

**UNIVERSITY OF GHANA
DEPARTMENT OF GEOGRAPHY AND RESOURCE
DEVELOPMENT**

**URBAN MINING AS A LIVELIHOOD STRATEGY: THE CASE
OF SCRAP METAL TRADE IN TEMA-ASHAIMAN
METROPOLIS.**

BY

**AGBEKA JOSEPH
(10507195)**

**THIS THESIS SUBMITTED TO THE UNIVERSITY OF GHANA,
LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT
FOR THE AWARD OF MPhil GEOGRAPHY AND RESOURCE
DEVELOPMENT DEGREE.**

JULY, 2016

DECLARATION

Apart from the works of other writers, which have been duly acknowledged, I hereby declare this thesis is my own work towards the attainment of the MPhil and that either in whole or part, has not be accepted elsewhere for another degree.

.....

AGBEKA JOSEPH
(CANDIDATE)

.....

DATE

.....

PROF MARTIN OTENG-ABABIO
(PRINCIPAL SUPERVISOR)

.....

DATE

.....

DR. AWERE GYEKYE
(CO-SUPERVISOR)

.....

DATE

DEDICATION

I dedicate this work to God Almighty for the strength and knowledge given. This work is also dedicated to my parents and siblings for their inspiration to see the end of this work.

ACKNOWLEDGEMENT

I am grateful to the Almighty God for his Grace, Mercy and Love upon which He has given me the understanding and strength to do all that I have done and seeing me through this work. I express my profound gratitude to my supervisors, Prof. Martin Oteng-Ababio and Dr. Awere Gyekye for their guidance, assistance, immense contribution and criticisms which made this thesis possible. My sincere thanks go to my father, Mr George Agbeka, who made it possible to pursue this academic adventure.

I also thank Mr. Abubakari Ibrahim of Ministry of Trade and Industry for the relevant information he supported me with. Furthermore, I also appreciate the assistance and services of the Scrap Dealers Association of Tema and Ashaiman which gave me the opportunity to carry out the survey at the scrap yards. My appreciation also goes to Mr. Rueben Yao Donkor and Miss Ellen Antwi for the overwhelming assistance they offered during the data collection. Finally, I thank my family, friends and more especially departmental colleagues for their love, co-operation and support in our quest for knowledge.

ABSTRACT

With the urbanisation of the world's population proceeding apace and the increasing demand for metals putting permanent pressure on natural resources, metals have become a priority area for decoupling economic growth from resource use and environmental degradation. This is imperative if cities are to remain relevant in ensuring appropriate levels of supply and reduce the negative environmental footprints in the quest for global green economy. In that perspective, urban mining has been vital and increasingly important as societies have recognized the need for sustainability. The study was about the informal scrap recycling in the Tema-Ashaiman Metropolis (TAM). The purpose was to examine the importance of scrap recycling as a sustainable livelihood option. This was done by examining the scrap participant's chain of activities, their modus operandi and their motives that lead them into the trade. The study also examined the incomes of the scrap metal participants and how secured and reliable are their incomes were. It further examined some environmental and health challenges associated with the informal scrap recycling trade.

The study was carried out using qualitative research design and employing semi-structured interview guides, in-depth interviews, focus group discussions and direct observations. A total of 35 respondents from the TAM took part in the study.

The results revealed that using secondary resources through "urban mining" temporarily unlocked the resource embedded in the scrap metals. Additionally, it has become 'sustainable livelihood opportunities' for the urban poor.

In that respect, getting all stakeholders on board is crucial in the quest for meeting the increasing metal needs of the future in a sustainable way. Though, a daunting task for policy makers, the study recommends the need to adopt a wide, systemic approach based on understanding the industrial and economic factors driving the recycling industry. Such knowledge base will allow developing a coherent regulatory framework and powerful incentives for all stakeholders to participate in recycling to guarantee transition to a resource efficient society.

TABLE OF CONTENTS

DECLARATION	i
DEDICATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT.....	iv
TABLE OF CONTENTS	v
LIST OF FIGURES	ix
LIST OF TABLES	x
LIST OF PLATES	xi
LIST OF ABBREVIATIONS	xii
CHAPTER ONE	1
GENERAL INTRODUCTION	1
1.0 Background of study	1
1.1 Problem Statement	6
1.2 Research questions	10
1.3 Research objectives	10
1.4 Propositions	11
1.5 Research justification	11
1.6 Organization of the study	12
1.7 Summary	13
CHAPTER TWO	14
LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK	14
2.0 Introduction	14
2.1 Scrap metal generation	14
2.1.1. Type of scrap metal.....	16
2.1.1.1 Ferrous scraps.....	17
2.1.1.2 Non-ferrous scraps	17
2.1.2 Reflections of urban mining - scrap metal recycling.....	18
2.1.3 Challenges associated with the scrap metal industry.....	22
2.1.4 Guidelines for environmentally sound management of scrap industry	24
2.2 Theoretical Framework	26
2.2.1 Vulnerability Context	27

2.2.2 Livelihood Assets	28
2.2.3 Livelihood Strategies	28
2.3 Livelihood framework’s significance to the participants involved in the scrap metal recycling industry	29
2.4 Summary	31
CHAPTER THREE.....	33
STUDY AREA AND RESEARCH METHODOLOGY	33
3.0 Introduction	33
3.1 Study area	33
3.2 The historical development of Tema.....	35
3.3 Population dynamics of Tema	36
3.4 Tema and the Ghanaian economy	37
3.5 Ashaiman: the dormitory of informal workers in Tema.....	40
3.6 Research methodology	42
3.6.1 Research design	42
3.6.2 Data collection techniques and collection tools.....	43
3.6.3 Sample size and sampling techniques.....	46
3.6.4 Ethical consideration.....	47
3.6.5 Data processing and mode of analysis	47
3.7 Limitations of the study.....	48
3.8 Summary	48
CHAPTER FOUR.....	50
RESULTS	50
4.0 Introduction	50
4.1 Socio-demographic characteristics of respondents	50
4.2 Clusters in value chain of the scrap industry.....	55
4.2.1 Scrap pickers.....	55
4.2.2 Dismantlers	57
4.2.3 Middlemen	59
4.2.4 Scrap dealers	60
4.2.5 Ancillary service providers	62
4.2.5.1 KIA truck drivers	62

4.2.5.2 Petty traders.....	63
4.2.5.3 Auto-mechanics.....	64
4.3 Reasons for participating in scrap metal scavenging and recycling.....	65
4.4. Processes involved in scrap metal recycling	67
4.4.1 Sources of scrap metal	67
4.4.2 Methods of processing	69
4.4.3 Disposal of non-valuable fractions	70
4.4.4 Downstream processors of scrap metal	70
4.5 Working conditions	71
4.6 Remunerations and economic viability of scrap metal recycling.....	73
4.6.1 Respondents' capital accumulation	74
4.6.2 Respondents' remittances	75
4.7 Summary	76
CHAPTER FIVE.....	77
DISCUSSIONS OF RELEVANT ISSUES AND PERCEIVED ENVIRONMENTAL HEALTH HAZARDS OF SCRAP METAL RECYCLING	77
5.0 Introduction	77
5.1 Socio-economic assessment of scrap metal recycling.....	77
5.1.1 Price mechanism	77
5.1.2 Income sufficiency and reliability	78
5.2 General comment on environmental health risks	79
5.3 Health impacts perceived by respondent.....	79
5.4 Sources of health risks in scrap metal business.....	81
5.5 Improving scrap metal recycling	82
5.5.1 Stakeholders' standpoint.....	82
5.5.2 Community's standpoint.....	83
5.6 Summary	84
CHAPTER SIX	85
SUMMARY, CONCLUSION AND RECOMMENDATION	85
6.0 Introduction	85
6.1 Summary of major findings.....	85
6.2 Conclusion.....	87

6.3 Recommendation.....	89
6.3.1 Systematic approach	89
6.3.2 Implementation of reformed policies.....	90
6.3.3 Income diversification	91
REFERENCES.....	92
APPENDICES	102
APPENDIX 1: INTERVIEW GUIDE FOR STEEL COMPANIES.....	102
APPENDIX2: INTERVIEW GUIDE FOR ANCILLARY SERVICES.....	104
APPENDIX3: INTERVIEW GUIDE FOR EPA, TMA, NGOs	106
APPENDIX4: INTERVIEW GUIDE FOR SCRAP DEALERS/COLLECTORS/DISMANTLERS	108

LIST OF FIGURES

Figure 2.1: Sustainable livelihood framework in respect to scrap metal recycling	31
Figure 3.1: Map of the study area	34

LIST OF TABLES

Table 3.1: Trends of Tema Metropolis's population (1970-2010)	37
Table 4.1: Socio-demographic information of interviewees	52
Table 4.2: Categories of respondents	55

LIST OF PLATES

Plate 3.1: A section of second hand vehicles on display for sale at Tema.....	40
Plate 4.1: A section of dismantled metal scraps at Ashaiman scrap yard	58
Plate 4.2: Examples of scrap metals storage facilities at Ashaiman scrap yard.....	59
Plate 4.3: Examples of weighing scales used in scrap trading activities at Ashaiman .	61
Plate 4.4: A section of broken vehicles acquired by scrap dealers at Tema	65
Plate 4.5: Example of a scrap picker recovering metals after open burning method....	69
Plate 4.6: Example of a hand cart used for scrap metals transportation	72

LIST OF ABBREVIATIONS

AshMA	Ashaiman Municipal Assembly
ASR	Automotive Shredder Residue
CO ₂	Carbon dioxide
CRT	Cathode Ray Tube
DFID	Department for International Development
DHHS	Department of Health and Human Services
DMW	Daily Minimum Wage
DNA	Deoxyribo Nucleic Acid
DTSC	Department of Toxic Substances Control
EEE	Electronic and Electrical Equipments
ELV	End-Of-Life Vehicles
EPA	Environmental Protection Agency
E-waste	Electronic Waste
FDI	Foreign Direct Investment
FER	Federación Española de la Recuperación y el Reciclaje
FGDs	Focus Group Discussions
Freq.	Frequency
GASDA	Greater Accra Scrap Dealer Association
GDP	Gross Domestic Product
GH¢	Ghana cedis
GICHD	Geneva International Centre for Humanitarian Demining
GJ	Grand Junction
GPHA	Ghana Port and Harbour Authority
GSS	Ghana Statistical Service
GVC	Global Value Chain

HMS	Heavy-Medium Separation
ICT	Information and Communication Technology
ILO	International Labor Organization
ISRI	Institute of Scrap Recycling Industries
ISWM	Integrate Solid Waste Management
JHS	Junior High School
Kg	Kilograms
Km	Kilometers
L.I	Legislative Instrument
MESTI	Ministry of Environment, Science, Technology and Innovation
MM	Millimeters
MOH	Ministry of Health
MSW	Municipal Solid Waste
Mt	Metric Tonnes
MTI	Ministry of Trade and Industry
ND	Not Dated
NGOs	Non Governmental Organizations
OSHA	Occupational Safety and Health Administration
PBDEs	Polybrominated Diphenyl Ethers
PBD _s	Polybrominated Diphenyls
PCBs	Polychlorinated Biphenyl
P I	Personal Interview
POP	Persistent Organic Pollutant
PPM	Part per Million
PVC	Polyvinyl Chloride
SAP	Structural Adjustment Program

SHS	Senior High School
SLA	Sustainable Livelihood Approach
Sq	Square
SWM	Solid Waste Management
TDC	Tema Development Cooperation
TMA	Tema Metropolis Assembly
TOR	Tema Oil Refinery
TV	Television
U.S	United State
U.S.A	United State of America
UK	United Kingdom
UNEP	United Nations Environment Programme
VALCO	Volta Aluminum Company Limited
WEEE	Waste Electrical and Electronic Equipment

CHAPTER ONE

GENERAL INTRODUCTION

1.0 Background of study

Since prehistoric times, people have physically modified the earth's landscape. Whether deliberately or otherwise human beings, who Szerszynski(2012) describes as 'geological agents' have affected the geological configuration of the earth through excavations of rocks and soils, creating different kinds of artificial grounds on which to build structures and in the process generating waste material which are value-laden (Grant and Oteng-Ababio, 2012). Over the last 20 years, studies have flourished that examined and captured value by actors along a global value chain (GVC) (Lepawsky and Billah, 2008; Grant and Oteng-Ababio, 2012; 2016; Oteng-Ababio, 2017). The GVC approach has been applied to agro-food, textile, automobile and electronics' industrial production and has shed more light on intra-industry and inter-industry trade along the continuum from production to consumption (Coe et al, 2008; Gibbon 2001). A major shortcoming, however, is that it does not take into consideration post-consumption and its intrinsic valuing of related economic activities (pre-processing, reuse, etc), and the flows of secondary materials (Lepawsky, 2015; Lepawsky and Billah, 2008). Much is said about the negative economic implications of trans-boundary trade in waste electrical and electronic equipment (WEEE) activities regarding the deleterious and non-valuable fractions that are left behind and their drastic effects on environmental, aquatic and human health (Greenpeace 2008, Asante et al, 2012; Daum, Stoler and Grant 2017) and may also influence cybercrimes (Warner, 2011; Doyon-Martin 2015).

Recently, used metal recycling is increasingly being promoted not only to address resource scarcity and mitigate environment challenges (climate variability), but also as a livelihood strategy and a potential pathway towards poverty reduction or get the most

vulnerable out of poverty (Amankwah et al., 2016; Grant and Oteng-Ababio, 2016). Studies indicate that the wastestreams in the mining, construction, manufacturing sectors often contain valuable metals whose recovery may be less costly (Caravanos et al, 2011; Grant and Oteng-Ababio, 2012; 2016) and environmentally friendlier (Oteng-Ababio, 2017). The UNEP (2010) particularly heralds the potential opportunities in recycling metals embedded overtly and/or covertly in the built environment, which are likely to continue to grow with population growth (Bergbäcket al, 2001). This realization can be partly attributed to changing environmental, economic, political, and social conditions (Oteng-Ababio,Owusu and Chama 2015; Senfuka, 2011; Yoshida et al. 2005).

The above notwithstanding, the WEEE industry in general and the scrap metal in particular has been interpreted differently (see Grant and Oteng-Ababio, 2016; Asante et al., 2012; Brigden et al., 2008). Globally, some proponents seek to liberalize the trade (Hoeltl et al., 2017) while others advocate for its restriction and even the imposition of a ban due to the purported hazardous nature of some of the items (Bennett, 2008; Caravanos et al, 2011). A study by Caravanos et al (2011) in Ghana found high lead levels (18,125 ppm) in the soil at Agbogbloshie, which are above USA-EPA standard (400 ppm)(Oteng-Ababio, Owusu andChama, 2015). Additionally, researchers at Blacksmith Institute estimate that 40,000-250,000 people at Agbogbloshie are at risk from various informal recycling activities; collecting, processing and disposal (Oteng-Ababio, Owusu and Chama, 2015; Caravanos et al 2011). Studies conducted in China and India where such practices have gone on for decades indicate that heavy metal contaminate the environment; air, groundwater, soil and sometimes spreads into homes, markets and public places (Sepulveda et al. 2010). On the surface, the challenge may seem straightforward, but the magnitude of the dilemma becomes even more difficult to implement in the era of complex industrial systems in which wastes are produced at various intervals along cross-

border value chains and are subsequently transformed into secondary resources. As Kahn (2016, 154) emphasizes “in a world where all commodities eventually turn into waste, and waste itself is increasingly turning back into commodities, the legal division between these two material categories is inevitable and confusing.”

Such conceptual confusion occurred when the Ghanaian government permitted computer donations after 2004 in an effort to reduce the price of computers, and accelerate the diffusion of second-hand devices into the marketplace to reduce the digital divide in a country where most people cannot afford to purchase new computers. Liberalizing the economy for importing computers inadvertently enabled the importation of various working and non-working devices and opened a flood gate of second-hand imports that embodied various hazardous materials within these shipments. Brokers, charitable organizations, large and small companies are all enmeshed in sourcing computers for export but transshipment also necessitates the role of waste dealers, shipping lines and other intermediaries that remain largely unacknowledged in regulatory contexts. As consequence, the possibly transnational actors in the global trade that engage in transactions have little accountability, and oftentimes preserving their anonymity, inevitably expands opportunities for transnational criminal activities.

These arguments point to the popular agendas of the green campaigners heralding the negative relationship between ‘waste’ and public health and environmental challenges, and deliberately concealing the most realistic manifestation of scrap metal, thus presenting an incomplete version of the metallic revolution (Oteng-Ababio, 2012). Without denouncing the claims by the environmental non-governmental organizations (ENGOS), this study concurs that maintaining global health (both public and environmental health) is penultimate and imperative (Brigden et al, 2008; Alloway, 1990; Bohr, 2007). However, it is equally true that one cannot easily gross over the social and economic imperatives of the

emerging industry without causing ‘intellectual blunder’ as lack of the appreciation of the various reasons accounting for the increase in scrap generation. Within the Ghanaian context, earlier studies indicate that thousands of people are involved in the informal metal scrap recycling which is mainly focused on resource recovery as a major source of livelihood. Unfortunately, the contribution of metal scrap economies in particular to livelihoods of those engaged in the process informally, and its achievements in reducing poverty, and the spontaneous ways it links informal and formal economies and contributes economic output is under acknowledged. Put differently, the contribution of the scrap trade to individual livelihoods and how it helps in alleviating poverty has received little academic attention.

It is this gap, i.e. the contribution of metal scrap economy to the livelihoods of its practitioners and the local, national and global economy in general that this research particularly addresses. The working hypothesis is that understanding not only the negative but also the positive contributions of the scrap metal trade is necessary for the effectiveness in any environmental policy to regulate the scrap industry. According to Oteng-Ababio (2012), the situation at hand in most cities is a decidedly local informal enterprise engage, basically in waste collection and disposal devoid of technology and regularizations, performing an activity which is a constitutional responsibility of city authorities. Within the Ghanaian context, many cities still have active informal sector and micro-enterprise recycling, reuse and repair systems, driven entirely by the market value of the materials and (discarded) products. These often achieve recycling rates of 20–30%wt (see Wilson et al., 2013) and by older literature data (Wilson et al., 2013). Moreover, by handling such large quantities of waste that would otherwise have to be collected and disposed of by the city, the informal recycling sector has been shown to save the city perhaps 20 percent or even more of its waste management budget (Scheinberg et

al., 2010a). In effect, the informal recycling sector – in most cases the city poor – is subsidising the rest of the city. There is a major opportunity to build on these existing recycling systems, to increase further existing recycling rates; protect and develop people’s livelihoods, address the actual and perceived problems of such activities (occupational and public health and safety, child labour, uncontrolled pollution, untaxed activities, crime and political collusion), and also reduce the costs to the city of managing residual wastes.

These challenges of integrating the informal sector with the formal can be addressed, but only if a systematic approach is followed and mutual difficulties are openly acknowledged (Wilson et al., 2013). Interestingly, there are some evidence that recycling rates are lower in some of the more developed upper-middle income countries (Wilson et al., 2013), perhaps reflecting the history of the developed world where the early formalisation of solid waste management as a municipal service displaced pre-existing informal recycling systems (Brigden et al, 2008; Foulke, 2008; Kopsick et al, 2005). Suffice to add that though, scrap metal contains complex toxic compounds, it is also a source of not only valuable materials that can be extracted and reintroduced in production but equally important livelihood strategy for many urban poor (Oteng-Ababio, Owusu and Chama, 2015; Grant and Oteng-Ababio, 2010).

However due to the high rate of uneducated unemployed youth; in their quest to survive, most of them have venture into the informal recycling industry (Oteng-Ababio, Owusu and Chama, 2015).

Indeed, a large opportunity that can help alleviate poverty and contribute to the country’s pursuit of United Nations Sustainable Development Goals especially; Goal 11 that seeks to “Make cities and human settlements inclusive, safe, resilient and sustainable”, but this appears to have been overlooked.

1.1 Problem Statement

The challenge of sustainable development at the beginning of the 21st century has become a systemic one, with environmental, social and economic dimensions on an equal footing. In recent decades, the world has experienced unprecedented urban growth. In 2015, close to 4 billion people — 54 per cent of the world's population — lived in cities and that number is projected to increase to about 5 billion people by 2030 (Owusu and Oteng-Ababio, 2015; Turok, 2016). Rapid urbanization has brought enormous challenges, including growing numbers of slum dwellers, increased air pollution, inadequate basic services and infrastructure, and unplanned urban sprawl, which also make cities more vulnerable to disasters and lack of productive employment opportunities (Nsokimieno et al. 2010) creating what has been severally described as urbanisation of poverty (Owusu and Oteng-Ababio, 2015). Recent studies highlight how the urban poor experience profound poverty, food and nutrition insecurity, as well as other socio-economic deprivations (Jorgensen, 2015; Owusu and Oteng-Ababio, 2015; Turok, 2016). In the circumstances, better urban planning and management are needed to make the world's urban spaces more inclusive, safe, resilient and sustainable. According to the UN SDGs, the future we want includes cities with opportunities for all, with access to basic services, energy, housing, transportation, and protected green spaces for all to enjoy.

