaNankana Municipality but for the management strategies adopted.

4.8 Access to and utilization of scrap metals

According to the respondents, they rely on scrap collectors and households who contact them to come and purchase scrap from their homes as well as fitting shops. The dealers stated that it is becoming increasingly difficult to have access to scraps in the Municipality. Unlike in the past, when one could easily come by scrap metals in the open space, in those days they used to select the desirable ones and leave the rest that were too small. However, in recent times, every scrap is bought, this attests to the fact that people have gained knowledge about the usefulness and benefits of scraps in the Municipality.

From the dealers' perspective, scrap metals are either reused or recycled after recovery is made. Normally, the scraps that are in good condition e.g. not ruined are sorted out manually for reuse. Some people purchase such items for reuse. For instance, when a bicycle or motorbike becomes scrap, some parts may still be good for reuse. Therefore, such parts are sold to repairers and mechanists to earn income.

On the other hand, those without reuse potentials go through the process of recycling to be able to manufacture either new kinds of the same products or entirely new different products. Several items are manufactured through the recycling process. These include cooking pots, charcoal pots, bangles, tea cartels, etc.

Table 4.3: Prices of scrap metals per kilogram

Scrap metal	Price (GHS)	Selling price to recyclers (GHS)
Aluminium	3.00	7.00
Ferrous items	0.20	N/A
Brass	4.00	10.00
Copper	8.00	15.00
Zink	2.00	N/A

Source: Field survey, 2016

Plate 4.3: Scales use in weighing scrap metals

The scrap dealers and recyclers used scales to weigh the scrap metals (Plate 4.3)



Source: field survey, 2016

4.9 Products manufacture during recycling

The recycling process leads to the manufacturing of some metallic products for household use and for sale. According to the recyclers, recycling makes possible for the manufacturing of farm implements such hoe blades, hoe bangles and animal plough. Other items include cans, rings, metallic boxes and cooking utensils.

4.10 Equipment for smelting recyclable materials

The recyclers use certain equipment to melt the metals for the recycling to take place. Some of the equipment are powered by, electricity while others are manually powered. The equipment (blower) label in plate 4.4 uses electricity and can also be powered manually to melt the recyclable materials.

Plate 4.4: Electrically and manually powered blower for smelting



Source: field survey, 2016

Plate 4.5: Manually powered blower for smelting



Source: field survey, 2016

Plate 4. 6: Recycling room



Source: field survey, 2016

This is the manufacturing room where raw materials (recyclables) are turned into new products for household use and for sale (Plate 4.6).

4.11 Challenges encountered by scrap dealers

There are myriad of challenges associated with scrap metal collection, storage, transportation and recycling.

First and foremost, some of the dealers and recyclers argued that scrap metal is an informal business making it difficult to have access to receipts as prove of transactions. As a result, some of the scrap collectors steal scraps and sell them to dealers which create serious problems in the business. Later, the real owners of those scraps will come and retrieve them from the dealers, yet some will even threaten them with court actions.

On the other hand, some people also steal the scraps from the scrap dealers' sites and resold them to other dealers. This situation arises because some scrap dealers are not financially sound to pay for the services of a watchman to take good care of the scraps. This situation is causing huge financial loss to the dealers at the end of the day.

Another serious challenge in the business has to do with limited access to market information regarding the prices of the scraps in urban centres like Accra, Tema and Kumasi. The respondents reported that there are fluctuations in the price of scrap metals and products. Sometimes, they will transport the scrap to the urban centres for sale only to realize that the market price is not favourable at all. In such circumstance, they are compelled to sell the scrap at "give away price" because they cannot return home without sales.

Lack of financial support and logistical support from the government do not help matters at all. The recyclers stated that the municipal assemblies collect taxes from them and it is not doing anything to help the recycling process.

Finally, record keeping is also one of the challenges faced by scrap dealers and recyclers in the study area. Record keeping are so important in monitoring the performance of every business and taking remedial actions to salvage the business from collapse. During the interviews, they stated that they do not keep records of their activities making it difficult to remember actually what happened in the previous years.



CHAPTER FIVE

DISCUSSION OF THE RESULTS

5.0 Introduction

This chapter deals with the detailed discussions of the research findings. The researcher intends to find out the implication of scrap metal handling and disposal on the environment and residents of the KassenaNankana Municipality. In doing so, respondents were interviewed in order to ascertain the facts on scrap metal activities and the perspectives of scrap metal dealers and recyclers on the topic under investigation.

5.1 Demographic characteristics of respondents

Demographic characteristics of the respondents of the study are so important because it provides useful information about the sex, age, educational status and occupation of the respondents. This will help to identify those who are involved in the scrap metal activities in the study area.

5.2 Sorting of scrap metals

Collectors and users of scrap metals were interviewed in the course of the study to find out whether sorting is considered important in the collection process. Some of the respondents reported that sorting was important because it help to segregate the scraps by type and also to separate the good ones for reuse. This findings were consistent with Brennan and Withgott (2005) who noted using already-used goods is one major way to reduce waste and there are many ways to reuse items. However, some of the respondents maintained that they did not see the need to sort because they collect

scraps in small quantities and sell to other collectors and users of scraps and hence they did not see the importance of sorting. Scrap dealers maintain that the sorting is done manually. This finding agrees with Ohimain, (2013), that there are two ways of sorting scrap metal, namely, magnetic and manual separation which can either be done at the point of collection or at destination point. Non-ferrous metal is separated from the ferrous metal using magnetic separation devices. Manual separation is used to separate the ferrous metals into two phases, the low carbon iron and the high carbon iron.

5.3 Number of years in the scrap metal business

The study sought to find out how long people have engaged in the scrap collection and recycling activities within the Municipality. It emerged from the findings that people started this income generation for more than two decades ago. However, majority of collectors and users have spent between six and ten years. This implies that scrap metal has been a source of livelihood for some people in the study area for over decades. The finding reveals that scrap metal management has made significant contribution to the local economy.

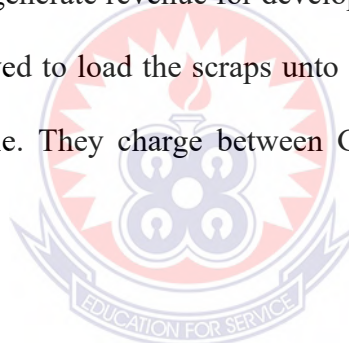
5.4 Reasons for collecting scraps

From the interviews, it came out clearly that people are collecting scrap metals for a number of reasons. To begin with, some of the collectors earn income daily for themselves and their families and hence it is the main occupation of such people. Others saw collection of scrap metals as means of getting additional income to augment family income. Yet others considered it an opportunity to use scrap metals as raw material to manufacture new items. The common factor is that all of them entered

into this business because it has some financial gains and rewards. From the results, it is clear that scrap metals have some economic benefits for some households and families in the local economy. The overall effect of this is that it contributes to poverty reductions and improves living conditions of residents in the KassenaNankana Municipality. Some of the scrap dealers of also pay taxes to the assembly which will contribute to development.

Sources of scrap metals include households, other collectors, market place, etc.

Scrap metals are transported through the use of motor king, and long vehicles. This finding brought to light the fact that the benefits of scrap metals go beyond those who are directly involved in the scrap business. The municipality assembly taxed scrap dealers and recyclers to generate revenue for development. In addition, the services of young men were employed to load the scraps unto long vehicles to be transported to Tema and Accra for sale. They charge between GHS750.00 and GHS1000.00 per load.



5.5 Methods and strategies adopted in managing scrap metals

From the interviews and field observation, it was revealed that there are several methods and strategies that are employed to manage scrap metals in the study area. These strategies vary and hence they have different consequences on scrap metal management.

One of the important scrap metal management strategies is collection and storage. This strategy takes advantage of the open disposal of solid waste of which scrap metal is a component. Scrap metal collectors go out in the open space to recover scrap metal that are disposed by individuals, households and others. They usually engaged in

collection and storage until they gather enough, then they convey the scrap metals to the scrap dealers for sale or they will rather call the scrap dealers to come and buy.

5.5.1 Reuse

While it is often assumed that waste collectors retrieve materials for recycling, this is not necessarily the case. The study found out that not all scrap metals recovered from the waste stream were meant for recycling as some of them have reusable potentials and indeed were reused by collectors themselves and others who were in need of such items because it is much cheaper to buy them. The study found that it is the scrap dealers who benefited most from the items with reusable potentials because they buy them in large quantities from the collectors and sort out the scraps that are still useful. Reusable scraps found in the study area include the following bicycle parts, motorbike and vehicle parts as well as roofing sheets. For instance, old roofing sheets were reused to fence gardens, trees and houses in the KassenaNankana Municipality. This is consistent with findings of Brennan and Withgott (2005) that using already-used goods is one major way to reduce waste, including saving them to use again or substituting disposal goods with durable ones.