Ghana is currently urbanising rapidly with over 50% of its population living in urban areas. These cities face many challenges to improve resource use and reduce pollution and poverty, while rural-to-urban migration increases (World Bank, 2015; Owusu and Oteng-Ababio, 2015). According to the report of the 2016 Survey conducted by the Ghana Statistical Services, unemployment among the economically active population is above 11% and estimated 8.2% of Ghana's population is living in extreme poverty. This may result from the days of the Structural Adjustment Program (SAP) which crippled the

Ghanaian economy (Anyinam, 1994). In addition the regular migration of people, particularly the youth from rural areas, particularly the 3 northern regions to the urban centers in search of better economic prospects which are often difficult to come by largely explains the phenomenon of the high urban unemployment rate. The non-attraction of rural life due to the absence of amenities such as electricity and water among others and the low income associated with rural economic activity dominated by farming also tend to push many rural youth from the rural areas into the cities creating surplus labor in the urban areas (Oteng-Ababio, 2012). However governments over the years have been unsuccessful in solving these problems through formal employment creation. While successive governments aspire to address a variety of urban unemployment and housing problems, while respecting the human rights of all residents, including those in slum neighbourhoods through several socio-economic interventions such as the Youth Employment Initiatives; promotion of informal sector where vulnerable groups such as women and persons with disabilities are empowered socially and economically to engage in petty trading, income generation skills etc., in order to create and support self-employment (Oteng-Ababio, 2018). They also place increasing importance on building up resilience to extreme poverty in the implementation of socio-economic infrastructure to facilitate private sector growth, and environmental protection. But most of the solution to the problems remains elusive. Informal sector is a non-structured sector that has emerged in urban centers as a result of formal sectors' inability to absorb new entrants (Oteng-Ababio, Owusu and Chama, 2015). As highlighted by Jorgensen, (2015) due to the employment challenge which affects the whole labour force, its impacts is particularly severe on the youth of which most tend to engaged into vulnerable and informal employment such as street hawking, shoe shining, carpentering and tailoring apprenticeship, bus conductor "trotromate", etc. which according to Oteng-Ababio, (2010)

and Yamoah,(2014) have become saturated. Through personal observation there is now an emerging interest in urban mining and the store of valuable metals that is circulating and in storage in the urban areas including Tema- Ashaiman metropolis. This has become an ingenious way most urban poor respond to or coping with high level of poverty by many individuals and households. Perhaps for the inadequacy of these commendable efforts and the quest to earn a living most individuals have venture into the scrap-metal business (Oteng-Ababio, 2010).These individuals mostly youth “*mine*” for scrap metals from households, fitting shops and landfills etc. Indeed scrap metal trade has become a livelihood of choice for many in the urban areas (Yamoah, 2014).

Meanwhile, even though the metal scrap trade has been going on informal with the Ghanaian economy for a long time, (see Oteng-Ababio, 2007), there is currently less empirical work concerning the current practices and the true scrap metal recycling rates that are possible and how to improve the situation considering the system in its totality. Although there are sensational and generalized publications of scrap metal trade in the media, some individuals in the communities even perceive them as thieves and accuse them of engaging in criminal activities such as spying for armed robbers and theft.The reasons for this development may be varied including the fact that the value embodied in scraps is often country specific and depends on the national policy regime, the constellations of different actors and on the creativity of the informal economy to extract value. Size and vibrancy of the refurbishment and repair sector is also related (Oteng-Ababio, 2010;Amankwah, 2013). Furthermore the latter are often city specific and depend on the waste management landscape and the range and scope of actors and the degrees of specialization in various waste streams. In addition, they may also depend on ability of domestic industry to use constituent inputs from scrap processing and incorporate it into recycling of which Ghana is no exception (Gillespie, 2015; Morrison, 2017).

The global demand for metals has also upsurge a continual flow of metal materials from the natural environment into the built environment (Simon and Kingston, 2013). This flow comes with some ramifications, which include energy consumption, environmental impact, and decline in mining of virgin ores (Simon and Kingston, 2013; Norgate and Hauge, 2009). Alternative to mining minerals from the natural environment is a tactical shift to scrap metals which have been identified to contain valuable metals (Richards, 2006; Moyes, 2008). The global economy is increasingly recognizing the recycling of scraps, a process termed urban mining, as both strategic and lucrative, and which according to Baldé et al. (2015) forms part of the US\$52 billion global industries of recycling and processing and re-export of retrievable metals. Moreover, the repair, refurbishment and reuse market is also significant: the mobile phone repair segment alone is a US\$4 billion industry (Baldé et al., 2015). Some research scientists call for new equipment that can pulverize WEEE at low temperature so that it can be sorted and processed appropriately so that value and non-value parts can be extracted and circulated so that they do not end up in landfills or wasted (Tiwari et. al., 2017). While various experts call for the end of WEEE and by extension the scrap trade, often by applying the latest technology and piecemeal corporate initiatives abound, international and national regulations are a long way from dismantling this intricate and multi-layered space economy. However the contribution of the metal scrap economy to the livelihoods of participants, its culminating role in poverty alleviation, and the spontaneous ways it links informal and formal economies remains under-acknowledged in developing countries of which Ghana is no exception.

To that extent, although the WEEE trade in general and indeed scrap metal industry has proven to be an important ally however; their activities have not been widely documented in Ghana (Oteng-Ababio, 2014; Grant and Oteng-Ababio, 2012;

2016). Therefore this thesis contributes to fill this lacuna using the Tema-Ashaiman scrap yard as a case study to contribute to the quest for building all-inclusive cities as stipulated in the UN-SDGs – Goal 11.

1.2 Research questions

The importance of the study is to reiterate to the attention of city authorities and policy makers the relevance of informal livelihood within the Ghanaian economy especially in the quest to remove the urban poor from the clutches of poverty and contribute to the attainment of the UN SDGs. In helping to respond to UNSDGs, Goal 11 specifically seeks to make cities and human settlements inclusive, safe, resilient and sustainable, but the importance of the scrap industry appears to have been overlooked. The study emphasises that any development programs regarding poverty alleviation and human health, should be carried out through government–community cooperation instigated at the local policy-making and implementation levels. So far this has not occurred to any great extent despite a long history of informal activities within the Ghanaian economy. The following research questions will push the current study:

- i. What are the various chain of activities within scrap industry?
- ii. What are the methods used by the actors in plying their trade?
- iii. How adequate are the incomes of scrap metal participants to meet the needs of their living condition and how secured and reliable are these incomes?
- iv. What are some of the health and environmental risks associated with the industry?

1.3 Research objectives

The main objective of the study is to examine the importance of scrap recycling as a sustainable livelihood option particularly in the quest for sustainable poverty alleviation strategies. Flowing from that, the specific objectives are as follows:

- i. To examine the chain of activities in the scrap industry;
- ii. To analyze the modus operandi of the actors in the various chain of activities.
- iii. To examine the incomes of scrap metal participants to meet the needs of their living condition and how secured and reliable are these incomes; and
- iv. To examine some environmental and health challenges associated with the industry.

1.4 Propositions

The study is based on the following propositions:

- I. The informal scrap recycling has contributed positively to improved livelihood situations of the scrap workers in the Tema- Ashaiman Metropolis
- II. The informal scrap recycling is associated with several environmental and health hazards.

1.5 Research justification

The sustainable Development Goal 1 is to end poverty in all its forms everywhere. In addition, it established that one in five people in Ghana still live with less than 1.25 US dollar a day (World Bank, 2007). The informal recycling sector has employed a number of individuals in Tema- Ashaiman Metropolis; most of the scrap metal workers (scrap pickers, dealers etc), receive income from the business (Broni-Sefah, 2012). However, income generated per scrap metal workers daily is not appropriately documented (Broni-Sefah, 2012). Whether the income received is sufficient and reliable in the future is not known. Meanwhile, income generated should be able to provide the basic social needs; food, shelter and access to 'proper' medical treatment (Broni-Sefah, 2012). In addition, the sustainable development goal 8 also emphasized on decent work and economic growth which is attentive with the working conditions of workers and assigned to advocating for decent work for all individual in the world as well as identified poverty to be attributed with the lack of decent work (Broni-Sefah, 2012). The 'supposed' decent work should be

able to earn some income for the worker which should be able to cater for his/her basic necessities of livelihood such as healthcare and food etc (Broni-Sefah, 2012; Ghaiet al., 2006). The informal recycling activities could also pose a serious environmental threat unlike any other economic activity. The processes employed by scrap collectors to recover metals would be environmentally unfriendly (Broni-Sefah, 2012; Brigden et al., 2008).

Indeed the scrap metal industry has huge potential opportunities, facing rapidly growing international demand of metals (Gordon et al., 2006). However the activity with good prospects for sustained income and employment generation coupled with environmental threats associated with the scrap metal trade in Tema-Ashaiman is not known (Broni-Sefah, 2012). The sustainable development goal 9, by 2030 is to build a resilient infrastructure, promote sustainable industrialization and foster innovation. Therefore whether the informal recycling activities in Tema-Ashaiman allow for rapid and sustained increase in living standard for the participants and provide the 'local' technological solution to sound environmental industrialization? Need to be investigated.

1.6 Organization of the study

The thesis is composed of 6 chapters. While this chapter introduces and provides the necessary background the study. Chapter 2 follows on from Chapter 1 by focussing on the theoretical material for garnering an understanding of the approaches, strategies and methods in the metal scraps recycling. Chapter 3 describes the fieldwork approaches of the thesis. This involves two largely descriptive sections on the techniques of data collection, which coalesce around the semi-structured interview; and the processes of analysis informed by thematic and narrative analysis. Chapter 4 and Chapter 5 presents the analysis and discussion of the interviewees' responses on the three key themes including the importance of metal scrap recycling as a sustainable livelihood option, its role in the national poverty reduction drive and the linkages between the informal and formal scrap

operators and how it contributes to the national economy respectively. Several questions (which reflected sub-themes found in the literature review that constituted each key theme) informed each thematic section. The analysis of the data was presented theme by theme. As the final chapter, Chapter 6 presents a theoretical and analytical synthesis of the thesis. It summarises its findings, provides suggestions for improving the scrap metal recycling and by extension, the informal economy in general in the study area and beyond, links the findings back to theory for critique, outlines the implications for further research, and makes some concluding remarks.

1.7 Summary

This chapter has given an introduction to the background to this research. In addition, the problem statement, the research objectives, the research questions as well as the propositions of the study, justification were touched on and the organization of the study presented in this chapter. The next chapter presented the literature review, conceptual theory and framework employed in the study.

CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.0 Introduction

This chapter provides relevant background and literature reviews of academic, government (official), intergovernmental and non-governmental organizations materials focusing WEEE in general and scrap studies in particular. It provides theoretical background for garnering an understanding of the scrap trade, strategies and methods in the field of informal livelihood options and the scrap trade. Metal recycling is increasingly being promoted as an effective way to address resource scarcity and mitigate environment impacts associated with metal production and use, yet there is little systemic information available regarding recycling performance, and still less on the true recycling rates that are possible and how they contributes to poverty alleviation and/or to do better considering the system in its totality. The first part reviews types and sources scrap metals generation and recycling which also informs the second section examines the categorization of scrap metal as well as the ease and its repeatedly and limitlessness recycling potential when metal materials reach the end of their designated lives without substantial degradation in quality.

2.1 Scrap metal generation

Scrap metal generation grows in tandem with rapid technology innovations and the short-life span of products. Generally, scrap metal can be categorized into ferrous scraps such as products made from iron and steel like old vehicles and machineries; nonferrous scraps (aluminum, copper, nickel, tin and lead) and; electronic scraps which also includes cell phones, led screens, computers and other electronic appliances. According to UNEP (2010), the global quantity of “electronic” scrap generated in 2014 was about 41.8mt of which Asia contribute 16Mt, Americas (11.7Mt), Europe (11.6Mt), and Africa (1.9Mt)

with the Oceania (0.6 Mt) being the lowest of all. Scrap metal recycling is a large industry. In the U.S. alone, 56 million tons of scrap metal, 1.5, million tons of scrap copper, 2.5 million tons of scrap aluminium, 1.3 million tons of scrap lead, 300,000 tons of scrap zinc and 800,000 tons of scrap stainless steel are processed on a yearly basis (Foulke, 2008; ISRI, 2014).

Although recycling levels are low in most developing countries, studies have revealed that most urban centers now contain greater concentrations of metal than the natural mines themselves (ISRI, 2014). This is equally true since most valuable metal materials (aluminum, copper etc) are found in old scraps including cans, discarded electronic equipments. Abreast, with augmenting public recognition and studies into the many environmental issues and implications, recycling of scrap metals is one of the most considered activities due to a numerous reasons associated to it (Javaid and Essadiqi, 2003;Tsikata et al., 2008; Emery et al., 2000). Although the activities can result in contaminating the local air and ground water, recycling is extremely energy efficient for instance, the production of one ton of copper from the virgin ore consumes about 16GJ of energy as compared to scrap copper which is significantly reduced to about 19GJ per ton (Broni-Sefah, 2012;JavaidandEssadiqi, 2003). These and other benefits as well as the economics of the recycling activities have created a good partnership and globalization relationship between developing and developed nation which includes Ghana through exportation (Broni-Sefah, 2012;Tsikataet al., 2008).

The need for metal in human society has increased the demand for consumer and industrial products resulting to higher production and use of more energy (Broni-Sefah, 2012;Emery et al.,2000). Recycling of metals is one substantial area where the natural environment resource depletions is minimized (ISRI, 2014). Each tonne of scrap metal recycled eradicates some level of carbon dioxide pollution into the local environment and

reduced the amount of water used from the recycling processes (Gayathri et al, 2015;ISRI, 2014).Additionally, scrap metal recycling diverts millions of tons of metal from the waste stream to the recycling stream(Kaseva& Gupta, 1996; JavaidandEssadiqi,2003; Muchová& Eder,2010). Recycling of scrap metals can be seen as an environmental friendly activity since it helps in maximizing, utilizing, conserving of natural resources and preventing pollution as well as waste reduction (Broni-Sefah, 2012; Kaseva and Gupta, 1996). Therefore by implication the absence of scrap metal industry would create a voluminous amount of waste polluting our society and also exacting pressure on the virgin ore (Kaseva and Gupta, 1996; Javaid and Essadiqi, 2003; Muchová and Eder, 2010).According to Broni-Sefah (2012), scrap metal recycling generally take place on three recognized stages. Firstly is pre-sales or manufacturing stage (where operation is well-organized and often takes place incorporated into the production of virgin ore). Secondly, the industrial or post-sales scrap and residues, and finally household scrap ‘mined’ by a local scrap dealers or local authority through a local municipal solid waste management. (Broni-Sefah, 2012; Kaseva and Gupta, 1996). However, for a successful and smooth operation of recycling activities, the inclusion of various stakeholders and the general community is deemed.

2.1.1. Type of scrap metal

The scrap metal recycling industry encompasses a wide range of metals. Some of the most commonly recycled metals by volume are iron and scrap steel, copper, aluminium, lead, zinc, and stainless steel (Muchová and Eder, 2010;ISRI, 2014).Generally, scrap metals are divided into two which are ferrous and nonferrous (Muchová and Eder, 2010).

2.1.1.1 Ferrous scraps

Ferrous scraps are metal that embeds iron which can be transformed and remanufactured to form new products (ISRI, 2014). Ferrous metals magnetic properties which are usually gathered in scrap sites with the use of crane with electro magnets fasten to it, which passes on a stockpile of scrap metal; to attract the metallic materials (Foulke, 2008). Most studies show that scrap metal recycling is energy saving (Broni-Sefah, 2012). For instance, one tonne of iron that is recycled saves about 1102 tons of raw iron, 54kg of limestone ore and 600kg coal (ISRI, 2014). By implication, it reduces environmental depletion as well as 86% less air pollution, 40% water used in the mining virgin ore, and 1161kg in reduction of solid waste generated (Broni-Sefah, 2012). In most developed nations with state of the art methods and technologies, hunk metal waste stream ore scaled down (Broni-Sefah, 2012). Most electronic appliances contain precious fractions such as copper, aluminium etc need to be separated from ferrous metals (Broni-Sefah, 2012; Oteng Ababio 2012). However, these elements can contaminate the iron, weakening the strength and quality when mixed together. Most electronic products have a lifespan of ten to fifty years (Broni-Sefah, 2012; Muchová and Eder, 2010).

2.1.1.2 Non-ferrous scraps

These are metals which do not contain any iron, magnetic properties and are usually more resistant to corrosion than ferrous metals (ISRI, 2014). Some non-ferrous metals include: copper, nickel, aluminium, lead, zinc, and tin. Copper is a non-ferrous metal and one of the most abundant elements present in the earth's crust (Coetzee and Hom, 2007; ISRI, 2014). Coetzee and Hom (2007) stated that theft of non-ferrous metals, copper and aluminium was a serious problem in South Africa and that non-ferrous metal theft had escalated to such an extent that loss ran into millions of rand annually (Coetzee and Hom 2007; ISRI, 2014).

2.1.2 Reflections of urban mining - scrap metal recycling

As rightly articulated by Grant and Oteng-Ababio, (2016: pp. 6-7), traditionally, mining refers to extraction sites—holes in the ground—generally located away from urban centers (also see Labban 2014), which have always been linked with mines because major cities initiate extraction, circulation, and accumulation processes related to extractive industries. According to the authors, new perspectives (also see Labban 2014; Minter 2013; Oteng-Ababio, Amankwaa, and Chama 2014) emphasize the growing urbanization of mining by extending the modes of extraction to include scrap metal recycling, concentrated in particular city locales and tied to international scrap circuits. Recycling reveals the urban dimension of both wasting and revaluing and the linked but occluded ongoing geographies of constituent elements.

Studies indicate that some materials, such as gold, silver, and copper, are now present more on the surface than below the surface (Labban 2014; Minter 2013;). The growth of urban ores has expanded in tandem with consumption but moves on a different plane than the stock beneath the ground. With increasing demand for global electronics (and, by association, the metals in them), decreasing supplies of some materials incorporated into device production (especially rare-earth elements), and supply and demand mechanisms that make mining primary metals expensive and subject to speculation, commodity fluctuations, and temporary supply-demand imbalances (including investments in mining capacity, which require time and extensive capital), sourcing secondary raw materials as a viable alternative is increasingly important (Grant and Oteng-Ababio, 2016: 6).

The rare-earth elements incorporated into smart phones enable screen displays to produce vivid red, blue, and green colours, and without rare earths such as neodymium and dysprosium, phones would be unable to vibrate. Labban (2014) elucidates the

accumulation of metals on the earth's surface: the planetary mine is comprised of all sorts of buildings and materials contained in them: it is embodied in bridges, rail-roads, and other languishing structures; it is on roads filled with cars and trucks and in the sky filled with aging air-planes; on the seabed, in sunken ships full of bullion; in the scrap yards, shipyards, and school bus graveyards; in batteries, tires, and electric wire; in air conditioners with long coils of copper and catalytic convertors rich in platinum, rhodium, and palladium (Labban, 2014:564.)

Grant and Oteng-Ababio, (2016) further reveal that the concentration of accumulations in the planetary mine varies across and within world regions and metropolitan areas. The overall stock appears to be highly concentrated in the northeast industrial zone of the United States, the industrial heartland of the European Union, large urban centers in Japan, and increasingly the megacities of China; however, it now is extended to and constituted by large cities of the Global South, which generate their own e-waste, and it is especially visible in informal e-waste sites in Accra, Lagos, Nairobi, and Johannesburg. Structured resource-recovery geography connects informal African urban mines to high-technological recovery and refining operations concentrated in Belgium, Canada, China, Germany, Japan, South Korea, and Sweden.

Urban mining has gained currency, but its origins are unclear. A Japanese engineer, Michio Nanjyo from Tohoku University, is often credited with coining the term "urban mine" in the late 1980s by highlighting the urban accumulation of above-the-ground metals (especially precious and rare-earth metals) from discarded electronics (Nanjyo 2014). Others, such as John Shegerian, CEO of Electronic Recyclers International, however, stake a claim to the term (Peters 2011). Increasingly, too, mining companies refer to the accumulation of materials containing toxic and valuable metals as the "mines in the city" (Dowa 2008) or "the urban mining field" (Oteng-Ababio,

Amankwaa and Chama 2014). Universities, advocacy groups, and the media have also come to recognize significant urban accumulations of untapped urban mineral resources. Geopolitically, states (e.g., United States, United Kingdom, and Japan) and regional organizations (e.g., the European Union) are leaning toward the promotion of mining of e-waste as a sustainable solution to e-waste dumping, simultaneously enhancing the resource security of the Global North and increasing domestic green-technology employment.

UNU (2012) calculates that, on average, deposits of precious metals in e-waste are 40 to 50 times richer than ore deposits currently available from primary mines. For example, one ton of e-waste contains up to 0.2 ton of copper; that is, a 20% grade compared with a declining average head grade of 0.2% to 1.65% (Labban 2014:565). In addition, one ton of PCBs contains 500 grams of gold compared with a declining average of 0.85–1.65 g/ton of mineral ore from open pits (Labban 2014:565). To put this in perspective, 30 smart phones contain as much gold as one ton of mine rock from a traditional gold mine. The gradual depletion of “economically” minable resources has encouraged large recycling companies (e.g., Umicore) to consider urban mining from technology metals a profitable venture. Umicore, the world leader in the extraction of secondary materials, presently has the capacity to recover 20 precious and other ferrous metals (Umicore 2011). Schluep et al. (2009) calculate that the combined sales of mobile phones and personal computers in 2007 accounted for 3% of the world mines’ supply of gold and silver, 13% of palladium, and 15% of cobalt. Taking into account the growth rates of electronic devices (which now include iPads, video game consoles, digital cameras, etc.), the demand for electronic equipment is a major driver of metal prices. Importantly, harvesting urban metal accumulations of end-of-life devices could potentially make millions of tons of metals available (reliable estimates are not yet available).

Urban mining is not without its challenges. Material recovery efficiency varies by place, by device, metal, recycling and preprocessing method (sorting, dismantling, and mechanical treatment), and operator skill and use of technology. Metals incorporated into used-electronic devices are combined with hazardous metals (e.g., arsenic, beryllium, cadmium) and contamination is a regular occurrence in the informal economy. High-tech formal processing is more environmentally friendly and safer for workers but also more costly, and therefore less common. A significant challenge with metal recovery is the tendency for recyclates to become less and less usable during subsequent recycling. Not all elements can be recycled in a cost-effective way because of present-day technological limitations. For example, indium, a rare-earth element incorporated into the production of touch screens during the manufacturing process, is virtually unrecoverable with current technologies. However, steel is 100% recoverable and can be used infinitely.

There is considerable debate over which high-technology end-processing should be prioritized in metal reclamation (Labban 2014; Cui and Zhang 2008). The separation science debate revolves around chemical versus biotechnological solutions, with various technologies subsumed within each category, yielding different recovery fractions but entailing different monetary and environmental costs. Investment to date has prioritized pyrometallurgical recovery, a chemical process that refines shredded e-waste for the extraction of various metals, but scientists are now gravitating toward biotechnological solutions (Labban 2014). Bioleaching, the process of using bacteria and fungi to separate materials from e-waste, is a research and development frontier (Cui and Zhang 2008). Another debate about preprocessing in developing countries and its potential to foster more positive incorporation into a global, more sustainable e-waste infrastructure is proceeding (Okolo 2013; Oteng-Ababio, Amankwaa, and Chama 2014), but to date this has been hardly addressed.

Urban mining offers the potential to move end-of-life device recovery into sustainable waste management. However, less than 10% of global scrap is currently recycled (Labban 2014:565). Therefore, this largely untapped vein offers a tremendous potential to reduce toxic waste, augment planetary resources while supporting a more judicious use, and bolster local employment by adding green jobs (and virtually eliminating hazardous and inefficient e-waste processing) with upgrading potential for local recyclers and industries. More careful and greener recycling reduces environmental damage at scrap sites, especially those in the developing world. Urban mining also has the potential to mitigate climate change by reducing greenhouse gases as metal recovery consumes less energy than extraction of primary raw materials. For example, copper produced from primary mining involves a continual series of production-energy processes from mining, crushing, grinding, roasting, smelting, and refining, whereas recycling avoids the energy-intensive stages of copper production as well as yields much content than copper ore. Above all, it has the potential to remove thousands of the urban poor out of poverty (Lepawsky, 2015; Oteng-Ababio, 2017).

2.1.3 Challenges associated with the scrap metal industry

According to UNEP, (2010) metals are uniquely useful substances by virtue of their properties (thermal, toughness, performance at high temperature and electrical conductivity). Unlike other recyclable materials such as paper and plastics, metals are inherently recyclable, and can be used over and over again without losing its qualities, minimizing the need of mining and processing virgin ores and thus saving substantial amount of energy and water as well as minimizing environmental depletion in the production (UNEP, 2010). These notwithstanding, the scrap metal recycling sector faces some challenges (ISRI, 2014). Jorge-Morales-Pedraza (2014) argued that future scrap metal recycling industry must work to significantly increase efficiency and minimize

highly mixed products. Collecting scrap metal waste with high efficiency and with proper care (to avoid mixing that would impede future processing) is largely an issue of behavioural habits and motivation (Javaid and Essadiqi, 2003).

Moreover, collection and recycling of metal scraps is also inhibited by the world market prices in second-hand products that sends complex products to nations with insufficient recycling plants re-echoed. According to Jorge-Morales-Pedraza (2014) this view is consistent with the study by UNEP (2010) in most developing countries; lacks scrap metal waste management infrastructure, which is showcased by the dearth of scrap metal regulation laws, poses environmental health threats to workers and local residents. Most studies have shown catastrophes in places like Guiyu, China and Agbogbloshie, Ghana due to poor management informal scrap metal recycling (Oteng-Ababio and Amankwaa, 2012; Javaid and Essadiqi, 2003; Kimani, 2007). Both Jorge-Morales-Pedraza (2014) and Hans De Keulenaer (2016) argue strongly against recycling alloys. All metals have to a lesser or greater amount composite of alloys in it, when the metal using equipment becomes obsolete scrap, it is likely to finish off with scrap of different alloys compositions and not only are these alloys different, often they remain unknown (Richards, 2006)

Jorge-Morales-Pedraza (2014) calls for proper designing of future products by ensuring proper materials combination with recycling in mind. Preferably, an information feed-back tie together to material selection, designing, and scientific knowledge would concentrate on the repercussions of complex design on the recyclability of the metal products (Barbara and Graedel, 2012). The final parameter is an enhanced recycling methods, application and technology. It is not much of a magnification to say that the production of modern products with the state-of-the-art technologies can devise but basically recycle them with relatively basic procedures (Barbara and Graedel, 2012;

Richards, 2006). Suffice to add that recycling is often strangled by unfavorable economics, which sometime also showcase an inadequate attention to design for recycling and lack of enthusiasm to bankroll an improved separation and sorting machineries (Barbara and Graedel, 2012). Therefore there is the need for industry, government, and researchers to work together to revamp the current practices by highlighting the need for continuing studies for the state-of-arts technologies and regulatory laws and financial initiatives that help address these challenges (Barbara and Graedel, 2012).

2.1.4 Guidelines for environmentally sound management of scrap industry

In Africa, only Cameroon and Nigeria have national scrap metal related legislation, while Ghana, Ethiopia and Kenya still have legislation pending approval (UNEP, 2014). In the case of Ghana however, there are some environment-related legislation such as the National Environmental Action Plan, 2010, which contains sections on “hazardous waste (Management and Handling) and provide broad guidelines for the control and management of hazardous waste. In addition the Environmental Protection Agency (EPA) has the mandate to regulate, coordinate and manage the environment under the Environmental Protection Agency Act, 1994 (Act 490).

In the main, Section 2 clearly stated the prescribed standards and guidelines relating to the pollution and the discharge and control of toxic substances-generation, treatment, storage, transportation as well as the types, quantity, constituents and effect of waste discharges in an environmentally sound manner so as to prevent adverse environmental health effects. Section 10 of the Act establishes the Hazardous Chemicals Committee required requiring monitoring the use of hazardous substance by collecting information on the importation, exportation, manufacture, distribution, sale, use and disposal of such chemicals, etc. Indeed, in 2016, the hazardous and e-waste control and management bill [LI 917] was passed by the Parliament of Ghana in 2016. The bill has

two parts; the first part relates to general hazardous waste management, and the second relates to the disposal of electrical and electronic equipment.

Prior to the formalization of the legal instrument, ad-hoc measures have been applied to respond to local conditions. For example, on the 30th April, 2013, the government, through the ministry of trade, banned on the exportation of ferrous scrap metals (Prohibition of Export L.I 2201), to promote the local steel industries. Though this was very unpopular decision among scrap workers, they accused the local steel millers of offering low prices for their products compare to prices in the international markets. However the local steel millers' agitations compelled government to regularize the administrative ban to give more leverage for the scrap metals to be traded locally.

The current practices in Ghana in recovering scraps and other precious metals (copper) such as through open burning result in high level of exposure of dioxin since copper is a catalyst for the formation of dioxin substances (Kimani, 2007). According to Sepúlveda et al.,(2010) most electrical cable are copper which may be present in coated with chlorine-containing polyvinylchloride(PVC) plastics which also add up to formation of dioxins (Yamoah,2014). High level exposure to lead fumes or dust put scrap workers at risk for lead poisoning which can result in many range of potential health risks including, gastrointestinal eases, cardiovascular and neurological (Haeffliger et al., 2009).Also noted by DHHS, (2005) and Hellstrom et al., (2001) high levels of exposure to cadmium fumes can cause malfunction of the respiratory system as well as kidney problems (Yamoah, 2014).

In developing countries, scrap workers have been reported to have a very high blood level of PBDEs as compared to the developed nations (Europe and North America) scrap workers (Brigden et al. 2008; Sjödin et al., 2003;Yamoah, 2014).By implication

these may be attributed to the absences of personal protective equipments (PPE) and other working standards. Therefore the high level exposure to PBDEs can results in brain damaged (Qu et al., 2007) and endocrine disruptive properties (Legler and Brouwer, 2003).According to Fenton (1998) the absence of PPE, in a bid to recover precious metals have some serious health implication on the scrap workers where by fumes or dusts generated from the informal scrap metal recycling expose scrap workers to inhale and dust ingestion of hazardous substances such as cadmium, lead fumes or dust etc to them (Prakash and Manhart, 2010). These threats are associated with the dismantlers at scrap sites According Yamoah, (2014) particularly the scrap picker faces a serious health issues when the pickers doubled as dismantlers in the recovery processes (Yamoah, 2014; Amoyaw-Osei et al., 2011; Oteng-Ababio, 2012). According to Foulke, (2008) many auto mechanics reported the inhalation of fumes during welding and straighten works as a major health risk (Yamoah, 2014).

2.2 Theoretical Framework

This study suggests a livelihood approach as a theoretical perspective in comprehending the livelihoods of the Ghanaian poor economy in general and the participants in the informal recycling sector, which remains a major source of livelihood for many of the urban poor, particularly in Agbogbloshie; Accra, Kumasi and Koforidua scrap yards, (Yamoah,2014; Oteng-Ababio,2012).Despite that the scrap metal trade serves as a major source of livelihood for many urban poor, it nonetheless imposes some threats to the environment and human health. To ensure the informal recycling sector is carried in a sustainable manner, the need to improve technology, investment, institution, governance and proper implementation of polices cannot be over-emphasized.

According to Carney, (1998)a sustainable livelihood can cope with and recover from stress and shocks, maintain and enhance its capabilities and assets, and provide

sustainable livelihood opportunities for now and future generation as well as contributes net benefits to other livelihoods both at the local and global level within the short or long term” (Carney,1998).Similarly, that occurs in the informal scrap metal recycling where scrap pickers, scrap dealers, recyclers and ancillary service providers in a manner to reduce their vulnerability and increase their livelihood assets and capabilities. In addition the policy makers are to formulate and implement policies and interaction plans equipped at warranting this livelihood strategy (informal scrap metal recycling) operates but in a manner which will help reduce the vulnerability and increase the assets of the participants involved in the informal scrap metal recycling and not imposing threats on the environment and health of the workers and local residents.

2.2.1 Vulnerability Context

Vulnerability is the insecurity or wellbeing of a person or society in the phase of changing environments such as technological, ecological, political, economic and social in the form of sudden shocks, trends, and seasonality (Moser 1996). The DFID (2007) particularly heralds that the degree of a person or a society’s vulnerability depends on their level of coping mechanism and recovery. The SLF shows the context in which the poor exist and been viewed as the pivotal point for analysis. The above notwithstanding the SL framework deems that livelihoods are caused by multiple forces and factors that are themselves constantly changing. The SL framework rightly articulated that livelihood trajectories and available assets are fundamentally affected by the 3 core elements (trends, shocks, and seasonality) within the vulnerability context which the poor are unable to cope with the negative outcomes of these conditions (DFID, 2007).DFID (2007) clearly stated that even if trends may be positive (including technological change) the poor are often not in a position to benefit. The vulnerability context consists of trends such as resource, population, local or international economic, governance and technology. These elements

are constantly changing and affecting every aspect of human life, be it political, cultural, social and economic.

Shocks refer to the unforeseen occurrences that afflict human life. This could be human health shocks such as diseases, epidemics, etc. economic shocks such as the strictness policies of SAP, financial crisis, etc.; and natural shocks such as earthquakes, fire, floods, famine, etc.

Seasonality explains the times and seasons of the year when economic activities viable. Moreover, seasonality can be a tragic time or occasion, price fluctuations of commodities, of health, of employment opportunities, of production, etc. and all these could have a serious effect on the assets and resources of the poor.

2.2.2 Livelihood Assets

Livelihood assets as outlined in the SL approach presents a true and realistic deep understanding into what individuals have as in terms of capital and resources; and how effectively one could turn these into cater for their needs. It's assumed that in order to attain positive livelihood outcomes, one will need to have a range of assets. Hence the livelihood assets provide an extensive range of resources specifically physical, human, social, natural, political and financial capital which can be drawn on. These resources may not be adequate on their own but need to be combined in order to attain the set goals. Despite the fact that they may not always be owned by the individuals who make use of them, they may be said to possess a substantial and varying control over these assets (DFID, 2007; Farrington et al., 2002).

2.2.3 Livelihood Strategies

These are the range of planned activities individuals engage in to attain their livelihood outcomes. It includes the combination of advantages, opportunities, choices,

etc. that accrue to individuals in their quest to attain their livelihood. Basically, the kind of livelihood strategy employed depends on the assets and possibilities at ones disposal (DFID, 2007; Farrington et al., 2002).

2.3 Livelihood framework's significance to the participants involved in the scrap metal recycling industry

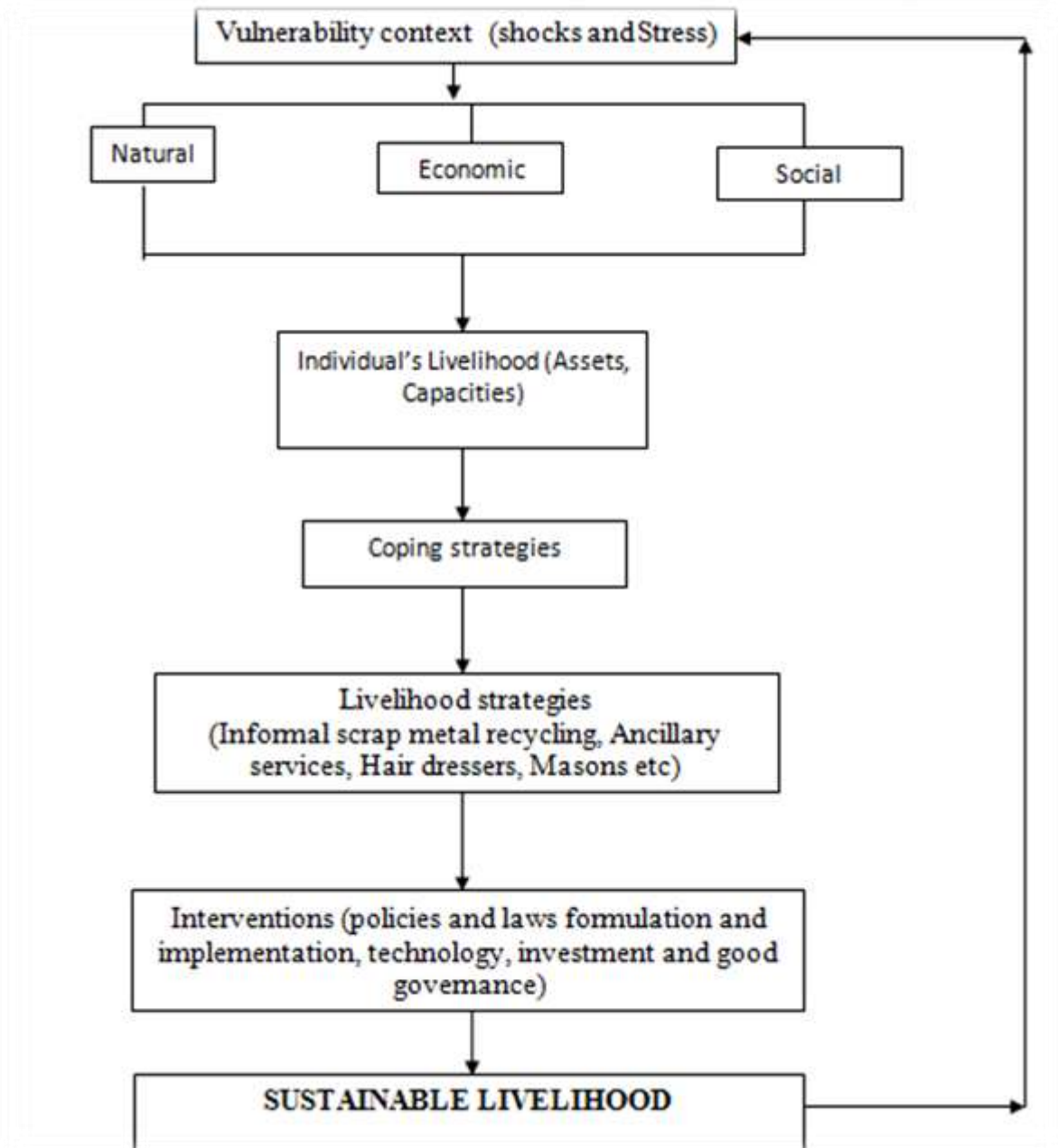
This section seeks to discuss the significance of the livelihood framework to the participants involved in the scrap business. Interesting insights of the livelihood framework conversed explored the livelihood activities involved in by the poor. Ashley & Carney (1999) further reveal that the SL approach was conceptualized to assist in the understanding of how the poor struggle to earn enough income to cater for their needs, both now and in the future as well as reducing their level of vulnerability. The core elements of the vulnerability context, livelihood assets, and livelihood strategies are outlined to gain a deeper understanding of the limitations and the opportunities available to the poor. Notwithstanding Toner & Franks (2006), stressed that several interventions anticipated has failed to attain the set goals and hence any effective intervention embarked upon to alleviate poverty should be developed from the beneficiaries' point of view and the choice of resources that are at their disposal.

The thesis employed the SL approach to gain a deeper understanding of the activities of participants engaged in the scrap metal recycling industry. Their activities are contextualized on the basis of the framework. As highlighted in the problem statement, the participants engaged in the scrap metal recycling industry are individuals who due to unemployment and the lucrative nature of the business have resorted to urban mining for livelihood. With the intention in the search for a livelihood, they are accounted for by the 3 core elements (shocks, trends, and seasonality). The participants involved in the scrap metal recycling industry mostly migrated to the urban cities due to harsh weather

conditions, unemployment, poverty, conflicts, etc. Nevertheless, they make use of the resources available to them in order to meet their basic needs both now and in the future. Suffice, they employ their “assets and resources” such as their physical strength, knowledge, financial resources, social connections, etc. to enable them survive. These individuals venture into scrap metal trade in order to attain their basic needs both presents and in the future. The individuals engaged in the informal recycling industry come to this conclusion after evaluating their vulnerability, their assets, and resources available to them, as well as their interests.

The conceptual framework (Figure 2.1) below comprises of five key elements. These include vulnerability context (shocks, trends, and seasonality), which are the source of insecurity to which the Ghanaian urban poor and their assets are exposed. Livelihood assets, which comprises all assets that individual households and institutions, use to maintain their livelihoods. Moreover major influence on people’s choice of livelihood strategies is their access to assets depends on the policies governing the individual and institutions that affect their ability to use these assets in order to achieve positive livelihood outcomes. In addition a livelihood strategy in the informal scrap metal recycling this includes scrap collection, dismantling, recycling and the ancillary services. Lastly, as framed by SL approach, sustainable livelihood outcome includes more income, increasing well-being, and education for their children and operate in a friendly environment etc., are all positive outcomes (DFID, 2007).In conclusion, the thesis employ the DFID, on the next page Figure 2.1 shows a graphical representation of the DFID, SLA framework, slightly modified for the purpose of this thesis.

Figure 2.1: Sustainable livelihood framework in respect to scrap metal recycling



Source: Author's own construct with insight from DFID SLA framework, 2016

2.4 Summary

In this chapter attempts are made to examine some of the existing literature on the subject under discussion. I have in the process examined the generation of scrap metal, types of scrap metal, urban mining-scrap metal recycling; environmental health risk associated with the trade and the challenges of scrap metal industry and the legislation

management of scrap metal industry in Ghana. The last section was focused on the sustainable livelihood framework in respect to scrap metal recycling. The next chapter explored the study area and the methodology employed in the study.