5.5.2 Recycling

The study discovered that recycling of scrap metals was one of the strategies of managing waste in the Municipality. Recyclers purchased scraps from collectors and dealers in order to turn them through the recycling process into new products for sale e.g. This created employment for some people in the scrap metal industry. This finding supports Miller (2006) who found that recycling is an important way to collect waste materials and turn them into useful products that can be sold in the marketplace

and Brennan and Withgott(2005) stated that recycling consists of collecting materials that can be broken down and reprocessed in order to manufacture new items.

5.6 Environmental benefits and health benefits

The activities of scrap dealers have positive and desirable outcomes on the environment. The findings of the study suggest that the actions of scrap dealers contribute immensely to environmental cleanliness and sanitation. The long time cumulative impact is that the environment will be freed of filth, disease will be minimized and the health of the people will improved tremendously. Hence, the recycling as a strategy for waste and for that matter scrap metal management is quite an important one as transforms products in the form of scraps into productive resources which is then transformed into completely new products to meet the needs of society. Miller (2006) came out with similar finding which indicates that recycling of scrap metal will avoid or reduce to the minimum level of air and water pollution. It is noted that using recycled materials generally creates less pollution. In addition, recycling will reduce leaching into the soil which could result in soil degradation.

5.7 Economic Benefits of recycling scrap metals

It was discovered that people no longer throw away scrap metal because households are aware of the economic benefits of scrap metal and so people gather the scrap metal and store them waiting for an opportunity where a buyer will come and purchase them. According to the respondents, this makes it possible for households to earn additional income on things they used to throw away. Due to the awareness of households that scrap metal has monetary value; it is not every scrap that is thrown away. Likewise, those who recycle scrap metals use the raw material produced

through the recycling process to produce other valuable items for sale. From the finding of the research, this group of people make more money than the collectors because dealers have been able to transform the scrap to something new.

Recycling which serves as a source of employment also ensures materials do not litter the environment (Nkansa et al., 2015). According to Areo&Ogungbile (2014), scrap metal scavenging creates jobs for reasonable number of young persons in Africa. Once people's efforts are rewarded in the form of cash they will leave no stone unturned to gather all the scrap to make more money. By so doing, it will reduce drastically human and environmental problems associated with waste.

5.8 Adverse impacts of scrap metals

In the course of study, respondents were asked to point out the negative impacts of scrap metals on the environment as well as human health. Respondents noticed that indiscriminate disposal of scrap metals make the environment filthy leading to contamination of water bodies and food crops grown on the land. Apart from that, the research also revealed that scrap metals occupy farm lands making it very difficult to plough and weed. It was argued by respondents that scrap metal cut farmers during the farming season which have negative health implications. Inappropriate disposal of scrap metals equally serves as breeding grounds for mosquitoes and reptiles which also pose a serious threat to human safety and health. Consequently, people fall sick due to mosquito bite and through direct and indirect exposure to diseases. From this perspective, one can draw the conclusion that scrap metals are destructive and inimical to the development within the KassenaNankana Municipality. This finding supports the findings of Areo&Ogungbile (2014) which indicated that Scrap metal cause infections due to injuries, water-borne diseases such as diarrhea, typhoid,

anthrax, etc. Scavengers do not wear protective materials as hand gloves, boots, goggles, overall raincoats and umbrella. Consequently, they are exposed to all forms of dangers.

5.9 Access to and utilization of scrap metals

According to the scrap dealers, mainly those who recycle scrap metal, they rely on scrap collectors and households who contact them to come and purchase scrap from their homes. The dealers stated that it is becoming increasingly difficult to have access to scraps in the Municipality. Unlike in the past, when one could easily come by scrap metals, in those days they used to select the desirable ones and leave the rest that were too small. However, in recent times, every scrap is bought, this attests to the fact that scraps are becoming very scarce in the Municipality.

From the dealers' perspective, scrap metals are either reused or recycled after recovery is made. Normally, the scraps that are still in good shape are sorted out manually for reuse. Some people purchase such items for reuse. For instance, when a bicycle or motorbike becomes scrap, some parts may still be good for reuse. Therefore, such parts are sold to repairers and mechanics to earn income.