CHAPTER THREE

STUDY AREA AND RESEARCH METHODOLOGY

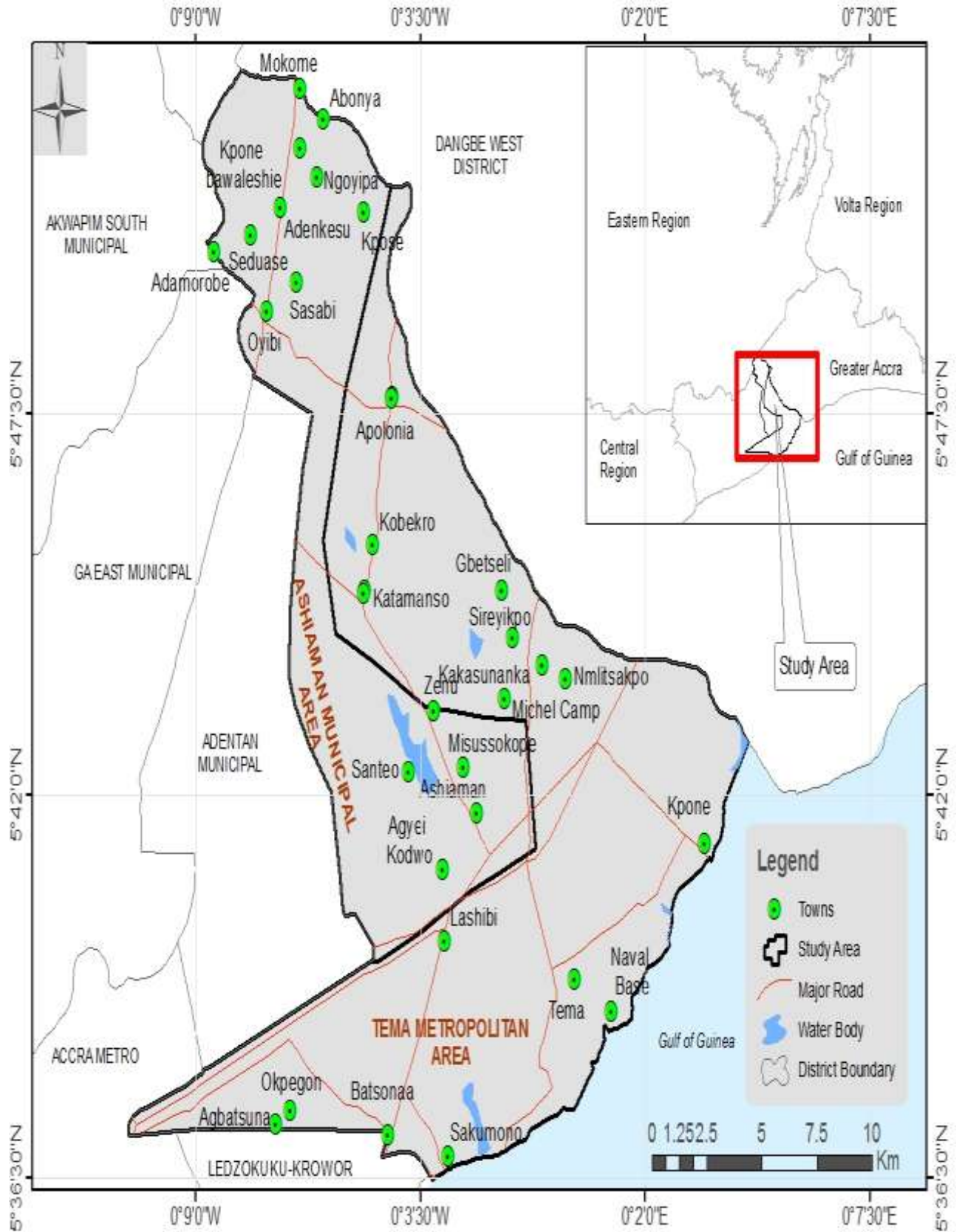
3.0 Introduction

For the purpose of this study, Tema Metropolis is operationalized to include Tema and Ashaiman, as it used to be before its fragmentation in 2008. This is particularly important since the scrap trade whose history dates back to the early 1970s when Ashaiman used to be the dormitory settlement of most workers still traverses the current “artificially” created boundaries. This chapter comprises two sections. The first section attempts to place the study areas within the urban space of Greater Accra. It traces the historical development of the areas and examines its genesis and gradual transformation as well as the role within the Ghanaian economy in general. The final section is devoted to the methodology employed to unpack the objectives of the study.

3.1 Study area

The study was conducted in the Tema –Ashaiman Metropolis, the industrial hub of Ghana. It concentrated largely on the activities of the participants involved in the scrap business in selected residential communities of Tema- Ashaiman and its environs; the scrap yards and scrap sales point within the light and heavy Industrial areas of Tema- Ashaiman. The researcher chose to situate his study in these areas mainly because Tema is noted for its flourishing industrial activities and the biggest harbor city in Ghana; and house nine (9) steel processor companies in the country. Notwithstanding, Ashaiman was included in the study because the Ashaiman Municipal Assembly (AshMA) is an in-lock municipality within the Tema Metropolitan Assembly (TMA) and purposefully serve as the dormitory of informal workers, who are the target of this study.

Figure 3.1: Map of the study area



Source: Author construct, 2016

3.2 The historical development of Tema

The city of Tema was constructed out from a small fishing village, where a group of Gas settled on a stretch of land between the Chemu lagoons to the east and the Sakumono lagoon to the west (GSS, 2012). The village was noted for its cultivation of gourd which was called “Tor” in their local language, the gourd served as various purposes such as storage of water, food stuffs etc. Therefore the small fishing village became known as Torman (gourd-land) which was corrupted to Tema (GSS, 2012). Tema is a city located on the Gulf of Guinea and Atlantic Ocean of Ghana. It is located 18 miles east of the capital city of Ghana. The Greenwich Meridian (00 Longitude) passes directly through the city. In 1951, the chronicles of Tema have not been the same, after comprehensive survey and consideration for a second construction of a second harbour in Ghana. An agreement between the governor of Gold Coast Sir George Listowel for the government and Nii Tetteh Anash signed on behalf of the people in Tema under the Compulsory Acquisition of Land Ordinance to acquire 64 square mile of land from Tema, Kpone and Nungua stool land for the project- construction of the harbour and the industrial town (GSS, 2012). According to GSS (2012), the 64 square mile lands extend 7 miles inland and 10 miles land stretched along the coast. In 1952, the government acquired 166 square kilometres of land north of the harbour and entrusted it to the Tema Development Corporation (TDC). The site was planned as an industrial and residential complex (GSS, 2012).

Most of the original inhabitants of Tema (Torman) were relocated to Tema Manhean or Tema Newtown in order to create way for the project- construction of the harbour and industrial town. Inhabitants from other parts of the country who had settled at Tema relocated to Ashaiman-a thriving community for low-income earners. In 1960, the first president of Ghana Dr. Kwame Nkrumah partially commissioned the harbour and the

city then comprising of community one and part of community two which had then been completed. After the construction of the new township and officially opening of Tema harbour in 1962, the city grew to become the new industrial hub of the new country Ghana. With a carefully constructed road layout featuring landscaping and street lights, modern recreational centers the city boasted among modern infrastructure-modern infrastructure which was rare among most cities in Africa-if not all at the time. The successes of the new city began to attract larger population to its centre, often attributed to the town's employment opportunities. Notwithstanding, human and industrial activities have destroyed the general environment in the Metropolis. The indiscriminate construction and putting up of unauthorized structures such as extension of buildings, sitting of shops and containers around street corners and road shoulders, sale of lands hitherto demarcated and reserved as greenbelts zones to businessmen and women, massive street hawking, commercial and private vehicles jamming the roads for lack of parking space, poor waste management etc., have marred the beauty of the Metropolis. Other activities, such as sand winning, defecating, dumping of refuse along the coast makes the beaches unattractive.

On the other hand, the city authorities are unable to meet all the housing needs and in addition provide other services to meet the needs of the migrants (GSS, 2012).

3.3 Population dynamics of Tema

In Ghana, officially urban centers are defined as settlements with population of 5000 or more (GSS, 2012). According to GSS (2005) based on the 1960, 1970, 1984 and 2000 population censuses, small towns are centers with population sized between 5000 and 19999, medium sized (20,000-99999) and large town sized (100,000 and over). Tema as an industrial hub, attributed to the rapid growth of population to its development has a port and industrial city after Ghana's political independence in 1957, making it one of the unique and ambitious example of an urban centre this view spotted by kirchner, (1968).

The population of Tema Metropolis according to the 2010 population and housing census is 292,773 representing 7.3 percent of the region's total population. Males constitute 47.8 percent and females represent 52.2 percent. Table 1.1 presents the trend of Tema's population between 1960 and 2010. Between 2000 and 2010, the growth rate for the overall population was approximately 3.98%. Moreover the urban centre continues to be influenced by rapid urbanization, globalization and the position of Tema as an industry hub.

Table 3.1: Trends of Tema Metropolis's population (1970-2010)

Years	1960	1970	1989	2000	2010
Population	15,161	60,767	100,052	141,479	292,773
Percentage contribution to the urban growth		1970-1989 2.69%	1989-2000 0.95%	2000-2010 3.98%	2010 7%

Source: Ghana Statistical Service (2005a, p. 130).

According to GSS (2012) the main factors contributing to this dynamic in the Tema Metropolis are many but include people migrating to Tema Metropolis for educational purposes and others look for employment in the formal and informal sectors; some retired public servants move back to their home towns when they are aged. Currently the metropolis has a migrant population of 166,506 as according to the 2010 population and housing census (GSS, 2012).

3.4 Tema and the Ghanaian economy

Tema is noted for its flourishing industrial activities. The industrial hub of Ghana hosts over 500 industries that produce chemicals, clothing, consumer electronics, electrical equipment, furniture, machinery, refined petroleum products, steel and tools of which its major companies include: Tema Oil Refinery (TOR), Volta Aluminum (VALCO), Tema

Shipyards and Nestle Ghana Limited among others (GSS, 2012). These chief industrials account for about 25.3% of total GDP. However, Ghana's industrial production is rising at a 7.8% rate, giving it the 38th fastest growing industrial production in the world (GSS, 2012). Significantly it has steadily contributed to the Ghanaian economy by generating revenue and employment. In addition, the Tema Shipyards, opened in 1962, which is the largest seaport in Ghana, aside of handling Ghanaian imports and exports, it is also a traffic junction, dealing with transit cargo destined for landlocked countries of Burkina Faso, Mali and Niger. The taxes derived from these countries are used in maintaining the harbour and other infrastructure in Ghana (GPHA, 2014).

The government of Ghana acquired a larger tract of land designated as a "Free Zones Area" near the port for the production of goods, 70 percent of which are for export and 30 percent for local consumption. This was backed by the Free Zone Act 1995 (Act 204) to enable Ghana provide the necessary environment to attract Foreign Direct Investment (FDI) for the promotion of economic development and also for the regulation of activities in free zone and its related purposes (GSS, 2014). The imports of free zone developer, sub-contractor or enterprise into a free zone's single-factory zone are exempted from duties, direct and indirect taxes as well as exempted from payment of income tax on profits for 10 years from the date of commencement of operation (GSS, 2014). Free zone enterprise contributes substantially to the Ghanaian economy, by providing directly and indirect employment to many Ghanaians. A large number of trained and untrained labours (masons, welders and artisans) have been employed for construction of the factories. Local factories and companies are also getting sub-contracts for the supply of raw materials, packaging materials, stationeries, spare parts for machines as well as janitor services. The arrival of foreign industries into the free zones has also intensified the managerial and technical expertise of Ghanaians, created opportunities for the Ghanaian labour force to

nurture skills development (GSS, 2014). In this respect, the success of the programme will enhance the poverty reduction efforts in the metropolis and the country in the long run.

Due to the fact that Tema was planned using the neighbourhood concept of town planning, almost all the communities within the city have market facilities, however the growth in population and growing commercial activities has made the market facilities inadequate due to the current situation generated by the numerous unauthorised commercial shops, stores in the form of wooden structures and metal containers within the city. Hence the generation of semi-commercial centre has become inescapable.

Generally, the proximity of the seaport in Tema has also made many individuals to tap into the importation of second hand vehicles and domestic appliances business. Most Ghanaians patronised second-hand vehicles due to its affordability as compared to the brand new vehicles (Amoyaw-Osei et al., 2011). However, second-hand vehicles have a shorter life span especially for the repaired ones as compared to the brand new ones. They eventually end up in dumping sites or being sold to informal collectors for recycling. Moreover as it stands there is no association of importers (Plate 3.1).

Plate 3.1: A section of second hand vehicles on display for sale at Tema



Source: Field Survey, 2016

Tourism and hospitality sectors play an important role in the economy of the Metropolis. The Tema Metropolis has a number of tourist attractions, such as, the Meridian Stone, Greenwich Meridian and the Sakumono beach. Tourism has the potential of diversifying the Metropolitan economy if the sector is given the needed attention, as well as, generating employment and revenue for TMA. Furthermore, there are 350 hotels and guest houses in the Metropolis (GSS, 2014). The Sakumono beach is one of the investment areas which have not been tapped into, and TMA, foreign and local investors need to channel resources to this sector for development.

3.5 Ashaiman: the dormitory of informal workers in Tema

Ashaiman (meaning Ashai's Town) was founded by Nii Ashai in the 17th century after he moved from Tema (GSS, 2012). Its population grew as the earliest migrants from Dangme West districts, Volta Region and Northern part of the country who settled and it

became a major slum settlement for most Ghanaian urban poor, its population rose from a mere 185 in 1948 to 2,624 in 1960, 22,000 in 1970 and increased to 70,000 in 1996. The annual growth rate between 1960 -1970 was 23.5%.However between 1970 -1996 the average annual population growth rate declined to 6 percent but it still prevailed high compared to other slum settlements in Ghana(GSS, 2012).

Communities such as Bethlehem, Middle East, Jericho and Lebanon derived their names because soldiers from peacekeeping duties came and settled there and the Zongo Lake came up. Ashaiman covers a total area of about 45 sq km. It's located about 4km to the North of Tema and about 30km from Accra, the capital of Ghana. Ashaiman shares boundaries to the North and East with Kpone- Katamanso Districts and to the South and West with Tema Metropolis. The 2010 Population and Housing Census report estimated the population of Ashaiman to be 190972, representing 4.8 percent of the Greater Accra total population (GSS,2014). Males constitute 49.1 percent and females represent 50.9 percent, of its estimated that 91.6% economically active populations are employed and 8.4% are unemployed in the Municipality.

With those engaged in the economically active working force, 73.1% are in the private informal, 20.5% in the private formal, 5.3% are in the public sector and the remaining 0.9% are in the semi-public, NGOs and other international organizations (GSS, 2014).Farming (crop farming, livestock and poultry rearing), fishing, manufacturing activities (kente waving, tier and die), quarrying and construction as well as commerce are the main occupations in Ashaiman. There are two main markets at Ashaiman (the Central and Nii Annong Adjor market).Ashaiman has 286 private basic schools and 17 public basic schools, 7 private senior high school with Ashaiman Senior School being the only public second cycle school(GSS, 2014).According to the Tema Human Development Report of 2004, Ashaiman has only one public health centre, 14 private clinics and one

private maternity home and some residents depend on the traditional healers. The development of Tema as an industrial city is linked to the development and growth of Ashaiman(GSS, 2012).

Moreover, the construction of Tema harbour and the railway lines in the 1950s, and industries in the Tema Township contributed to the migration of people to the area in search of jobs and relatively less expensive accommodation as compared to Accra and Tema, and its proximity makes it easy for community members to have access to high level social facilities and infrastructure such as good roads, water, hospitals and electricity. However made Ashaiman to serves as a dormitory town for most workers (formal and informal sectors). The major challenges of Ashaiman are the improper disposal of wastes, pressure on social amenities and social vices among others faced by the Municipality which could trigger the outbreak of communicable diseases like typhoid, cholera and malaria and apparently ward off possible investors.

3.6 Research methodology

This section discusses the research methodologies that were used in answering the objectives set for the study. This section covers the research design, sources of data and collection instruments, sampling techniques and sample size, data processing and mode of analysis.

3.6.1 Research design

This research examines the contribution of scrap trade on participants' household and poverty alleviation strategies in Tema-Ashaiman Metropolis. In order to achieve this objective, a qualitative research technique was employed. The choice for this technique stems from the fact that it allows more thorough examination of experiences, feelings or opinions that quantitative technique could never hope to capture (Creswell, 2009; Yin,

2003; Bryman, 2008). However, there is more to this technique than simply asking participant questions since it involves complex social encounter. According to Creswell (2009), before using this technique, there is the need to understand the dynamics and in addition be aware of the strength and limitations of using the qualitative research technique. A case study was conducted to document the context with regards to how scrap trade contributes to participants' household and poverty alleviation strategies in Tema-Ashaiman Metropolis. Case studies allow a particular issue to be studied in depth and from a variety of perspectives (Yin, 2003). No one data generation method was used and quite commonly a number of techniques are employed; in the main case studies are qualitative in nature, often using observation and interviewing as methods of data collection (Yin, 2003).

Thus, using a discursive framework, twenty-six scrap dealers were engaged in semi-structured interviews in order to gain a better understanding of their experiences with collecting recyclable scrap waste from various places to make a livelihood. Such narrative methodology was used to put together a 'big picture' about the experiences of people making a living and contributing significantly to urban sustainability, resource recovery and provide an income for them. Critical themes were identified using conventional content analysis and recommendations for improvements. It is my hope that this research can be a starting point to inspire others to look more closely and analyse the multifaceted aspects of the scrap dealers' everyday life and work experiences.

3.6.2 Data collection techniques and collection tools

In-depth interviews and Observations were used to collect data in order to address, the research question. In-depth interview were conducted in Twi and English, in an isolated environment so as to avoid interruptions by other people. Each interview was not less than 30 minutes and the outcome of the interviews was tape recorded. The tape

recordings were later transcribed and translated verbatim into English at the end of each day's work. This enabled the researcher to remember the relevant points raised by the participants and also to prepare properly for the next day's work. Tape recording is important because it allows one to accurately record an interview word-for-word with a minimum amount of effort. Similarly, it allows the interviewer to concentrate fully upon the discussion rather than trying to balance conversation and note taking. As noted by Yin (2003) some respondents were uncomfortable knowing that they are being recorded. Direct observations was carried out by researcher through observing the daily activities of the scrap workers activities which include collection, sorting, manual dismantling, loading scrap metals into trucks, and sale of scraps to downstream processors for final melting for the manufacturing of iron rods, roofing sheets, etc. As echoed by Thagaard's (2002), observation is when the researcher is presence in the situation under-study and observes participants and activities that take place. He further articulated that observation can be active; a situation where the researcher participates fully in the activities and he or she is known to be studying the phenomenon under-study or passive; when the researcher conceals his identity yet focusing on the activities taking place. The researcher, in his bid to get the best information, applied both types of observations in the data collection process. There were no major problems encountered by the researcher as he wisely identified with the main respondents in many ways in terms of their social demographics, and: respondents also accepted the theme of the research. The field observations, photographs, and reflections were recorded in the field diary. Thus the researcher experienced the day to day activities and the working conditions of the scrap workers: their behaviour, verbal and non-verbal reactions, physical surroundings, etc. These equipped the researcher with first-hand data of the main respondents for the study.

Besides using interviews and observations, the study also relied on secondary documentation such as newspapers, articles, reports, books for case findings and other details of scrap trade and poverty alleviation strategies.

Structured open-ended questions were used to obtain information from participants. Since the open-ended questions are structured, standardized and open, the interviewee's responses are not constrained to categories provided by the interviewer (Yin, 2003). In this as noted by (Yin, 2003) the respondents gave whatever answer they wish to give and all respondents were asked the same basic questions in the same order. This strategy help the researcher to compare the responses, and at the same time ensure that respondents responses to all questions. In all, this strategy reduces interviewer effects and biases introduced through free conversation (Bryman, 2008) and also provides a 'natural' basis of organization for analysis (Yin, 2003). Besides there are some limitations to this strategy; first since, interview is so highly structured and standardized, it allows little flexibility in relating the interviews to particular individuals or circumstances and may also constrain and limit the naturalness and relevance of questions and answers.

Focus Group Discussions (FGDs) were used to complement the structured open-ended interview. The advantage for using FGDs is that the dynamics of a group discussion work to bring out feelings and experiences that might not have been articulated in face-to-face interview (Yin, 2003). Nevertheless, the group dynamics may perhaps work in a negative way as well, with some participants reluctant to speak to an opinion through shyness and fear embarrassment. According to Bryman (2008) the selection of people for the group is very crucial; thus the individuals chosen were generally participants who are involved in the scrap metal trade in the metropolis having the same background and characteristics. Two separate FGDs were organized between scrap dealers and scrap pickers; and secondly, between association leaders and representatives of the local

authority with the aim of gaining deeper understanding of the structure, processes and human behaviour and the rational governing such action. The FGDs took place in the scrap yards, and focus on issues touching on power relations, efficiency, prospects, challenges and policy recommendations.

3.6.3 Sample size and sampling techniques

In all, a total of about 35 informants partook in the interview for the study. This consisted of the following: 20 participants in the scrap trade (out of which 11 were scrap pickers, 6 scrap dealer, 2 dismantle and 1 middleman); 10 ancillary service providers (out of which 3 were KIA- truck drivers, 3 Auto-mechanics and 4 Petty traders); 2 key official from 2 different Steel processing companies; and 4 public officials from the Tema Municipal Assembly, Environmental Protection Agency, Ministry of Trade and Industry were interrogated respectively. All the informants who were directly involved with the scrap metals trade were males. This is because the nature of the work is basically labor intense.

The study adopted an exploratory nature non-probabilistic sampling techniques. As rightly articulated by Saumure and Given, (2008) traditionally selection of sample unit is based on assumptions, and not all members of the population have an equal chance of being selected. Purposive sampling and snowball sampling method were employed in the selection of respondents for the study.

Earlier to setting out to the study area to collect data, the researcher had an idea as to where to found the respondents for the interview, and upon offering to be interviewed, respondents led the researcher to involve other willing participants who contributed relevantly and insightful information to the study. Hence the fallouts of the sampling technique employed complied with the definitions of purposive and snowball sampling methods respectively. A purposive sample is one that is selected based on the knowledge

of a population and the purpose of the study. As noted by Kumekpor (2002) respondents are selected based upon specialist knowledge of the research issue, or capacity and willingness to participate in the study. Conversely, a snowball sample technique is appropriate to be used in research when the members of a population are difficult to locate. Goodman (2011) also rightly articulated that it is best used when respondents are difficult to be found and are very few in number or where a higher level of trust are needed to initiate contact. As noted by Noy (2008, p. 330) snowball sampling technique involves the researcher accessing informants through other informants. Therefore, this technique was appropriate as it enabled the researcher to identify other informants based on the information.

3.6.4 Ethical consideration

Ethical issues were addressed considering the various precautionary approaches. First, an introductory letter of permission to obtain data/information was obtained from the Department of Geography and Resource Development, University of Ghana. Second, the purpose and objectives of the study was concisely explained to the target respondents. Third, the confidentiality of their responses was explained for the appreciation of the participants. In all, before the commencement of any interview, the participant were alert that it is their right to participate or not, and in addition their involvement did not have anything to do with their job evaluation much less to use it to tax them. As a form of assurance, it was emphasized that their involvement are entirely voluntary.