On the other hand, those without reuse potentials go through the process of recycling to be able to manufacture either new kinds of the same products or entirely new different products. Several items are manufactured through the recycling process. These include cooking pots, charcoal pots, bangles, tea cartels etc.

5.10 Challenges encountered by scrap dealers and recyclers

Studies reviewed were silent about challenges faced by scrap dealers and recyclers in the scrap industry. This study found a number challenges in the scrap metal industry.

First and foremost, some of the dealers and recyclers contend that scrap metal is an informal business making it difficult to have access to receipts as prove of transactions. As a result, some of the scrap collectors steal scraps and sell them to dealers which create serious problems in the business. Later, the real owners of those scraps will come and retrieve them from the dealers, yet some will even threaten them with court actions.

On the other hand, some people also steal the scraps from the scrap dealers' sites and resold them other dealers. This situation arises because some scrap dealers are not financially sound to pay for the services of a watchman to take good of care of the scraps. This situation is causing huge financial loss to the dealers at the end the day.

Another serious challenge in the business has to do with limited access to market information regarding the prices of the scraps in urban centres like Accra, Tema and Kumasi. The respondents reported that there are fluctuations in the price of scrap metals and products. Sometimes, they will transport the scrap to the urban centres for sale only to realize that the market price is not favourable at all. In such circumstance, they are compelled to sell the scrap at "give away price" because they cannot return home with the scraps.

Lack of financial support and logistical support from the government do not help matters at all. The recyclers stated that the municipal assemblies collect taxes from them and they do not anything to help the recycling process.

Finally, records keeping is also one of the challenges faced by scrap dealers and recyclers in the study area. Records keeping are so important in monitoring the

performance of every business and taking remedial actions to salvage the business from collapse. During the interviews, it was stated that dealers do not keep records of their activities making it difficult to remember actually what happened in the previous years.



CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This is the final chapter which provides brief overview of the study, highlighting the summary of the major findings, conclusion and recommendations. The main objective of the study was to assess scrap metal management strategies and their effects on the environment and the people in the KassenaNankana Municipality. Specifically, the study seeks to: (1) ascertain the impacts of metal scrap waste on the people of the KassenaNankana Municipality, (2) investigate methods adopted in managing scrap metals and (3) find out economic benefits of managing scrap metals in the KassenaNankana Municipality.

6.1 Summary of key findings

The study found out that inappropriate disposal of solid waste which includes scrap metal has some consequences on the environment and human wellbeing. First of all, the scrap metals create filthy and dirty environment which have negative bearing on agricultural activities and human health. Respondents reported that scrap metal occupies farm lands which make ploughing and weeding difficult task for farmers in the study area. The scraps pose a serious threat to farmers because the scrap could harm farmers and cause injuries.

In addition, the scrap metals also contaminated water bodies and serve as breeding grounds mosquitoes and reptiles. The combined effect is that human health will be at risk.

The study also discovered scrap metal was considered as a resource due to the management strategies adopted in the study area. As a result, scrap collectors, dealers and recyclers were involved actively at different stages with different management strategies which made scrap metal a resource in the final analysis.

The scrap collectors engaged in collection and storage as means to manage scrap and turn into a resource. They usually store the scraps until they get appreciable quantities so they will then sell them to the scrap dealers. The scrap dealers buy scraps from households, fitting shops, companies and scrap collectors. The scrap dealers usually sort out the scrap manually to be able to recover those with reusable potentials. The scrap dealers sell the reusable ones which include roofing sheets, bicycle parts, motorbike parts and so on to people who are in need of them. The dealers reserve some for personal and family use.

Furthermore, the study found that scrap metal management generate some economic benefits for the players in the industry as well as other people who are not directly involved in the scrap business.

Finally the dealers and recyclers of scrap metals encountered operational and technical challenges in the course of their business.

6.2 Conclusion

The following conclusions can be drawn from the findings of the study.

- Scrap metals have had some consequences on the environment and on the residents of Kassena Nankana Municipality as it created filthy environment which breed reptiles and mosquitoes.
- The study revealed that people throw away things that are still useful.