3.6.5 Data processing and mode of analysis

The data processing and mode of analysis was a continuous process, which occur during the data collection as the researcher apprehend and reflected upon developing trends which the researcher used to confirm what are expected and unexpected. The

researcher was fluent in Twi and English, all Twi interviews were transcribed and translated “word-for-word” into English and the interview notes were also elaborated. Principles of grounded theory approach were used in manual coding of transcripts and elaborated note (Glaser,1998).Clearly the coding process involved identifying main themes and sub themes in each of the transcripts. The identified themes were compared across the transcripts to determine distinctness and similarities in the prospects and opportunities, challenges and recommendations of the scrap metal trade.

3.7 Limitations of the study

It could have been proper to engage with the ASHMA instead of TMA only. However, initial key informants interviewed revealed that the scrap trade commenced in the late 1980s when Ashaiman was put under TMA. Actually all the permits and regulating processes were provided by the TMA, which had a superintendent role on the land on which the scrap dealers are currently operating. Ashaiman municipal assembly was not interviewed, which may have provided some relevant information of the scrap trade business, since most of the scrap yards were located there.

Timeline and lack of finance did not make the approach feasible for the study. Moreover, the study was limited in sample size compared to the number of participants in the scrap metal trade in the Tema-Ashaiman Metropolis. However the study provides in-depth knowledge that can be used as reference for further study.

3.8 Summary

This chapter presented the background information on the study area as prelude to the discussion of the results on the ground. These include the socio economic, physical characteristics as well as how the urban poor eke out a living for “waste”. The final section also provided an in-depth understanding into the methods employed as well as the

limitation of the study. The next chapter presented the results of the study as captured during the fieldwork.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter examines the findings of the study resulting from reading, re-reading, and analysis of the key interviews. Using conventional content analysis, where the goals are to draw out themes and categories from the interview data, the study was able to identify six broad themes. The first wherein “the demographic characteristics of the key informants” and their importance in filling gaps, that have been left by the government’s inactivity. Second is the theme of “clusters in the value chain of scrap metal trade”. From the perspective of members within the industry, there is functional segregation in the industry and the potential one transitioning from lower ebb to the top of the ladder. The third theme identified was “overwhelmingly positive personal motivation to participate in scrap metal scavenging and recycling”; in this section the study offers the narratives shared by participants in terms of their own personal motivations and experiences with the scrap industry. The fourth and fifth themes are tangentially related; the fourth theme covers the processes involved and the fifth echoes the working condition. The final theme highlights remunerations and economic viability of scrap metal recycling including capital accumulation and remittances from the informal scrap business.

4.1 Socio-demographic characteristics of respondents

Information gathered from informants in regard to their socio-demographic background in the course of the fieldwork includes gender, age, marital status, education level attained, place of origin and number of years in trade (Table 4.1). In order to make the presentation simple, the findings on the demographic background has been presented in Table 4.1. The findings revealed that 26 of the informants were males with only 4 females. Findings on the distribution of gender of the study participants is not surprising

and expectedly dominated by males because of the labor intensive nature of their work (collection, sorting, manual dismantling etc). Most of the survey respondents (87%) have migrated to Accra from Northern Ghana, often following disaster events (e.g. river erosion, cyclones, flooding), lack of jobs or family conflicts (see Figure 3). Often expelled due to extreme weather events, possibly linked to climate change, these already poor youth left the countryside to find a job in the cities.

Table 4.1: Socio-demographic information of interviewees

Demographic information	Number of interviewees
Gender:	
<i>Male</i>	30
<i>Female</i>	5
Age:	
<i>Below 15</i>	3
<i>16-29</i>	22
<i>30-49</i>	8
<i>Over 50</i>	2
Marital status:	
<i>Single</i>	20
<i>Married</i>	6
<i>Divorced/Widowed</i>	9
Education:	
<i>No formal education</i>	20
<i>Primary education</i>	7
<i>Junior high education</i>	6
<i>Senior high education</i>	2
<i>Tertiary education</i>	0
Place of origin:	
<i>Akan</i>	1
<i>Ewe</i>	3
<i>Ga/Adangbe</i>	3
<i>Northern Region</i>	23
<i>Foreigner</i>	5
Number of years in trade:	
<i>Less than 0</i>	7
<i>1-5</i>	20
<i>Above 5</i>	8

Source: Fieldwork, 2016

The findings also show that majority of the participants, numbering 22 were between the age group of 16-19. This finding also shows that most of the informants were within their youthful age. Eight (8) of the informants interviewed were within the age bracket of 30-49 years. A number of insights can be gathered from these results. Given the fact that most of the people working in the scrap metal industry are migrants from other

parts of the country, especially from northern Ghana, it can be suggested that economic migrants are mostly youth. Further, the nature of the work which is basically labour intensive has made the industry a preserve for the youth and an area where they can eke out a living and lift most out of poverty.

The findings also show that 20 out of the 35 informants were single or unmarried. 6 of the informants were married and 9 were divorced or widowed. The number of people who were single is not surprising given the fact that a majority of the informants were youth. Indeed, the priority of most youth who find themselves in the scrap metal business is to make a living first, support their families back home before starting a family. It was revealed during the course of the interview that those who are married were those who have been engaged in the business for some time now and are relatively established. Others also pointed out that they were married in their place of origin but came down south to engage in the scrap metal business so that they can support their families back home.

The data further showed that 20 out of the 35 informants had no formal education, 7 and 6 had primary and junior high school education respectively while the remaining 2 of the informants had attained senior school high education. None of the informants have had tertiary education. Conversely, this show why many find themselves in the scrap metal recycling in the Tema-Ashaiman Metropolis, since it is very difficult to obtain alternative job opportunities with their low level of education in Ghana. As echoed by Holmes (1999) the higher formal education obtained is an important determinant of one's future earnings.

In terms of nationality, the data show that out of the total number of informants, 30 were Ghanaians of which 23 were from the north while the remaining 5 originated either from Burkina Faso, Niger or Nigeria. The result clearly shows that many people migrate

down south in their quest to earn a living. According to Oteng-Ababio (2012b), high unemployment among the economically active population in Ghana and that of Accra, the scrap metal business provides refuge for these unemployed youth. Finally, in terms of years in trade, the results show that half of the scrap metal workers interviewed numbering 20, had worked for at least 5 years while the remaining 8 had been in the trade for over 6 years. This is important because there is a direct relationship between the years of work, income generation and health hazards.

Per their individual characteristics, participants were asked whether they were able to access public services such as education, water and sanitation. Surprisingly, the majority declined (89%), leaving a bleak perspective of negligence and exclusion for the scrap dealers. Not being able to enter formal education and study prevents progress and skill building. Low levels of education and the lack of formal work experience often impact negatively on their labour market mobility and thus on their ability to compete for jobs in the formal market (Viljoen et al., 2016). Not having sufficient access to clean water and sanitation represents a major health concern. Unsurprisingly, their low socio-economic status, translates into lack of adequate housing conditions and poor household hygiene practices which contribute to their health vulnerabilities (Viljoen et al., 2016). This resonates with Uddin et al. (2016) report, who indicated various water, sanitation and hygiene (WASH) - borne diseases such as diarrhoea, malaria, typhoid, stomach pain, fever, jaundice, and skin diseases among the homeless people in Dhaka, Bangladesh. Factors behind these diseases include lack of safe drinking water, insufficient public toilets, and lack of public facilities for a regular shower, lack of water for hand and cloth washing, and open defecation practices. Our current study also found these same factors applying to the scrap dealers and their health hazards.

4.2 Clusters in value chain of the scrap industry

Table 4.2 presents seven main clusters in the value chain of scrap metal trade observed in the course of the fieldwork. The first two involve those directly engaged in the scrap metal business and this includes those involved in activities such as collection, sorting/dismantling. The last among the seven clusters are those indirectly connected to the scrap business or what we may term as ancillary service providers and these include activities such as Kia drivers, auto-mechanics and petty traders, comprising related but indirectly engaged in the scrap metal activities.

Table 4.2: Categories of respondents

Work category	Number of interviewees
Scrap pickers	11
Dismantlers	2
Middlemen	1
Scrap dealers	6
Ancillary work	
Kia drivers	3
Auto-mechanics	3
Petty traders	4

Source: Fieldwork, 2016

4.2.1 Scrap pickers

The study identified, that 11 out of the 35 informants interviewed were involved in the scrap metal collection, which is the initial stage of entry into the scrap metal trade. The scrap pickers interviewed were males and mostly in their youthful age. As part of their routine activity, they moved around the city and beyond with a sack or handcarts and trucks to collect scrap metals which they take to the assembly points-Ashaiman to sell to the scrap dealers and other actors in the chain (Prakash and Manhart, 2010). Formally, they use to pick this for free but currently they have to pay due to an increasing competition and awareness of the trade. It was revealed in the course of the interview that some of the scrap pickers do not have a particular schedule for their daily runs but just

decide on where to go for scavenging, although it is not guarantee whether or not they will get scrap metals. According to them, on some occasion business is so bad that they return without any goods. They usually work in pairs or individually with their sacks, push carts or trucks and operational tools (spanners, hammer and screwdrivers).

The study revealed that the increasing awareness and competitive nature of the scrap metal trade has steadily increased the entrance of new migrants and job seekers in this work category. Again, some scrap pickers also extend their mining trek to “un-mined” locations and spend weeks to dismantle and build bulk (of scrap metals) before conveying the materials to their assembly points. It was revealed in the course of the interview that most scrap pickers often sell their booty at a low price to their colleagues at the nearest recycling points, due to the high cost of conveying their bulk.

Moreover, the study revealed that some scrap pickers are being contracted to dismantle and recover valuable fractions (copper and aluminum) through burning. Again, all the scrap pickers interviewed confirmed that the current global financial crisis has affected their scrap metal trade. They all echoed that the downstream processors in Tema offer lower prices for their valuable fractions (copper, aluminum, brass and lead) that are brought in for sale. Although the scrap dealers deal directly with the downstream processors, they also indicated that they were affected by the attendant price fluctuation. This point is important as it brings to the fore the fact that no one in the value chain of the scrap metal business is immune to price volatility. An important finding from the study and one which seems to have been given little attention in previous studies was the exposure of scrap pickers to social hazards such as assault and verbal abuse which they encountered in the course of going about their work. As Musa Fattah recounted:

After completing primary school, I joined my elder brother at Ashaiman who introduced me into this scrap metal business. In search for scrap metals, on our day's expeditions most of us are been abused verbally, tagged with all kinds of denigrated names. For instance one of my colleagues about two to three year ago which I started the scavenging with was nearly mistaken for a thief, since no one understood his language. Actually he was really humiliated. So in short our business is quite risky operating in certain environments. [Personal Interview (PI), A 20-year old, Scrap Picker in Ashaiman town; June 2016].

The quote provides insight on a number of issues and presents the hazardous nature of the work. The dangers encountered can be attributed to a number of factors and include the environment they are operating in which could be friendly or unfriendly, the experience obtained in the scrap collection trade which could also help in navigating through the urban environment and the extent to which one is able to communicate in one of the well-known languages spoken in Accra.

4.2.2 Dismantlers

Recycling of scrap metal aimed at recovery of precious fraction is emerging as 'a lucrative business' in Ghana. A total of 2 dismantlers were interviewed. The primary activities of recyclers (sometimes called dismantlers mostly based in scrap yard) include manual disassembly and segregation products for their components (Grant and Oteng-Ababio, 2010). However, their recovery methods require some level of professional skill and expensive equipment to be used in the process (Oteng-Ababio and Amankwaa, 2012). Despite these requirements, it was revealed in the course of the interview that some dismantlers normally do not use the right equipment or are unskilled in the way they go about the whole dismantling process. This exposes them to injuries and occupational hazards. Further, the poor environmental conditions within which most of the dismantlers work expose them to toxics. Plate 4.1 shows a dismantler separating scraps into various

fractions, sell their components to middle-men, auto repair shops as well as artisans who use local technology to manufacture cooking pot, coal pot etc.

Plate 4.1: A section of dismantled metal scraps at Ashaiman scrap yard



Source: Field work, 2016

However, the study revealed that most of the dismantlers work without any protective gear or respiratory marks. During the field work, it was found that some dismantlers eat with their bare hands. Perhaps they are ignorant of the potential health threat to their activities they face. From that perspective, a number of long-term plans have been suggested by the participants during the data collection and fieldwork. One of them was the provision of health cards for scrap workers. Advocacy was suggested to convince government officials for formalizing their works within the official waste management system through adequate policy development, to protect these workers. When they were asked if they wore protective clothing during work, as Arham Ayaan recounted:

“No! I can’t wear hand gloves when working because I can’t hold the hammer well”.

“The toxic chemicals and gases that emit from the engines might affect us in .But want can we do because man have to hustle to make it in life. But the dismantlers are the ones likely to be affected because the inhale different gases and chemicals every day. So they are the ones that need gloves, noise mask and helmet not us”[A 25-year old, dismantler in Ashaiman scrap yard].

4.2.3 Middlemen

The middlemen serve as intermediaries between scrap pickers, dismantlers. Only one middleman was interviewed. Indeed, it was difficult getting the middlemen due to the nature of their work because they are not always present at the yard. The middlemen build bulk and eventually sell to the scrap dealers who also sell to the downstream processors in Tema. An observation that was made during the fieldwork was that in the middleman’s shed it was common to find a weighing scale which is most at times adjusted by the middleman to their advantage. After weighing the scraps metals cash exchange hands quickly and goods enter the stocks (metal containers /protected yard were scrap metal are kept) (Plate 4.2).

Plate 4.2: Examples of scrap metals storage facilities at Ashaiman scrap yard



Source: Field work, 2016

The study revealed that the middlemen are well-financed and in most cases provide financial support to some scrap pickers in their activities, albeit the system comes with the risk of some absconding. Abbas shares his experience:

I have never been to school before but my uncle who introduced me into the scrap business has passed away. I sometime pre-finance the activities of scrap pickers although some boys don't return back is all part of the business. Moreover I also travel beyond Ashaiman to other regions just to get more scrap metal and come and stock it in my container to build bulk and eventually sell it some scrap dealers on my bargaining skill so as to make enough profit [PI: 40 year old middleman at Ashaiman scrap site].

4.2.4 Scrap dealers

Generally, the scrap dealer serves as the negotiator between the collection and final marketing of valuable metal fractions to the downstream processors in the recycling trade at Tema. 2 of the scrap dealers were selected for the in-depth interviews. Within the value chain at the assembly point- Ashaiman scrap yards, the scrap dealers occupy the highest level with well-established permanent sheds to keep their wares and activities as compared to the scrap pickers. During the study it was observed that some scrap dealers do re-sell. They have weighing scales which are often adjusted to their merits which accounts for difference of prices in Ashaiman and Tema. It is often common to see measuring scales located in front of their sheds, where scrap pickers, dismantlers and other main actors within the chain weigh their valuable fractions (copper, aluminium and steels) before or after processing. After weighing, cash and good exchange takes place. The study identified an Avery Birmingham scale 3205 ABA type, S-610546, manufactured by W&T Limited in England

Plate 4.3: Examples of weighing scales used in scrap trading activities at Ashaiman



Source: Field work, 2016

The study also identified that scrap dealers have their connections with the agents of the various downstream processors in Tema. Most of the downstream processors recycled the fractions (copper, steel and aluminum) into manufacturing of nails, iron rods, roofing sheets and domestic equipment like cooking utensils etc. Observation during the field work revealed that the activities of the scrap dealers are capital intensive because they need money to build bulks for months before sending them to the recycling companies in Tema and also sometimes pre-finance scrap pickers in their day's expeditions. Communication and transportation are essential modules of the recycling activities at the assembly point. At Ashaiman scrap yards, scrap dealers stay connected with their clients in Tema. The study also revealed that, the current global economic crisis is having a serious influence on the trading activities of the scrap dealers. Most of the recycling companies in Tema trade in dollar and the fluctuations of the dollar on the international market make the scrap metal price to change. Likewise, most of the recycling companies also export directly to other countries, which characterize that variation in international prices may also affects the prices at Tema. Saafir Saal shares his experience:

“When I completed JHS, I relocated to Ghana as a herdsman. I got introduced to scrap business by a friend and I became interested in it because the scrap business is lucrative”

[41 year old, scrap dealer had lived most of his life in TAM. He hails from Burkina Faso. He has been dealing in scraps for the past 8 years]

4.2.5 Ancillary service providers

A total of 10 informants were selected from activities within the ancillary activities connected to the e-waste/scraps business. Out of the 10, 3 of the informants were KIA truck drivers, 4 were petty traders and 3 auto-mechanics. The number of activities indirectly connected to the scrap business is more than what is represented in this study. Indeed, I agree with Oteng-Ababio (2012) on the point that the scrap trade has increased the mainstream economic activities for a number of individuals thus the practice has involved supporting services such as daily hiring of handcarts, sales of operational tool kits, and food and water vendors among others.

4.2.5.1 KIA truck drivers

Transportation is one of the major components of the scrap metal trade. The Kia truck drivers are involved indirectly through the conveying of scrap metal “to and from” the scrap yard-Ashaiman. 3 of the drivers were selected for the study. Their activities are stimulated time-driven. All the drivers cited the peak working days are when scraps are available and ready to be conveyed to the recycling industries at Tema. Another interesting finding that emerged during the study about the truck drivers was that during periods when their services are not required (time when scraps are not ready to be conveyed) drivers resort to transporting food and other materials which are not scrap related and returned to their usual scrap transportation after being called by dealers to transport load. Another remarkable observation was that, some Kia drivers were contracted to help load and off-load scrap metals. By implication occupational risks

associated with the scrap metal recycling may not only be limited to the scrap workers but also similar impacts on the Kia driver and other actors (who may not be directly engaged in the activities). Further, discussion with the Kia driver indicated that, there is a Kia driver association which has countrywide membership. They cited their business is an informal economy and registered with the Ghana private road transport union. However, pay taxes to the respective authorities. Some accounts of a Kia driver who lived most of their lives in the TAM collaborates and confirms this analysis.

“After my JHS education, I desired to become a driver. One day a scrap dealer engaged me to transport his wares to Tema and the pay was good. So I decided to use my vehicle to carry only scrap metals” [25year old, Kofi Boakye].

4.2.5.2 Petty traders

The petty traders are engaged indirectly in the chain of scrap metal trade activities through provision of ancillary services. 4 out of the 10 informants were within this. During the fieldwork, a number of women were identified engaging in the sale of sachets water, food, second-hand clothes and operational tools (spanner, hammer and chisel). It was clearly established that sachets water served a dual function (occupational and domestic uses). The scrap workers use it for ablution (since most of the workers are predominately Muslims), drinking and cooling the recovered fractions (copper, zinc etc) after burning.

Discussions with traders (sachets water) selected revealed that they come to the scrap yards as early as 5:30 am to meet up with morning prayers and in the hours of 12pm to 3pm when the heat is intense, since workers consume more water. It was also observed that some of the women who trade in operation tools and second-hand clothing sell to the scrap workers on credit and later go for it. It was obvious from the field observation that scrap business has sought to increase the mainstream economic activities for a number of individuals thus the practices have engaged supporting services such as daily hiring of

handcarts, trucks, sales of operational tool kits, food, and water vendors, etc., however it was revealed that the environmental health risk associated with scrap metal recycling processes may not only be limited to the scrap workers but also traders, visitors and other actors suffers similar effects when they trade or visits the site regularly. This has also been echoed by Oteng-Ababio (2012). This was reflected in a comment by Aairah Aafiya;

“I hail from Wa in the Upper West Region, I have never been to school. My husband is a scarp dealer who advised me to come here (Ashaiman scrap yard) and provide ancillary services such as sales of operational tool kits, sachets water and daily hiring of handcarts to scrap workers”[25years, petty trader].

4.2.5.3 Auto-mechanics

This is a formidable economic activity under the Ghana National Association of Garages (GNAG) which has country wide membership. It's an informal economy and many of them are not registered with the department of the Registrar General. However, they pay income taxes to the Assembly. Generally, activities of the auto-mechanics usually involve the transformation of malfunctioned and old automobiles through the repairing and replacing of faulty parts in order to get it functioning again. Plate 4.4 shows an automobile shop in the vicinity of the study locations. The significance of this occupation is to help extend the lifespan of automobiles but those beyond repairs are sold or given out for free to the scrap picker or scrap dealers. In all, 3 of the informants spoken with were auto-mechanics. Field observation showed that they work on their own with a few apprentices. Beyond its affordability, it also helps clean the environment and conserves energy and raw materials needed in producing new ones. Yaw Asare collaborates and confirms this analysis

“After my SHS education, I desired to enroll as a mechanic apprentice because my parents could no long afford for my tertiary education. I sell faulty parts of

automobiles which are beyond repairs to scrap workers and make extra cash as well as help clean the environment”[A 19years, mechanic apprentice].

Plate 4.4: A section of broken vehicles acquired by scrap dealers at Tema



Source: Field work, 2016

4.3 Reasons for participating in scrap metal scavenging and recycling

The scrap business has become an economic activity that has seen a lot of the youth going into as has been indicated in previous studies and in the previous section of this thesis. A number of factors have motivated a lot of the youth to involve them in this scrap business. During the course of the fieldwork and discussion with the various categories of workers three main important issues cropped up as being the motivation for engaging in this activity.

The first reason they gave was that it provided them with sustainable job opportunity and was a lucrative economic venture to enter into. This point is very significant especially when scrap metal business like many informal sector activities has an easy entry and one may also be provided with the start up support and then transition as

the years go by when capital is accumulated. The profitability of the activity is contingent on the category of work one is engaged in. Previous studies have shown that scrap dealers earned the highest average monthly income, followed by the middle men then the collectors. The scrap collector earned the lowest. However, when their daily wages are aggregated to the monthly level, it is good enough to take care of them and their dependants. This point is corroborated with a quote from Amankwaa et al (2016: 25).