- Conscious efforts have been made to address the problem by adopting some scrap metal management strategies which have positive implications on the environment.
- As a result of the management strategies adopted, it has created some economic benefits for those directly involved in the business and environmental benefits for the entire municipality.
- However, dealers and recyclers have encountered some challenges which include theft of scraps, inadequate financial resources to expand their operations among others. Some sustain injuries because they do not take precautionary measures.

6.3 Recommendations

Based on the findings, the following recommendations are made.

- Municipal solid waste managers should educate and encourage scrap dealers to use the scraps till their life span is exhausted before they discard them.
- The assembly should assist scrap metal dealers and recyclers in particular to identify low cost technologies and strategies of managing scrap metals.
- The Municipal assembly should help scrap dealers and recyclers to access credit facilities in order to expand their businesses.
- Last but not the least, Municipal solid waste managers should educate scrap dealers and recyclers on safety measures and ensure that precautionary measures are adhere to.

REFERENCES

- Agbesola, Y. (2013). *Sustainability of Municipal Solid Waste Management in Nigeria: A Case Study in Lagos*. Water and Environmental Studies Department . Linköping University Electronic Press.
- Areo, A. B., & Ogungbile, P. O. (2014). Scrap Metal Scavenging: Consumer Market, Consumer Buying Behaviour and the Environment. *Academic Research International*, 5(5), 270-2833.
- Bhattacharjee, A. (2012). *Social Science Research: Principles, Methods, and Practices*. USF Tampa Bay Open Access Textbooks. Collection Book3.
- Brennan, S., & Withgott, J. (2005). *Environment: the Science behind the stories*. San Francisco: Pearson Education.
- BroniI-Sefah, K. (2012). *A Study of the Scrap Metal Trade in the Kumasi Metropolitan Area*. Unpublished.
- Creswell, J. (2003). *Research Design, Qualitative, Quantitative and Mixed Methods Approaches* (2nd ed.). Sage Publication.
- de Sadeleer, N. (2012). Scrap Metal Intended for Metal Production: Thing Line between Waste and Products. *Journal for European Environmental and Planning Law*, 9(2), 136- 163.
- Ghana Statistical Service. (2014). *2010 Population and Housing Census: Kassena Nankana East Municipal Assembly*. District Analysis Report.
- Hydro. (2012). *Aluminium, Environment and Society*. Hydro.
- ISRI. (2012). *Benefits of Scrap Metal Recycling*.
- Kusi, H. (2012). *Doing Qualitative Research, a guide for Researchers*. Emmpong Press, Accra-New Town.

- Miller, G. T. (2006). *Environmental Science: Working with the Earth* (11 ed.). Thomson Brooks/Cole.
- Morakinyo, A. D., & Vershima, A. N. (2014). Recycling of Scrap Solid (Metal) Industrial Waste in Fabrication of Tile Making Machine as a Strategy in Waste Management in Kaduna, Nigeria. *The Pacific Journal of Science and Technology*, 15(1), 47-57.
- Moyes, R. (2005). *Report on A study of scrap metal collection in Lao PDR*. Geneva: International Centre for Humanitarian Demining.
- Muchová, L., & Eder, P. (2010). *End-of-waste Criteria for Iron and Steel Scrap: Technical Proposal*. European Commission Joint Research Centre.
- Nkansah, A., Attiogbe, F., & Kumi, E. (2015). Scrap metals' role in circular economy in Ghana, using Sunyani as a Case Study. *African Journal of Environmental Science and Technology*, 11, 793-799.
- Ohimain, E. I. (2013). Scrap Iron and Steel Recycling in Nigeria. *Greener Journal of Environmental Management and Public Safety*, 2(1), 001-009.
- Onwuegbuzie, A. J., & Leech, N. L. (2006). Linking Research Questions to Mixed Methods Data Analysis Procedures. 474-498.
- OSHA. (2008). *Guidance for the Identification and Control of Safety and Health Hazards in Metal Scrap Recycling*. Occupational Safety and Health Administration U.S. Department of Labour.