Abdus Salam shares his experience:

“After SHS education, my grandparents couldn’t afford to help me further my education. I was jobless for over 5 years. I got introduced to scrap business by my uncle and I became interested in it because it is lucrative”. [PI: 35 year old scrap dealer at Ashaiman scrap site].

Further, informant indicated that the reason for going into the scrap metal business was that jobs were hard to find these days and going into scrap metal business will reduce their plight. Indeed, the issue of unemployment is a major problem in the country. Even graduates from tertiary institutions are finding it difficult to get sustainable employment opportunities in the formal market. The informal sector has become the only source of hope for most of the youth, especially those with no skills and minimum form of formal education. With an easy entry and informal support mechanism to help them fine tune with the rhythm of the business, most migrants who are willing to engage in the business are given initial support either with some money or tools to begin with. However, with time they transition to other higher levels within the chain. A respondent shares his experience:

“I relocated from Salaga to Ashaiman because of lack of opportunities and financial problems. I only want to make it life but in Salaga there are no opportunities like jobs and living there was a total waste of time. I never had been to school. I only attended Makranta. I realized here in Ashaimantoo; there are no jobs for me. Therefore my brothers and friends who have been in Ashaiman for

over 4years to hustle, advised me to do scrap business hence is easily to enter with little or no capital or education”. [25year old, SulleyBukari].

Further, informants highlighted the point that the current business they are engaged in is able to cater for their present needs and also enable them provide support for their families back home. For the scrap dealers who have been able to accumulate some capital and made investment into their business, they are able to make more returns from their investment. For the scrap collectors, their immediate needs have been food, clothing and some basic expenses that they need to make for their survival in the urban economy, which most are able to achieve. For the scrap dealers and refurbishers interviewed, some did indicate that they have been able to cater for the needs of their families back home through remittances. Some have even begun building projects and others long term projects. Thus it is the future prospects of the business that has encouraged a lot of the youth to opt for this business activity. The quote by Alhaji Musa; a scrap dealer interviewed highlight this point below:

‘The income levels indicate that scrap trade livelihood has the potential to reduce poverty, if they are given the needed support, because average daily incomes are higher than the daily minimum wage (GH¢ 6). For example an average collector earns a monthly gross income of about GH¢750. Despite the vicissitude in earnings and daily expenditure including water and sanitation, bathing, food, and hiring of push trucks, the results are higher than that of an average public servant in Ghana who earns approximately GH¢180 a month’. [PI: 43 year old Scrap dealer at Ashaiman scrap site].

4.4. Processes involved in scrap metal recycling

4.4.1 Sources of scrap metal

Ferrous (cast, iron and steel) and non-ferrous (copper, aluminium, brass, lead and tin) metals are the type of scrap metal the scrap pickers and scrap dealers are most concerned about. The scrap metal participants at Ashaiman mainly focused on recovering

precious fractions (ferrous and non-ferrous metals) as major source of livelihood out of the sale of these fractions. The study showed that the scrap metal recycling involves a number of activities which include collection, sorting, manual dismantling and final melting at the steelworks for the manufacturing of iron rods, roofing sheets among others. The collection of scrap is mostly performed by new entrants who are mostly made up of young people in their teenage or early twenties. They usually go in pairs or individually to various suburbs of Accra: Ashaiman, Tema and beyond with sacks, trucks to collect scrap metals from houses, landfills, streets and mining site with equipment used varying from the use of simple operational tools to the use of the hands. This was reflected in a comment by Adullah Salifu, a scrap picker:

After completing JHS in 2016, I joined the scrap business as a scrap picker but I hope one day I would become a scrap dealer. As part of my work, we move in pairs or individually in search of scrap metals at the dumping site, mechanical shops, houses, companies for a fee or free, using sacks, jute bags and trucks depending on the quantity and then convey to the assembling points-Ashaiman where sorting is done [PI: 25-year old scrap picker at Ashaiman scrap yard].

It was further established that the scrap dealers purchase the precious fractions from the scrap pickers for processing. They have weighing scales which are mostly adjusted (to their merit). It was also observed that different scrap metals (e.g. aluminium, copper and steel) have special weighing scales and prices. In most cases the scrap dealers pre-finance the scrap pickers for their daily expedition in search of scrap metals. Another remarkable observation was that the scrap dealers used a range of methods to separate ferrous and non-ferrous metals and this include magnetic detectors, visual inspection and hand selection. All scrap dealers interviewed indicated that the ferrous metals are the type of raw materials needed for production by the steel companies. They further said, ferrous metals are graded due to its quality (Hms1.Hms2 and Lm₃) and the best of quality the

higher the price. This view of scrap dealers was confirmed by the steel companies interviewed.

4.4.2 Methods of processing

Evidence gathered shows that after the scrap dealers purchase the scrap metals; they either dismantle them by themselves or contracted others to dismantle it for a fee, depending on the quantity of the scrap metal. Dismantling is done in order to retrieve precious fractions (copper, aluminium, steel etc.) from faulty engine blocks, wire, machineries etc. Often operational tools (hammer, chisel, spanners etc.) and gas torch or electrode are used to dismantle and cut large sizes into smaller pieces for easy loading and off-loading into trucks. Another important observation was that the main activity done by the scrap metal workers was to extract valuable fractions from cable wires through open burning (see Plate 4.5).

Plate 4.5: Example of a scrap picker recovering metals after open burning method



Source: Field work, 2016.

It was further established that during the burning process, the scrap metal workers use old car tires to fuel the fire available at the site. Moreover, direct observation and discussions had with informants revealed that during dismantling of the scrap, dismantlers work without any protective wears or equipment. This was reflected in a comment by one of the informants, who said:

I have being in this trade for close to 2 years now as a collector but sometime, I am contracted by some dealers to burn for them for a fee. We burn without any protective wears or respiratory equipment which is faster than using the scrapper to remove the rubber covering them. Although am aware of the environmental and health risk our work poses, boss what man for do, man for survive. [A 24-year old scrap picker in Ashaiman scrap yard].

4.4.3 Disposal of non-valuable fractions

The recycling of scrap metal generates waste, especially during the dismantling and burning processes. The environmental situation at the recycling centre at Ashaiman is very poor as current operations is not engineered and the place is characterized by open-burning and poor waste management as hazardous fractions as well as non-valuable fractions are disposed of at the adjacent dumpsite by scrap metal recycling workers.

4.4.4 Downstream processors of scrap metal

Downstream processors are the companies that purchase the valuable fractions (ferrous and non-ferrous). All these companies are located in Tema and their main activities involve the processing of valuable fractions into the manufacturing of iron-rods, roofing sheets and domestic equipment (cooking utensils, aluminium pots etc.). During the fieldwork, the following downstream processors (steel and aluminium processing companies) were identified:

1. Ferro Fabric Limited
2. United Steel Company
6. Special Steel Limited
7. Sentuo Steel Limited

3. Aluworks Limited

8. Rider Steel Ghana Limited

4. Tema Steel Limited

9. Western Steel and Forging Company

5. VALCO.

Evidence gathered shows that, there are a number of informal aluminium smelting activities at Ashaiman and Tema, from which aluminium scraps are used to produce domestic equipment which includes cooking utensil, pots etc. Another remarkable observation was that agents (who act as middlemen in the scrap metal trade) assigned by the scrap dealers normally as part of their operations do a survey of all the recycling companies to verify which one offers good price for the metal scraps. This is done in response to the fluctuations in the dollar rate which as a result affect the prices. Moreover, this is done not only, to decide which companies to trade with but also the ability to pay upfront. Further, interaction with the companies interviewed indicated that, usually when there is change in price, scrap dealers create shortage in propagating for a good offer which consequently affects production coupled with the current power supply crisis in the country.

4.5 Working conditions

Scrap metal recycling activities at Tema-Ashaiman has its own range of economic and environmental benefits it offers, however the participants involved in the activity work under appalling conditions which poses a range of health threats ranging from bodily pains, cuts and all kinds of contamination diseases. It was further established that most of the scrap metal workers work without any kind of protective cloths and respiratory equipment. All Scrap pickers interviewed indicated that they were exposed to different kinds of disease contamination when in the process of searching for scrap metals from landfill sites, dumping sites, gutters among others. Almost all informants interviewed

complained of body pains during long hours of walk in search of metals coupled with pushing of hand carts, carrying of sacks and loading and off-loading of heavy metals on their hand cart (Plate 4.6).

Plate 4.6: Example of a hand cart used for scrap metals transportation



Source, Field work, 2016

In most cases informants sustain serious injuries and bitten by snakes and dangerous animals in the absence of protective wear including goggles, nose marks gloves and boots this was confirmed by the scrap dealers. The study revealed that the participants in the trade do not have a fixed working time as compared to the employee of a formal sector who works in the hours of 8am to 5pm and break for an hour (Prakash and Manhart, 2010). Majority of the participants confirmed that they sometime work for 10 hours or even more and just rest on Sundays, because the more scrap metals available at your

disposal the more income you earn. Almost all scrap pickers confirmed being harassed by the police and other city authorities and in instances mistakenly tugged as thieves, mostly in the residential areas in quest to earn a living. Also, all participants in the scrap metal trade indicated not to be insured and also not enrolled in any form of retirement benefits or social benefit (Fofana, 2009).

4.6 Remunerations and economic viability of scrap metal recycling

Earlier part of the discussion did give a hint about the relevance of the scrap business and why a lot of the youth who have migrated from northern Ghana find it useful to enter into it. This section provides some insight about the remuneration and economic viability of the business. During the fieldwork, discussions with informants revealed that scrap pickers, who are at the lowest level of the value chain earned on the average GH¢ 30 on a daily basis which is very high by Ghanaian standard. This is because the current minimum wage is GH¢ 8 which imply that scrap pickers earns about three and a half times the average income of a minor worker in the formal employment sector in Ghana.

Conversely, scrap dealers earn approximately GH¢ 100 daily and earn even more GH¢ 150 on a good day. This is far more than a minor worker in the formal employment sector in Ghana who earns an average monthly salary of GH¢ 216 (GSS, 2014). During the study, it was asserted by all participants that the scrap metal trade is indeed lucrative if business is good, and they are able to use the proceeds to support themselves and their families/dependents. The findings validate that of Prakash and Manhart (2010) which shows that scrap metal recycling activities create about \$100,000 to \$200,000 annually, sustaining not less than 200,000 individuals nationwide.

It must be admitted that, one has to treat revenue and expenditure created from operators in the informal economy with caution due to the significant fluctuation in their

fortunes and their tendencies to mix business with personal stipend. Looking at their earnings against the local economic realities however gives a clue why the wealth creation in the trade and the “supposed” economic viability becomes apparent.

4.6.1 Respondents’ capital accumulation

One important issue that the study revealed was the saving habit of informants. As indicated earlier, capital accumulation is very important for occupational mobility within the scrap trade chain. Again savings is important especially when it is difficult to access loan and credit facilities from the financial institutions due to the informal nature of the business. Workers save with “Susu” collectors or small financial institutions who are into savings and loans business. The amount saved varies depending on the category of work within the scrap business chain. During the course of the fieldwork, interviewees were asked how much they saved within the week. 9 out of the total number of informant indicated that they saved close to GH¢ 500 per week, while 2 of the informants indicated that they saved about GH¢ 50 per week. Not surprisingly, all the scrap dealers I interviewed belonged to the former group in addition the middleman who was also interviewed. It was revealed that the need to make such huge savings was because of a number of reasons. This includes the need to make more investment since that also yields more returns, and also the volatile nature of the business which also cushions them to wither the storm. The quote from an informant highlights this point.

“It all begun when I met some scrap workers who needed help in pushing their truck because of the heavy load they were carrying. I offered to help them voluntarily but I was paid some money at close of the day, and so I became interested in the job, since then I always move with them in search for scraps. To be frank I have made a lot of money and I have enough savings from this trade which I have invested into mobile money business in my home town, Tamale”.
[25year old scrap picker, Baba Ali]

In all, about 17 out of the 30 informants interviewed indicated that they saved with the “local susu operators” while the remaining 3 engaged with the formal banking institutions. All 3 of these informants were scrap dealers and they did indicate that they saved with the bank so that they can benefit from loan facilities from their financial institutions. Apparently these scrap dealers have been in the business for quite a while now and have been able to accumulate some amount of money over the years. In addition to the above, the participants indicated that they have joined the Greater Accra Scrap Dealers Association (GASDA) where they are required to make monthly contribution. These contributions are used to run activities of the association including stationary issues, organizing events and making donations to members who are facing some challenges including loss of a family member, injury during the course of the work and sickness. For this contribution, irrespective of whether one is saving with a financial entity or not it is required that you contribute.

4.6.2 Respondents’ remittances

Discussions on the demographic background of informants showed that 23 of the informants were from Northern Ghana. The predominance of people from Northern Ghana in the trade is also corroborated by other studies (Grant and Oteng-Ababio, 2016: 6). The major reason for their movement down south has always been for economic reasons. Again an important aspect in their migratory process is the need to offer assistance to family members back home in the form of remittances. Discussion with informants revealed that in addition to remittance which are sent in the form of cash transfer through mobile money, other items sent back home included items such as electronic appliances (TV, DVD, computers phones) domestic items (gas cookers, soap, clothes) capital goods (motor, bicycle) and farm inputs. Discussions also revealed that remittances were used to

assuage concerns and any form of bitterness harbored by friends and close acquaintance who were not officially informed about the departure of migrant scrap workers.

A remarkable observation made was that, the type of remittances depended on which part of the value chain one occupied. It is not surprising remittances were substantial in the case of scrap dealers as compared to the scrap pickers. This situation can be explained by the close connection between upward occupational mobility and income earned. By implication, well established workers are more economically empowered than the new entrants.

4.7 Summary

This chapter described how due to high unemployment rate and lack of formal employment opportunities has led to the festering of an informal recycling sector as a major livelihood strategy for most individuals within the context of the urban poor in Tema-Ashaiman. It further explored on the prospects, working conditions, activities involved and the potential opportunities it offers. The results show that the economic benefits of the scrap metal recycling appear to be more lucrative as compared to other informal activities. The next chapter focuses on the discussion and analysis of relevant issues on the livelihoods of the participants, and perceived environmental and occupational health hazards, from the viewpoint of respondents, stakeholders concerning the trade.

CHAPTER FIVE
DISCUSSIONS OF RELEVANT ISSUES AND PERCEIVED ENVIRONMENTAL
HEALTH HAZARDS OF SCRAP METAL RECYCLING

5.0 Introduction

This chapter has two parts. The first part examines the socio-economic impact of the participants. The final part explores the perceived environmental and occupational health hazards, from the standpoint of informants associated with scrap metal recycling. It also examines both stakeholders and community's perspective for improving scrap metal recycling at scrap recycling centers.

5.1 Socio-economic assessment of scrap metal recycling

This part of the discussion assesses the economic impact of scrap business as a livelihood strategy within the urban informal economy. Among issues interrogated is the sustainability of the livelihood vis a vis global and local conditions that tend to affect the business. Other pressing issues touched on include the price mechanism or pricing regime, reliability of income and its sufficiency and how the current condition can sustain the viability of their livelihood.

5.1.1 Price mechanism

The prices of scrap are an important indicator of whether the scrap business will be attractive and economically viable. The informal scrap business, if not, is one of the main activities which is very sensitive to global market forces. This is because scrap metal is mostly exported in various forms after undergoing some form of recycling which dictates or affects the value of the dollar on the global market. By implication, if the demand for goods made from metals falls, the global market forces are also affected, especially during economic crisis. In such situations, prices for the scraps can be suppressed and scrap workers will be offered little for their efforts. When this happens, scrap workers are

worried, for most scraps workers who do not have any form of savings or insurance to rely on. All the scrap workers indicated that this is the risk part of their trade, which they normally go through when the global market prices fall. An important issue that came up during the course of discussion with informants was how scrap prices were fixed at the steel processing companies even if the global market price for goods made from metals increases or decreases. All the scraps participants show that there was a lack of information flow within the supply chain of the trade. Perhaps, this means that there are no standardize scrap metal prices. It was further established by the scrap metal workers that the unstable nature of the scrap metal prices is “worrying” and thus this might discourage their motivation in conducting the scrap recycling activities.

5.1.2 Income sufficiency and reliability

Global efforts to reduce poverty is clearly corroborated by the adoption of the UN sustainable development goals which (SDGs) which was built on the millennium development goals (MDGs). The target of the MDGs was to reduce by half the proportion of people who live on less than 1.25 US dollars a day. Earlier part of the thesis has indicated that the income of the scrap pickers, who are at the bottom of the value chain (income distribution of scrap metal workers varies with one’s progression within the value chain) is about GH¢ 30 daily, which is higher than the current daily minimum wage (GH¢8).

By implication, what this means is that despite its environmental health threats, the business is a lucrative venture to enter into and income earned can meet the basic needs of life. In regard to the scrap dealers, the discussion thus far suggests that they are able to get enough and also able to use some of the proceeds to make investments and support their external families. Again, this is not to lose sight of the precarious environment within which the business operates which is characterized by price volatility and wavering

income situation. This trend therefore has the potential of creating an atmosphere of unease in the minds of scrap workers and can discourage their enthusiasm in the trade.

Another remarkable observation was that the income from the scrap business was unreliable in comparison to the minimum wage of an employee in the formal sector who received a regular monthly salary, albeit it was more than the later in most cases. The study revealed that unreliability of income is attributed to the price fluctuation and continuous risk of exhaustion of scraps in houses, refuse dumpsite and landfill sites. By implication if the accumulated scrap metals ran out, leaving the scrap workers with a sense of income insecurity and for that matter the scrap metal trade in Tema- Ashaiman Metropolis would be under threat. However, this is to say that their income reliability depended on the continual inflow of scrap metals.

5.2 General comment on environmental health risks

There are phases to scrap metal/e-waste business at Tema-Ashaiman Metropolis. The first is the poor environmental conditions within which workers work in and the second is the myriad of economic opportunities ready to be harnessed. However, how will an insider perceive these two contrasting situations? The following discusses informants' perspective of these two contrasting issues. Almost all informants interviewed did indicate that the present environmental conditions posed severe health threat to them. Clarifying why they continue to involve in scrap metal recycling considering their views on the health consequence, they "unitedly" argued that they have no better alternative source of livelihood.

5.3 Health impacts perceived by respondent

Most studies have shown that "informal" scrap metal recycling activities stand a high risk of exposure of respiratory irritation, coughing, physical injuries, cancer clusters

and even death arising out of accidents (Prakash and Manhart, 2010). A country environmental analysis conducted in Ghana by the World Bank estimates that poor resource management generally costs Ghana about 10% of GDP, with 4% due to air and water pollution (World Bank, 2007). In addition, Ghana Medical Association also re-echoed that about five million children die annually from illnesses caused by their locality in which they live (World Bank, 2007).

The study sought to find out from informants if they had knowledge about ailment or health threatening situation associated with their activities and whether they had personally experienced these conditions in the course of their business. The discussion revealed that almost all informants had an idea of the health effect associated with their engagement with the activity. In regard to personal experiences with these conditions, variation was shown in the course of the various interviews. For instance, 7 of the informants indicated that they normally get respiratory problems. 3 of the informant indicated that they normally get body pains as a result of their engagement in the business. 5 indicated that they get malaria and 15 also indicated they have had various forms of injuries in the course of engaging in the work. Thus, it was apparent that exposure to injury was a major health risk associated with the business.

The study findings are in synch with studies such as Lakoff and Johnson (2008) which showed that continuous carrying of heavy loads can cause musculoskeletal injuries. This is true, because all of their activities present obvious risk factors. However, when asked about what type of medical treatment they apply. Majority of the respondents mentioned that they preferred self-medication rather than the formal medical treatment. Perhaps due to their nature of work, they hardly have time to spend at the health facilities. By implication, it seems they are not fully in appreciation of the severity of the health impacts associated with their work.

Abdul threw more light on the side effects of the scrap business, saying:

It is a difficult thing to do because sometimes the metals can hit your head, eyes and other parts of your body. At times, we cough so much after work and have sleepless nights. But we cannot stop it because we get money from it [A 20years dismantler/scrap picker at the Ashaiman scrap site]

The side effect of the scrap metal business has on the people and the public is a major concern that needs to be looked at, especially when there are dire health and environmental consequences. For instance, even though the place is very unhygienic, food vendors and fruit sellers carry their wares around for the public to buy and eat. Also, livestock such as cattle, sheep, goats, feed on piles of refuse that are dumped around. These animals are later slaughtered and their meat sold to members of the public. There are no figures to show the number of deaths that result from the risky lifestyle in this area but it is certain that many lives are lost every now and then

5.4 Sources of health risks in scrap metal business

The study further sought to find out informants' opinion in regard to sources of major health problems associated with their activities. This issue was important as it can be easily related to specific health concerns prevalent among workers within the scrap business. After talking to the entire informants, it was revealed that 18 out of the 30 informants alluded to air pollution and noise pollution which is as a result of the constant open burning and dismantling of scraps to extract precious fractions (copper, aluminium etc.). Further, 9 of the informants expressed the opinion that poor sanitation to them was a major environmental problem that did affect their health conditions. However it can be conclude that the situation about poor sanitation is due to the fact that there are inadequate sanitation facilities to informal settlement like Ashaiman characterized with the poor layout. In addition the organizational structures of the chain of scrap activities have aggravated the situation.

5.5 Improving scrap metal recycling

5.5.1 Stakeholders' standpoint

The study engaged some stakeholders from the Ministry of Trade and Industry (MTI), Tema Metropolitan Assembly (TMA) and the Environmental Protection Agency (EPA) in an in-depth interview in order to seek their stands on how to ensure the scrap metal recycling industry in Ghana. During interaction with a senior officer from the EPA, he disclosed that in order to exploit the opportunities and simultaneously mitigate pollution, good policies are needed that facilitate the creation of an infrastructure, ensure that all collected scrap metal is treated using state-of-the-art technologies. He stated;

Currently, there are no state-of-the-art and effective mechanism in place that regulates on how their activities are conducted, in an environmentally sound manner so as to prevent adverse environmentally and health effects. He further added the national scrap metal legislation is still pending approval and hopefully when approved such practices would be a time of the past. [A 45-year old, environmental officer at EPA].

However, it was discovered that the Agency often exposes scrap metal workers and the general public to possible harmful effects and as such there was the need to address this problem through public forums to educate and create awareness as well as mainstreaming environmental issues into developmental plans from the community to regional and then to the national level. In addition, an industrial promotion officer from the Ministry of Trade and Industry also revealed that the scrap metal trade is generating income and employment for the economy. They therefore advocate for the promulgation of scrap metal legislation to regulate their activities as well as a routine visitation among the stakeholder involved.

The Assembly (TMA) also made a remarkable contribution. Not surprisingly, an officer stated that:

Scrap pickers tend to steal metals (gutter covers, electrical cables etc) from the built environment due to the income lucrative nature of the business, for example metal used in designing tombs are stolen by these boys in community nine cemetery. In most cases complains coming from communities of their stolen containers etc. Replacing these items is very costly and suggested that all metal sold and bought should have some form of receipts or documents backing it [A member of the task force at the TMA office].

5.5.2 Community's standpoint

As already been established, the informal scrap metal recycling sector provides employment opportunities to thousands of individuals in the Ghanaian economy as well as supported the formal waste collectors' companies. Discussion with community's members attested for the rationalization of the scrap trade, optimal through the formation of cooperatives desirable around their institutionalized association. However, the study revealed that a professional association - the Greater Accra Scrap Dealers Association (GASDA) formed by the scrap dealers. Membership is open to all but not mandatory and no requirement is needed. Field checks revealed that more than 1,500 individuals were registered with the association. New entrants obtained association membership and were supposed to pay monthly dues and make contributions when the need arises. For the youthful, inexperienced and vulnerable workers, membership offered solidarity and 'provisional shelter'. A member cited social, economic and security benefits of joining the Association, resonating;

Although we have an informal association formed based on ethnic groups/ places of origin, I also have a membership with the Grater Accra Scrap Dealer Association (GASDA).The GASDA supports members when they are getting married, out-dooring and also when a member is bereaved etc and more importantly, fall upon when we have police cases. [A 39 year old member of GASDA at Ashaiman scrap yard].

During the study, majority of the respondents (90%) cited organized association as an important option for achieving a more sustainable scrap metal industry. Oteng-Ababio and Amankwaa (2012) made a strong argument for a ‘federated model’-integrating the formal and informal on the principle of comparative advantage, which consensus with that of the study. The cooperative, they opined will provide a formidable force that will represent the scrap workers at local level coupled by partnering government in a manner of tailoring out appropriate measures without creating disaffection to both parties. Whereby, the informal sector must be encouraged to concentrate on the collection, disassembly and segregation of scrap metal based on their adequate experience, knowledge and networks while the formal sector concentrates in ensuring the using of state-of-the-art technologies and good polices.

5.6 Summary

This chapter assessed the socio-economic aspect on the livelihood of participants’ involved in the scrap metal recycling, by focusing on how scrap metal prices are fixed, sufficient, reliability and sustainability of the trade. The final part also focused on the perceived environmental and occupational health hazards from the scrap metal recycling. It however seeks the opinion on the sustainability of the practice. The scrap metal workers object to any attempts to ban their operation and rather call for rationalization of their trade through formation of cooperative despite the stakeholders outlined some negativities associated with the trade. These findings complicate the trade and provide updated information on the industry that will help local and city authorities to develop appropriate policy interventions that will help increase the awareness and willful participation. The next chapter presents the general conclusion and suggested recommendation for the study.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

6.0 Introduction

This chapter is the concluding part of the study. The first part gives a broad summary accompanied by the main conclusion in line with objectives presented in chapter one for the study. The final part suggested some recommendations for policy consideration.

6.1 Summary of major findings

Evidences provided by the study conclude that the informal recycling activity is not just a livelihood strategy but a potential opportunity to alleviate most Ghanaian urban poor below the poverty line. As far as there is a high demand of second-hand product due to the fact that the majority of Ghanaian populace patronized these products it tend to establish a positive relationship between the scrap metal recycling and hence boost up the informal scrap metal sector.

In regards to the prospect and opportunities of scrap trade the results showed that it was easier for individuals with little or no education and capital to venture into the trade. It is dominated by men due to its labor nature. However the current scrap metal practice in Tema-Ashaiman Metropolis has increased the mainstream economic activities for a number of individuals to find themselves various strategies to improve their living condition in the urban space. Due to its lucrative nature, it has created networks capital and other supporting services such as daily hiring of handcarts and trucks, sales of operational tool kits (hammer, chisel etc.) food and water vendors (Oteng-Ababio, 2012). The study however also has fully appreciated how scrap metal recycling have increased the mainstream economic activities both locally and globally, where scraps are reused,

reprocessed or broken down as feed-stock of primary materials in the production of new products (Oteng-Ababio, 2012b).

There are profit elements and socio-economic dimensions to the issue of informal recycling of scrapping metal in Ghana. Indeed it's true that the current practices in Tema-Ashaiman Metropolis remain a major source of livelihood for many of the urban poor, especially the migrant youth with very little or no education or capital. Also, most of the scrap workers are able to accumulate income and remittent regularly to their families/dependents. The findings revealed that there are different kinds of remittances ranging from cash, farm inputs, and household appliances amongst others.

Suffices it was revealed that, the income of the participants was insufficient; due to the price volatilities of scrap metal which has made it seems the trade has no potentials to improve the living conditions of the participants but it incomes are reliable to meet their basic needs, however the findings shows that their average monthly income is higher than the minimum wage of an untrained employee in the formal sector.

In addition the findings also revealed that the informal scrap metal industry save the city of its waste management budget by handling such large quantities of waste that would otherwise have to be collected and disposed of by city authorities.

It is also true that there are some environmental challenges and health threats associated with the activities in Tema-Ashaiman Metropolis. Scrap metal participants are exposed to several risk and hazards associated with the trade due to its working conditions such as injuries, cuts, body pains and inhaling of toxic substance of the participants and the local residents, during the scrap metal recycling processes.

All participants lack insurances to cover the nature of their work as wellas there was no provision made for their social benefits as compared to untrained workers in the formal sector. The findings of the study on the risk perceptions among respondents are

consistent with the result of earlier studies elsewhere (Agyei-Mensah and Oteng-Ababio, 2012).

6.2 Conclusion

The urban mining literature gives a good insight into the current practice in the Tema-Ashaiman Metropolis. A characteristic of the informal economy, the scrap metal business is easy to enter, requires little or no initial income. It requires no special skills or apprenticeship before one can start the trade.

The SL frame work's analysis provides an insight on how the scrap workers strive in their day to day activities with the focus on what is available to them (their financial, physical strength, opportunities, and social networks, etc.), assets, vulnerabilities, and their coping mechanisms.

Their operations provide raw materials for the steel industry for the manufacture of iron rods, roofing sheets which are used for construction works; which saves the government from spending foreign exchange on the importation of raw materials (billets) and hence ensure the steelworkers sustained their jobs.

In addition, their operations also sought to increase the mainstream economic activities for a number of individuals thus the practices have engaged supporting services such as daily hiring of handcarts, trucks, sales of operational tool kits, food, and water vendors, etc.

Other beneficiaries include the families/dependents of migrant scrap workers who receive remittances in the form of cash transfer through mobile money, electronic appliance, domestic items, capital goods, and farm inputs. On the whole, it can be stated that the scrap business has been very beneficial to the scrap workers especially as well as positively impacted the lives of the people.

It was further established that the scrap business is a tedious, labor intense. It involves long hours of a walk- in search of scrap metals, loading, and off-loading heavy metals, pushing of hand carts, etc.

The income of the participants seems to be insufficient; due to the price volatilities of scrap metal which has made the trade to have no prospect and potentials to improve the living conditions of the participants however it incomes are reliable to meet their basic needs as compared to an untrained employee in the formal sector.

Their current operations generally pose a lot of environmental- health hazards to the lives of participants and their immediate environment. Such threats include high risk of exposure of respiratory irritation, coughing, physical injuries, cancer clusters and even death arising out of accidents. In addition, the scrap worker faces a lot of risk in their line of duty such as frequent Police arrests, public embarrassment and disrespect for their work, etc.

Despite the risky nature of their work, it presents a satisfactory reward to the participants involved in the scrap business. Firstly, it offers the scrap workers with employment which enable them to cater for their basic warrant of life. To extension provides financial support to their families/dependents. Others have acquired properties through the scraps business. It has also offered some scrap workers enough savings to invest in other income generation activities.

In conclusion, the current scrap business in TAM remains a major source of livelihood for many of the urban poor especially the migrant youth from the Northern Region of Ghana with very little or no education or capital. It is alleged that the informal scrap recycling industry has engaged some of the country's unemployed youth. It also serves as a source of supply for the raw materials for the steel industries in Ghana.

Overall, the scrap metal recycling industry has proven to be an important ally rather than the magnitude of the dilemma and thus must be encouraged

6.3 Recommendation

Scrap metal recycling has been seen to play a pivotal role in environmental protection, conservation and sustainable development (Gordon et al., 2006). There is an enormous potential of growth for the metal industry in the international market. Therefore policy makers should appreciate the fact that the informal nature of the trade is not a challenge to urban development but rather as part of sustainable industrialization process which needs much attention. To make the scrap metal trade industry more sustainable and beneficial to reducing environmental and health risks associated with the trade, the following recommendations based on the findings can help improve the current practice in Tema-Ashaiman Metropolis.

6.3.1 Systemic approach

There is a need to adopt a wide, systemic approach based on understanding the industrial and socio-economic factors driving the recycling industry. This approach would empower the capacity of the poor to make choices for their socio-economic status as well as formalizing their work by adopting a registration mechanism and formation of association at each processing stage which are collection, storage, segregation, recycling and marketing. It is true their daily incomes are comparatively high to that of the formal sector but they are faced with the burden of high living standards in the urban centers and furthermore their income dynamics. The additional expenditure incurred will put pressure on their finances. Therefore informal-formal integration may result in issue of taxes which must be done with caution, considering their income rates.

The study also concedes with the proposal of Oteng-Ababio and Amankwaa (2012) for a federated model that integrates the formal and informal sectors on the principle of

comparative advantage. They envisage a situation where the formal sector concentrates on providing the-state-of-the art-technologies whereas the informal sector concentrates on collection, disassembly, and segregation of which they have adequate knowledge, experience and networks. The participation of stakeholders which includes ministry of trade and industry, ministry of environment, science, technology and innovation, ministry of health and the environmental protection agency (EPA) must become more salient.

For instance, the ministry of trade and industry has a vital role to play by creating awareness among the various groups through education on the importance of social benefit and encourage scrap metal workers to enroll into the scheme so as to solve the issue of social security and insurance against occupational hazards associated to their work if formal-informal integration is achieved. Moreover, the EPA also must be avail to create an enabling environment for the smooth operation and formalization procedures by embarking on sensitization drives. For examples, the EPA must create awareness on the health and environmental impacts associated with their job and also identify the disparity between their perceptions and what is reported in literatures.

6.3.2 Reformed policies

The implementation of policies and regulations should take into consideration the importance of all stakeholders as well as harmonizing their difference to avoid exploitation among them. Thus, the formal-informal integration should build more inclusive, sustainable polices and should be strictly adhered to. In view of this integration, all stakeholders involved should dialogue and design policies and regulations that will addresses issues related to the scrap recycling trade which involves price fluctuations, scrap metal price, environmental and health impact and provision of personal protective equipment (PPEs) in the form of credits to the scrap metal workers. Moreover, policy makers should take the leading role in designing targeted policies of multi-dimensional

scope on the trade which includes the current form of networks the trade has assumed. There should be streamlined attempts to regulate the importation of products most likely to be non-repairable and therefore waste of such products should be of most serious concern.

6.3.3 Income diversification

Scrap metal workers should be encouraged and empowered to diversify their income generating activities by undertaking other income activities such as agriculture (farming) and other commercial businesses so as to cope with external stresses of scrap recycling activities. The main reason for this suggested recommendation is to provide them with an additional income to enable them to survive in an urban economy which is characterized by high living standards due to the income dynamics of these scrap metal workers as well as a source of income even if scrap metal recycling is to be halted.

REFERENCES

- Agyei-Mensah, S., & Oteng-Ababio, M. (2012). Perceptions of health and environmental impacts of e-waste management in Ghana. *International journal of environmental health research*, 22(6), 500-517.
- Alloway, B. J. (1990). *Heavy Metals in Soil*, John Wiley & Sons. Inc., New York, USA, 1, 990.
- Amankwaa E, F. (2013). *Livelihoods in risk: exploring health and environmental implications of e-waste recycling as a livelihood strategy*. *Journal of Modern African Studies* 51, 551–75.
- Amankwah, E. F, Tsikudo, A. K. A., & Bowman, K. (2016). Analysis of e-waste livelihoods and blood lead levels at Ghana's recycling hub, Agbogbloshie. Working Paper. E-33113-GHA-1.
- Amoyaw-Osei, Y., Agyekum, O. O., Pwamang, J. A., Mueller, E., Fasko, R., & Schluep, M. (2011). Ghana e-waste country assessment. *SBC e-waste Africa project, 20111111*.
- Anyinam, C. (1994). Spatial implications of structural adjustment programmes in Ghana. *Tijdschrift voor economische en sociale geografie*, 85(5), 446-460.
- Asante KA, Agusa T, Biney CA, Agyekum WA, Bello M, Otsuka M, et al. (2012). *Multi-trace element levels and arsenic speciation in urine of e-waste recycling workers from Agbogbloshie, Accra in Ghana*. *Sci Total Environ* 424:63–73.
- Ashley, C., & Carney, D. (1999). Sustainable Livelihoods: Lessons from Early Experience [Internet]. Available from: <<http://www.eldis.org/vfile/upload/1/document/0902/DOC7388.pdf>> [Accessed 22 December 2015].
- Baldé, C. P., Wang, F., Kuehr, R., & Huisman, J. (2015). *The global e-waste monitor—2014*. Bonn, Germany: United Nations University, IAS –SCYCLE
- Barbara K. R., & Graedel, T. E. (2012). *Challenges in Metal Recycling*. *Science*, 337(6095), 690-695.
- Bennett, L. (2008). Assets under attack: metal theft, the built environment and the dark side of the global recycling market. *Environmental law and Management*, 20, 176-183.
- Bergbäck, B., Johansson, K., & Mohlander, U. (2001). Urban metal flows—a case study of Stockholm. Review and Conclusions. *Water, air and soil pollution: Focus*, 1(3-4), 3-24.

- Bohr, P. (2007). *The Economics of Electronics Recycling: New Approaches to Extended Producer Responsibility*. PhD thesis, Technischen Universität, Berlin, Germany.
- Brigden, K., Labunska, I., Santillo, D., & Johnston, P. (2008). *Chemical contamination at e-waste recycling and disposal sites in Accra and Korforidua, Ghana*. Greenpeace International, Amsterdam.
- Broni-Sefah, K. (2012). *A Study of the Scrap Metal Trade in the Kumasi Metropolitan* <http://ir.knust.edu.gh/bitstream/123456789/5842/1/KWASI%20BRONI-SEFAH.pdf>.
- Bryman, A. (2008). *Social Research Methods. Third Edition*. New York, Oxford University Press.
- Caravanos, J., Clark, E., Fuller, R., & Lambertson, C. (2011). "Assessing Worker and Environmental Chemical Exposure Risks at an e-Waste Recycling and Disposal Site in Accra, Ghana." *Blacksmith Institute Journal of Health and Pollution* 1.1: 16-25.
- Carney, D. (Ed) (1998). *Sustainable Rural Livelihoods. What contribution can we make?* London: Department for International Development.
- Coe, N. M., Dicken, P., & Hess, M. (2008). *Global production networks: realizing the potential*. *Journal of Economic Geography*, 8(3), 271–295.
- Coetzee, B., & Horn, R. (2007). *The theft of precious metals: from South African mines and refineries* (No. 133). Institute for Security Studies.
- Creswell, J. W. (2009). *Designing and conducting mixed methods research* (2nd ed.). Thousand Oaks, CA: Sage.
- Cui, J., & Zhang, L. (2008). *Metallurgical Recovery of Metals from Electronic Waste: A Review*. *Journal of Hazardous Materials*, 158, 228-256.
- Daum, K., Stoler, J., & Grant, R. (2017). *Toward a more sustainable trajectory for E-waste Policy: A review of a decade of E-waste research in Accra, Ghana*. *International journal of environmental research and public health*, 14(2), 135.
- DFID (2007). *The DFID approach to sustainable livelihood in a nutshell*. Available: <http://www.poverty-wellbeing.net/media/sla/docs/2-1.htm> Assessed on 16th October, 2015
- DHHS (2005). *U.S. Department of Health and Human Services (DHHS), Public Health Service, National Toxicology Program: Report on Carcinogens, Eleventh Edition*
- Dowa. (2008). *Annual Report*. Tokyo: Dowa Holdings.

- Doyon-Martin, J. (2015). *Cybercrime in West Africa as a Result of Transboundary E-Waste*. [Journal of Applied Security Research](#) Volume 10, 2015 - [Issue 2](#).
- Emery, A., Griffiths, A. J., & Williams, K. P. (2000). Analysis of waste entering a typical small landfill site in the South Wales Valleys—phase 2. *Cardiff University, report*, (2683).
- Farrington, J., Ramasut, T. & Walker, J. (March 2002). Sustainable Livelihoods Approaches in Urban Areas: General Lessons, with Illustrations from Indian Cases. Retrieved from: http://www.sida.se/contentassets/c85be1c3fc0e4a139c59cf86090429e0/sustainable-livelihoods-approaches-in-urban-areas_1153.pdf on 23/06/2015.
- Fenton, M. D. (1998). Iron and steel recycling in the United States in 1998., U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.
- Fofana, I. N. (2009). A Socio-economic sustainability assessment of the livelihoods from scrap metal collection in Freetown, Sierra Leone. MSc. Thesis Lund University Center for Sustainability Studies, Sweden.
- Foulke, E. G. (2008). Guidance for the identification and control of safety and health hazards in metal scrap recycling. Occupational Safety and Health Administration, US Department of Labour. OSHA 3348-05.
- Gayathri, K. D., Dwarakish, G. S., & Ganasri, B. P. (2015). A Review on Hydrological Models. *Aquatic Procedure*, doi: 10.1016/j.aqpro.2015.02.126
- Ghai, D., Godfrey, M., Hepple, B., Kuruvilla, S., & Saith, A., (2006). Pedagogical materials on decent work. International Institute for Labour Studies, Geneva, Switzerland.
- Ghana Ports and Harbours Authority (2014). *Port Overview*. GPHA Press, Tema, Ghana.
- Ghana Statistical Service (2005). PHC National Analytical Report, GSS. Accra
- Ghana Statistical Service (2014). 2010 PHC National Analytical Report, GSS. Accra
- Ghana Statistical Service, (2012). 2010 Population and housing census. Summary report of final results, <http://www.statsghana.gov.gh/2010phc/Census2010>.
- Gibbon, P. (2001). *Upgrading Primary Production: A Global Commodity Chain Approach*. *World Development*, 29(2), 345-363, 2001
- Gillespie, A. (2015). *New Horizon in Environmental and Energy Law*. Published by Edward Elgar Publishing Limited, Cheltenham, UK Northampton, MA, USA.
- Glaser, B. G. (1998). *Doing grounded theory: Issues and discussions*. Mill Valley, CA: Sociology Press.
- Gordon, R. B., Bertram, M., & Graedel, T. E. (2006). Metal stocks and sustainability. *Proceedings of the National Academy of Sciences*, 103(5), 1209-1214.