APPENDICES

Appendix I

FACULTY OF TECHNICAL EDUCATION

DEPARTMENT OF MECHANICAL TECHNOLOGY EDUCATION, KUMASI

RESEARCHING TOPIC:

EFFECTS OF SCRAP METALS MANAGEMENT ON THE PEOPLE OF THE
KASSENA NANAKANA MUNICIPALITY

Research Questionnaire

A. Personal information

1. Sex of respondents

a. Male ()

b. Female ()

2. Age of the study respondents

a. 20-29 ()

b. 30-39 ()

c. 40-49 ()

d. 50-59 ()

e. 60+ ()

3. Level of education:

a. No education ()

b. Primary ()

c. J.H.S ()

d. S.H.S ()

e. Vocation ()

f. Tertiary ()



4. Religion:
- a. Christian ()
 - b. Islamic ()
 - c. Traditional []
 - Others (specify).....
5. What is your main occupation?
- A. Farming ()
 - b. Public/Civil servant ()
 - c. Trading ()
 - d. scrap dealers ()
 - Others (specify).....
6. Marital status:
- a. Never Married []
 - b. Married []
 - c. Devoice []
 - d. Widower []
 - e. Widow []



Activities of scrap metal dealers

1. Do you collect scrap metal?
- Yes []
 - No []
2. Do you sort your scrap metals before selling them?
- Yes []
 - No []
3. How is the sorting done?

4. How long have you been collecting scrap metal?.....
.....
5. What quantity (in kilos) do you collect a. in week.....b. in a month.....c. in a year.....
6. What are the sources of scrap metals in KNM?
 - A. households []
 - b. refuse dumps []
 - c. fitting shops []
 - d. open places []
 - e. others (specify)
7. How do you transport the scrap metals to the market?
8. How difficult is it to get scrap metals?
9. Do you pick the scrap metals for free or you buy them from people?
10. Mention the types of scrap metals you collect

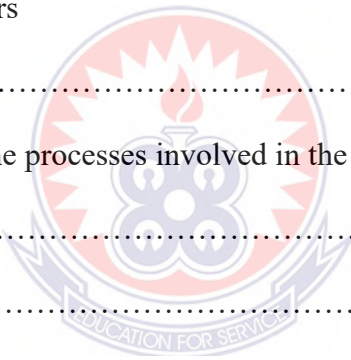
Impacts of scrap metal among the people of the Kassena Nankana Municipality

- How does the disposal of scrap metal affect the environment?
.....
.....
.....
- What is the health implication for inappropriate disposal of scrap metal in this community?
.....
.....
.....
.....

- How does the recycling of metal scrap help in generating income for your household?.....
.....
.....

Methods adopted in managing scrap metal

1. What methods are used in managing metal scrap in this area?
 - A. recycling []
 - b. manufacturing other products []
 - c. collection and storage []
 - d. open disposal []
 - e. sells to collectors
 - f. others
2. Kindly describe the processes involved in the following
 - a. Recycling.....
.....
.....
 - b. Where is the source of the recycling technology?
.....
 - c. What challenges do you face in recycling scrap metal?
.....
.....
.....
 - d. Manufacture other product



.....

.....

.....

e. Collection and storage

.....

.....

.....

Table1. Indicate items, their prices and monthly sales.

Item (product)	Price (GHS)	Monthly sales (if any)

3. Do you employ people to help in the recycling activities? Yes [] no []

Economic benefits of scrap metals in the Kassena Nankana Municipality

1. Why do you collect scrap metal?

2. How much is your income from sale of scrap metals? Daily
.....weekly.....monthly.....annually

3. How much do you sell your scrap metal per kilos/pound?

4. Who determines the price of scrap metals?

5. Is income made from sale of scrap metals enough to cater for dependents?

Yes []

No []

7. Do you pay tax on your income?

Yes []

No []

7. What do you use the income from the sale of scrap metal for?

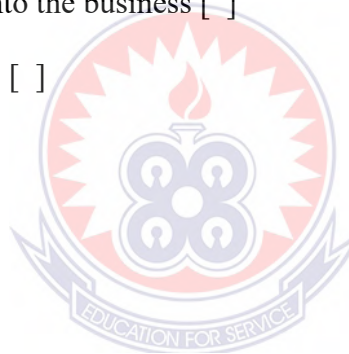
A. medical bills []

B. school fees []

C. food stuff []

D. plough back into the business []

E. electricity bills []



Appendix II

Observational Schedule

Observable actions	Observation made	Comments/remarks
Types of scrap metal collected and sold		
Sorting activities in the collection and selling processes		
Selling and buying arrangements, using scale to weigh the scraps and pricing is		
Recycling: machines and equipment used for recycling scrap metal and safety measures		
Items and products manufactured from the recycling process		
Actions of those who are doing the recycling		
Others		