- Goodman, L. A. (2011, August). Comment: on respondent-driven sampling and snowball sampling in hard-to-reach populations and snowball sampling not in hard-to-reach populations *Sociological Methodology*. *Volume 41, Issue 1*, pp.347–353.
- Grant, R. & Oteng-Ababio, M., (2010). “Waste Africa?” The Accra E-waste Hub in an International and Urban Space Economy (Forth-coming, *Urban Geography*).
- Grant, R., & Oteng-Ababio, M. (2016). *The global transformation of materials and the emergence of informal “urban mining” in Accra, Ghana*. *AfricaToday*, 62(4), 3–20.
- Grant, R., & Oteng-Ababio, M., (2012). *Mapping the invisible and real African economy: urban e-waste circuitry*. *Urban Geography* 33 1–21.
- Greenpeace International, (2008). *Poisoning the Poor – Electronic Waste in Ghana*, available from Greenpeace International website
at <http://www.greenpeace.org/international/en/news/features/poisoning-the-poor-electronic/>
- Haefliger, P., Mathieu-Nolf, M., Locicero, S., Ndiaye, C., Coly, M., Diouf, A., Faye, A.L., Sow, A., Tempowski, J., Pronczuk, J., Filipe Junior, A. P., Bertolini, R. & Neira, M. (2009). Mass lead intoxication from informal used lead-acid battery recycling in Dakar, Senegal. *Environmental Health Perspective*, 117(10), 1535-1540
- Hans De Keulenaer (2016). European Copper Institute (ECI) eci@copperalliance.eu. Katrien Delbeke [Accessed on 14 July 2016]
- Hellstrom, L., Elinder, C. G., Dahlberg, B., Lundberg, M., Jarup, L., Persson, B. & Axelson, O. (2001). Cadmium Exposure and End-Stage Renal Disease. *American Journal of Kidney Diseases*, 38(5), 1001-1008.
- Hoeltl, A., Brandtweiner, R., & Muller, R., (2017). Approach to Solving the E-waste Problem – Case Study Ghana. *Int. J. Sus. Dev. Plann.* 12(6), 1050–1060.
- Holmes, J. (1999). “Measuring the Determinants of School Completion in Pakistan: An Analysis of Censoring and Selection Bias.” Economic Growth Center Discussion Paper 794, Yale University, New Haven.
- ISRI, Scrap Yearbook. (2014) www.isri.org. [Accessed 10 January, 2016].
- Javid, A., & Essadiqi, E. (2003). Final Report on Scrap Management, Sorting and Classification of Steel. Report No. 2003-23(CF) The Government of Canada Action Plan 2000 on Climate Change Minerals and Metals Program.

- Jorge-Morales-Pedraza (2014) A New Organizational Structure for the International Atomic Energy Agency(IAEA)<http://link.springer.com/search?facet-creator=%22Jorge+Morales+Pedraza%22> . [Accessed on 14 July 2016]
- Jorgensen, D. L. (2015). Participant observation. Emerging trends in the social and behavioral sciences: An interdisciplinary, searchable, and linkable resource, 1-15.
- Kahn, A., (2016). *E-products, E-waste and the Basel Convention: Regulatory Challenges and Impossibilities of International Environmental Law*.
- Kaseva, M. E.,& Gupta, S. K. (1996). Recycling - an environmentally friendly and income generating activity towards sustainable solid waste management. Case study - Dar es Salaam City, Tanzania. *Resources, conservation and recycling*, 17 (4), 299-309.
- Kimani, N. G. (2007). Environmental pollution and impact to public health; Implication of the Dandora Municipal Dumping site in Nairobi, Kenya. A pilot study report in cooperation with the United Nations Environment Programme (UNEP), Nairobi, Kenya.
- Kirchner, H. (1968). High-resolution magneto-optical observation of magnetic structures in superconductors. *Physics Letters A*, 26(12), 651-652.
- Kopsick, D., Chen, S. Y., Turner, R., Magold, M.,& Pope, R. B., (2005). International approach to monitoring for radioactively contaminated scrap metal. WM'05 Conference, Tucson, AZ.
- Kumekpor, T. K. (2002). *Research Methods & Techniques of Social Research*. Accra: Son Life Printing Press & Services.
- Labban, M. (2014). *Deterritorializing Extraction: Bioaccumulation and the Planetary Mine*. *Annals of the Association of American Geographers* 104(3), 560–76.
- Lakoff, G.,& Johnson, M. (2008). *Metaphors we live by*. University of Chicago press.
- Legler, J.,&Brouwer, A. (2003). Are brominated flame retardants endocrine disruptors?.*Environment International*, 29(6), 879-885.
- Lepawsky, J.,&Billah, M. (2008). Making chains that (un)make things: waste–value relations and the bangladeshi rubbish electronics industry. *GeografiskaAnnaler: Series B, Human Geography*, 93 (2), 121-139.
- Lepawsky, J. (2015). The changing geography of global trade in electronic discards: time to rethink the e-waste problem.*Geography. J.* 181 (2), 147–159.
- Minter, A. (2013). US isn't flooding the Third World with E-waste.
- Morrison, J. (2017). *DSM-5 made easy: The clinician's guide to diagnosis*. Guilford Publications.

- Moser, C. (1996). *Confronting crisis: A comparative study of household responses to poverty and vulnerability in four urban communities*. Washington DC: ESD.
- Moyes, R. (2008). Perspectives from Lao PDR: scrap metal, economics & risk. Policy and Research Director, Landmine Action.
- MuchováL.,& Eder P., (2010). End of waste criteria for iron and steel scrap: Technical Proposals. Joint Research Centre – Institute for Prospective Technological Studies. Luxembourg: Publications Office of the European Union.
- Nanjyo, M.(2014). *Urban Mine, new resource for the year 2000 and beyond*. Bulletin of the research institute of Mineral Dressing and Metallurgy. Tohuko University 43, 239 251.
- Norgate, T.,&Hauge, N. (2009). Energy and greenhouse gas impacts of mining and mineral processing operations. *Journal of Cleaner Production* (18), 266–274.
- Noy, C. (2008). Sampling knowledge: The hermeneutics of snowball sampling in qualitative research. *International Journal of social research methodology*, 11(4), 327-344.
- Nsokimieno, E. M. M., Shouyu, C.,& Qin, Z. L. (2010). Sustainable urbanization's challenge in Democratic Republic of Congo. *Journal of Sustainable Development*, 3(2), 242.
- Okolo, I., (2013). *E-waste management in Accra Examining informal workers and informal-formal linkages for sustainable recycling*. A dissertation is submitted as part of a MA degree in Environment and Development at King's College London. Retrieved online
<https://www.kcl.ac.uk/sspp/departments/geography/study/masters/dissertations/dissertation-2013-okolo.pdf>.
- Oteng-Ababio, M (2018). Crossing conceptual boundaries: re-envisioning coordination and collaboration among women for sustainable livelihoods in Ghana, Local Environment, doi.org/10.1080/13549839.2017.1418847
- Oteng-Ababio, M.,&Amankwaa, E. F. (2012). E-waste Blue in Ghana:A New World,New Waste, New Challenge. *International Development Planning Review* (Forthcoming)
- Oteng-Ababio, M. (2007). Private-public Partnership in Solid Waste Management in the Greater Accra Metropolitan Area. (Ph.D. thesis, University of Ghana, Legon).
- Oteng-Ababio, M. (2010). E-waste: an emerging challenge to solid waste management in Ghana. *International Development Planning Review*, 32(2), 191-206.

- Oteng-Ababio, M. (2012). Electronic e-waste management in Ghana: issues and practices. *In: eds. Curkovic, S and Cao, J. Sustainable Development – Authoritative and Leading Edge Content for Environmental Management*, Rijeka, Croatia: InTech, 149-166.
- Oteng-Ababio, M. (2012). When necessity begets ingenuity: E-waste scavenging as a livelihood strategy in Accra, Ghana. *African Studies Quarterly*, 13(1-2), 1-21.
- Oteng-Ababio, M.. (2014). *Rethinking waste as a resource: insights from a low-income community in Accra, Ghana*. *City, Territory and Architecture* 1 1–14.
- Oteng-Ababio, M., (2017). New wines, old bottles? Cities in the global South and the Sustainable Development Goals, *Ghana Journal of Geography*. 9(2), 175–196.
- Oteng-Ababio, M., Amankwaa, E.F., & Chama, M.A. (2014). The local contours of scavenging for e-waste and higher-valued constituent parts in Accra, Ghana. *Habitat International*. 43, 163-171.
- Oteng-Ababio, M., Owusu G., & Chama M. (2015). “Intelligent Enterprise: Wasting, value and re-valuing waste electrical and electronic equipment. <http://dx.doi.org/10.1111/geoj.12140>.
- Oteng-Ababio, M., Amankwaa, E., & Chama, M. (2014). The Local Contours of Scavenging for E-Waste and Higher-Value Constituent Parts in Accra, Ghana. *Habitat International* 43, 163–71.
- Owusu, G., & Oteng-Ababio, M. (2015). *Moving unruly contemporary urbanism toward sustainable urban development in Ghana by 2030*. *American Behavioral Scientists (ABS)*, 59(3), 311–327.
- Peters, J. (2011). Regulators, Recyclers and Retailers Build “Urban Mining” Industry. <http://www.nytimes.com/cwire/2011/04/22/22climatewire-regulators-recyclers-and-retailers-build-urb-62592.html?pagewanted=all>.
- Prakash, S., & Manhart, A. (2010). *Socio-economic assessment and feasibility study on sustainable e-waste management in Ghana* (Published by Öko-Institute of Applied Ecology, Freiburg,).
- Qu, W., Bi, X., Sheng, G., Lu, S., Fu, J., Yuan, J., & Li, L. (2007). Exposure to polybrominated diphenyl ethers among workers at an electronic waste dismantling region in Guangdong, China. *Environment International*, 33(8), 1021-1028
- Richards, J. (2006). “Precious” metals: The case for treating metals as irreplaceable. *Journal of Cleaner Production*, 14 (3-4), 324-333.

- Saumure, K., & Given, L. (2008). Data saturation. In L. Given (Ed.), *The SAGE encyclopedia of qualitative research methods*. (pp. 196-197). Thousand Oaks, CA: SAGE Publications, Inc.
- Scheinberg, Anne, Michael, H., Simpson, YaminiGupt, et al (2010): “*Economic Aspects of the Informal Sector in Solid Waste.*” GTZ (German Technical Cooperation), Eschborn, Germany.
- Schluep, M., Hagelüken, Meskers, C. E. M., Magalini, F., Wang, F., Müller, Kuehr, R., Maurer, C.,&Sonnemann, G. (2009). Market potential of innovative e-waste recycling technologies in developing countries. *In: R’09 World Congress, Davos 14 -15, September* [n.p.]: [n.p.].
- Senfuka, C. (2011). Sustainability and value of steel recycling in Uganda. *Journal of Civil Engineering and Construction Technology*. 2(10): 212-217.
- Sepúlveda, A., Schluep, M., Renaud, F. G., Streicher, M., Kuehr, R., Hagelüken, C.,&Gerecke, A. C. (2010). A review of the environmental fate and effects of hazardous substances released from electrical and electronic equipments during recycling: Examples from China and India. *Environmental impact assessment review*, 30(1), 28-41.
- Simon, J. A., & Kingston, R. E. (2013). Occupying chromatin: Polycomb mechanisms for getting to genomic targets, stopping transcriptional traffic, and staying put. *Molecular cell*, 49(5), 808-824.
- Sjödin, A., Patterson, D. G.,& Bergman, Å. (2003). A review on human exposure to brominated flame retardants—particularly polybrominateddiphenyl ethers. *Environment International*, 29(6), 829-839.
- Szerszynski, B. (2012).”The End of the End of Nature: The Anthropocene and the Fate of the Human”, *The Oxford Literary Review* 34(2), 165-184.
- Thagaard, T. (2002). *Systematics and empathy. An introduction to qualitative methods*. Fagbokforlaget:Oslo.
- Toner, A., & Franks, T. (2006). Putting livelihoods thinking into practice: implications for development management. *Public Administration and Development: The International Journal of Management Research and Practice*, 26(1), 81-92.
- Tiwari, A., Farnsworth, M. & Liu, Y., (2017). *A review of optimisation techniques used in the composite recycling area: State-of-the-art and steps towards a research agenda*. School of Aerospace, Transport and Manufacturing, Cranfield University, Cranfield, MK43 0AL, United Kingdom.

- Tsikata, D., Fenny, A. P., & Aryeetey E., (2008). China-Africa Relations: A case study of Ghana. Draft Scoping Study for African Economic Research Consortium.
- Turok, I. (2016). South Africa's new urban agenda: Transformation of compensation? *Local Economy*, 31(1), 9–27.
- Uddin, S. M., Walters, V., Gaillard, J. C., Hridi, S. M., & McSherry, A., (2016). *Water, sanitation and hygiene for homeless people*. *J Water Health*. 2016; 14:47-51.
- Umicore. (2011). “Technology” Metals Scarcity and Umicore's Offering. Second Quarter Report. <http://umicore.com/investorrelations/en/newsPublications/presentations/2011/2011June>
- UNEP (2010). *Metal stocks in society* (International Panel for Sustainable Resource Management, Working Group on the Global Metal Flows: United Nations Environment Programme).
- UNEP, 2014. Annual Report. Retrieved from https://wedocs.unep.org/bitstream/handle/20.500.11822/9420/-UNEP_2014_Annual_Report-2015UNEP_Annual_Report_2014_Production_LQ.pdf.pdf?sequence=3&isAllowed=y
- UNU. (2012). E-Waste: Annual Gold, Silver “Deposits” in New High-Tech Goods Worth \$21 Billion+; Less Than 15% Recovered. Press release, July 6. http://i.unu.edu/media/unu.edu/news/25814/StEP-news-release_6July2012.pdf.
- Viljoen, K., Blaauw, P. F., & Schenck, R. (2016). “I would rather have a decent job”: Potential barriers preventing street-waste pickers from improving their socio-economic conditions. *South African Journal of Economic and Management Sciences*, 19(2), 175-191. Doi: <http://dx.doi.org/10.17159/2222-3436/2016/v19n2a2>
- Warner, J. (2011). Understanding Cybercrime in Ghana: A View from Below. *International Journal of Cybercriminology*, 5 (1), 736-749.
- Wilson, D. C., Velis, C. A., & Rodic, L. (2013, May). Integrated sustainable waste management in developing countries. In *Proceedings of the Institution of Civil Engineers: Waste and Resource Management* (Vol. 166, No. 2, pp. 52-68). Thomas Telford.
- World Bank (2007) Port Reform Toolkit, 2nd ed. <http://www.ppiaf.org/documents/toolkits/Portoolkit/Toolkit/index.html> (Accessed on 26th June, 2014).

- World Bank, (2015). Rising through Cities in Ghana. Ghana Urbanization Review Overview Report. Retrieved 23rd August 2018 from <http://documents.worldbank.org/curated/en/613251468182958526/pdf/96449-WP-PUBLIC-GhanaRisingThroughCities-Overview-full.pdf>
- Yamoah, S. B. (2014). E-waste in developing country context-Issues, challenges, practices, opportunities: Addressing the WEEE Challenge in Ghana.
- Yin, R. K. (2003). Case study research: Design and methods. Third Edition. California: Sage Publications, Inc.
- Yoshida A., Terazono A., Aramaki T.,&Hanaki K. (2005). Secondary materials transfer from Japan to China: destination analysis. *Journal of Material Cycle and Waste Management*, 7, 8-15.

APPENDICES

APPENDIX 1: INTERVIEW GUIDE FOR STEEL COMPANIES

UNIVERSITY OF GHANA, LEGON

DEPARTMENT OF GEOGRAPHY AND RESOURCE DEVELOPMENT QUESTIONS FOR STEEL COMPANIES

Good morning/afternoon/evening, I am a student at Department of Geography and Resource Development; conducting a survey on “**Urban Mining as a Livelihood Strategy: The Case of Scrap Metal Trade in Tema Metropolis**”. You would therefore be contributing greatly to the success of this survey if you can set aside sometime to answer the questions here. All response made shall be kept confidential.

Time and Date	
Geographical Coordinate	
Settlement	
Name	
Age	
Sex	
Position (Steel Companies)	

The question provided below should be viewed conversation starters interviewers are encouraged to ask follow up questions based on the interviewer response.

Activity Checklist	Findings
Can you give me brief background information about your company (date of establishment, number of workers etc)?	
Why are you involved in the scrap metal trade and how do you transact your business?	
Do you know of any steel company (name, location etc)? Are you in competition for scrap metals with these other companies?	
How and where do you receive scrap metals? Are the quantity received enough to meet the company’s daily capacity?	
Do you export scrap metals outside Ghana? (mention countries)? Have you ever been forced to import scrap metal during periods of short supply? (mention countries)	
How does the scrap metal trade business support the economy? How does it contribute to participants livelihoods?	
Challenges	
What challenges do you face in your work? (with scrap traders, government, epaetc)	

What environmental and health hazards do you encounter?	
Recommendations	
What do you think can be done to improve the scrap metal trade industry in Ghana?	
How do you think environmental and health hazards arising from scrap metal can be improved?	

APPENDIX2: INTERVIEW GUIDE FOR ANCILLARY SERVICES

UNIVERSITY OF GHANA, LEGON

DEPARTMENT OF GEOGRAPHY AND RESOURCE DEVELOPMENT

QUESTIONS FOR ANCILLARY SERVICES

Good morning/afternoon/evening, I am a student at Department of Geography and Resource Development; conducting a survey on “**Urban Mining as a Livelihood Strategy: The Case of Scrap Metal Trade in Tema Metropolis**”. You would therefore be contributing greatly to the success of this survey if you can set aside sometime to answer the questions here. All response made shall be kept confidential.

Time and Date	
Geographical Coordinate	
Settlement	
Name	
Age	
Sex	
Position (Supporting services)	

The question provided below should be viewed conversation starters interviewers are encouraged to ask follow up questions based on the interviewer response.

Activity Checklist	Findings
Can you please give me brief background information about yourself? (E.g. education, marital status, house, no. of dependents etc).	
Prospects and Opportunities	
How does your business support participants involved in the scrap metal trade? How do you transact your business?	
What is your weekly/daily income from your business? Is income made from your business enough to cater for your basic needs (food, shelter, medical etc) and dependents? Do you save? Do you pay tax on your income?	
Challenges	
Are there some particular times in the year when short falls in scrap metal affect your business?	
What challenges do you face in your work? (with scrap traders, government, epaetc)	
What environmental and health hazards do you encounter?	
Recommendations	
What do you think can be done to improve your business?	

How do you think environmental and health hazards arising from scrap metal can be improved?	
---	--

APPENDIX3: INTERVIEW GUIDE FOR EPA, TMA, NGOs

UNIVERSITY OF GHANA, LEGON DEPARTMENT OF GEOGRAPHY AND RESOURCE DEVELOPMENT

QUESTIONS FOR EPA, TMA, NGOs etc

Good morning/afternoon/evening, I am a student at Department of Geography and Resource Development; conducting a survey on “**Urban Mining as a Livelihood Strategy: The Case of Scrap Metal Trade in Tema Metropolis**”. You would therefore be contributing greatly to the success of this survey if you can set aside sometime to answer the questions here. All response made shall be kept confidential.

Time and Date	
Geographical Coordinate	
Settlement	
Name	
Age	
Sex	
Position (EPA, TMA, NGOs, Min. of Trade and Industry, etc)	

The question provided below should be viewed conversation starters interviewers are encouraged to ask follow up questions based on the interviewer response.

Activity Checklist	Findings
Are you aware of the scrap trade in Tema Metropolis? Can you explain how they operate within the metropolis?	
Are metal parts being stolen from the built environment by collectors for scraps? What type of metals are being stolen? What is the cost of replacing the stolen metal parts?	
Are there environmental and health concerns about the scrap metal trade?	
Do you monitor the activities of participants involved in the scrap metal trade? In your opinion how does the scrap metal trade contributes to participants livelihood?	
Does scrap metal trade play a role in the economy of Ghana? Briefly explain	
Do you have any procedures for participants’ involved in the scrap metal trade to follow when collecting, treating and exporting scrap metals? Briefly explain the procedures.	
Challenges	
What difficulties do you encounter when dealing with participants involved in the scrap metal trade?	

What environmental and health hazards are prevalent to the workers and their immediate environment?	
Recommendation	
What can be done in order to ensure a cordial relationship between the authorities and participants involved in the scrap metal trade?	
How can we ensure that the workers involved in the scrap metal trade follow safety standard measures (collection, treatment, and exporting scrap metals)?	

APPENDIX4: INTERVIEW GUIDE FOR SCRAP

DEALERS/COLLECTORS/DISMANTLERS

UNIVERSITY OF GHANA, LEGON
DEPARTMENT OF GEOGRAPHY AND RESOURCE DEVELOPMENT

QUESTIONS FOR SCRAP DEALERS/COLLECTORS/REFURBISHERS

Good morning/afternoon/evening, I am a student at Department of Geography and Resource Development; conducting a survey on “**Urban Mining as a Livelihood Strategy: The Case of Scrap Metal Trade in Tema Metropolis**”. You would therefore be contributing greatly to the success of this survey if you can set aside sometime to answer the questions here. All response made shall be kept confidential.

Time and Date	
Geographical Coordinate	
Settlement	
Name	
Age	
Sex	
Position (Dealers/Collectors/Refurbishers etc)	

The question provided below should be viewed conversation starters interviewers are encouraged to ask follow up questions based on the interviewer response.

Activity Checklist	Findings
Can you please give me brief background information about yourself? (e.g. education, marital status, house, no. of dependents etc).	
Prospects and opportunities	
Why are you involved in the scrap metal trade and how do you transact your business? Please give brief details. Are you a registered company? Do you have any other business apart from the scrap metal trade?	
How do you get your scrap metals (any specific method)? How do you transport the scrap metal to the yard?	
Do you consider the quality of scrap metals you collect or buy? How do you assess the quality?	
How do you sell your scrap metals? (e.g Ghana Cedis, Kg, pounds etc), Who set the price of scrap metals at the point of sale?	

What is your weekly/daily income from sales of scrap metals? Is income made from sale of scrap metals enough to cater for basic needs (food, shelter, medical etc) and dependents? Do you save? Do you pay tax on your income?	
Are aware of any safety standard measures (e.g EPA procedures etc)? Do you follow these procedures?	
Challenges	
Are you aware of collectors stealing metal coverings/pipes and electrical cables? Do you think the stealing has adverse effect on the environment?	
Are there some particular times in the year when scrap metals are scarce? What risks are associated with your business?	
Are you aware of the environmental and health hazards associated with your operations?	
Recommendations	
What do you think can be done to improve scrap metal trade?	
What do you think the government can do to help the scrap trade industry in Ghana?	