

UNIVERSITY OF GHANA

**GENDER DYNAMICS OF E-WASTE MANAGEMENT PRACTICES
IN ACCRA AND KUMASI (GHANA)**

BY

ONALLIA ESTHER OSEI

(10221964)



**A THESIS SUBMITTED TO THE UNIVERSITY OF GHANA,
LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT
FOR THE AWARD OF MASTER OF PHILOSOPHY (M. PHIL)
DEGREE IN GEOGRAPHY AND RESOURCE DEVELOPMENT**

JULY, 2015



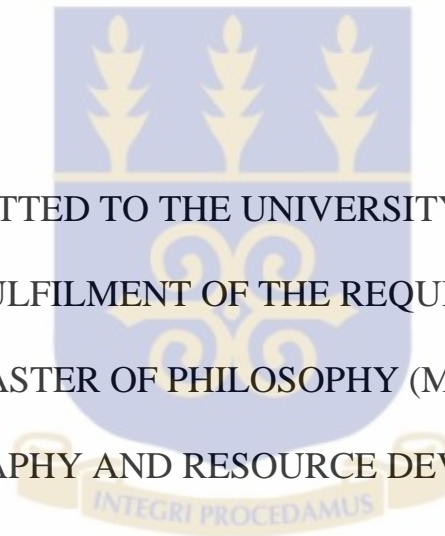
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JULY, 2015

DECLARATION

I, ONALLIA ESTHER OSEI, hereby declare that this thesis is an original research undertaken by myself under the guidance of my supervisors. With the exception of references to other people’s work which have been duly acknowledged, this thesis has neither in part nor in whole been presented for another degree elsewhere.

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.....

DATE

DATE

DEDICATION

I dedicate this thesis to the glory of God for his grace, guidance, protection and wisdom throughout my academic pursuit and life.



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First and foremost, I thank the Lord God Almighty for the journey of my life so far and that to come. Secondly, my deepest appreciation goes to my supervisors, Prof. Martin Oteng-Ababio and Dr. Charlotte Wrigley-Asante. This project would not have been successful without their comments, criticisms, encouragement, kind support and scholarly insight given to me throughout this entire journey. I am also grateful to all the lecturers and staff of Department of Geography and Resource Development, University of Ghana for their comments, criticisms and kind support.

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ABSTRACT

E-waste management, a subcomponent of e-scrap management, has become a major global environmental issue. Studies conducted in Ghana have shown that e-waste management is a major livelihood for mostly underprivileged migrant male urban dwellers. However, none of these studies have examined the gender dynamics of e-waste management. This study therefore employs gender and development (GAD) analytical framework, through a mixed research approach to investigate the gender dynamics of e-waste management in Accra and Kumasi.

This research observed a continuum of a formal-informal dichotomy in the e-waste industry. Significantly, the informal sector at one end of the chain engages in the collection and recycling for e-scrap to trade to formal manufacturing and exporting industries in both Accra and Kumasi for further processing and trading respectively. This transaction is carried through the middlemen/women, scrap dealers or the agents of these formal industries commencing a circuitry which transcends metropolitan, regional and indeed, national boundaries. Those receiving industries connects the e-waste industry in Ghana to local and foreign consumers across U.S.A, Russia, Asia, Europe and Canada.

This study focusing on the informal e-waste management sector discovered 4 and 300 out of a total number of 5,000 e-waste managers working in Accra and Kumasi respectively were middle-women. The rest of the females left uncounted from the 5,000 workers provide ancillary services. Major causes of these gendered roles are attributable to physical, economic and socio-cultural determinants. Therefore, conscious efforts must be made by all stakeholders to minimise or remove these barriers to gendering e-waste management practice in Ghana.

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LIST OF ABBREVIATIONS

ADB	Agricultural Development Bank
AMA	Accra Metropolitan Assembly
AR	Ashanti Region
ASDA	Accra Scrap Dealers Association
CBD	Central Business District
CBOs	Community Based Organisations
CCM	Continuous Casting Machine
CSOs	Civil Society Organisations
CSPRO	Census and Survey Processing System
CWM	Community Waste Management
EEE	Electronic and Electrical Equipment
EOL	End of Life
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
EU	European Union
FGD	Focus Group Discussion
GAD	Gender and Development
GAMA	Greater Accra Metropolitan Area
GAR	Greater Accra Region
GHC	New Ghana Cedis
GoG	Government of Ghana
GSS	Ghana Statistical Service
ICT	Information and Communication Technology
ISDA	Insight Scrap Dealers Association
JHS	Junior High School

KMA	Kumasi Metropolitan Assembly
KMA/WMD	Kumasi Metropolitan Assembly Waste Management Department
LI	Legislative Instrument
MDG	Millennium Development Goal
MESTI	Ministry of Environment, Science, Technology and Innovation
MLM	Multi-nomial Logit Modelling
MMDAs	Municipal, Metropolitan and District Assembly
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NAM	Non-Aligned Movement
NGOs	Non Governmental Organisations
PC	Personal Computer
PHC	Population and Housing Census
PPP	Polluter-Pays-Principle
PPP	Private Public Partnership
SAP	Structural Adjustment Programme
SHS	Senior High School
SSA	Sub-Saharan Africa
STMA	Sekondi-Takoradi Metropolitan Assembly
SW	Solid Waste
SWM	Solid Waste Management
SWW	Second World War
TaMA	Tamale Metropolitan Assembly
TMA	Tema Metropolitan Assembly
UNEP	United Nations Environment Programme
UNFPA	United Nations Population Fund

UNICEF	United Nations Children's Fund
USA	United States of America
USCB	United States Census Bureau
WDR	World Development Report
WEEE	Waste Electronic and Electrical Equipment
WM	Waste Management

CHAPTER ONE

GENERAL INTRODUCTION

1.0 Introduction

E-waste has become one of the fastest streams of global municipal solid waste (MSW) because of today's digital age (Widmer et al., 2005; Hjelmar, 1997; Kahhat et al., 2008). This digital age or the high tech electronic sector are key drivers of innovation and economic growth (Oteng-Ababio et al., 2015). Between computers, television, mobile devices, electronic games and even devices which measure metabolic rate, it is estimated that the average person owes 24 electronic products. However, the rapid technological advancement has also resulted in increasing generation of waste electronic and electrical equipment (WEEE) otherwise popularly termed electronic waste or e-waste. The world generates about 1.3 billion tonnes of MSW annually, out of which about 20 to 50 million tonnes is e-waste (UNEP, 2005). E-waste is a term for describing any kind of electrical or electronic equipment (EEE) discarded by the user or owner, whether working or non-working (Oteng-Ababio, 2011). Personal computers (PCs), mobile phones and entertainment gadgets take a very large share of e-waste (Widmer et al., 2005; Sinha et al., 2009).

Current studies indicate that mobile phone today are fast becoming the most pervasive communication technology in human history (The Mobile Economy, 2015). Half of the world's population now have a mobile subscription which was one out of 5 some 10 years ago (The Mobile Economy, 2015). For the past four years, about 1.7 billion new mobile phones were shipped worldwide every year (Statista, 2014). Yet the average lifespan of mobile phones continue to decrease especially in Western Europe and North America to 18 months. The reality today is that the rapid evolution of electronic

technology supported by the marketing and promotion campaigns is making many electronics prematurely obsolete, transforming most devices into disposable products. We live in a society where newer is better, and for each new electronic gadget that reaches the market, one or more becomes outdated or reaches end-of-life (EOL).

Put differently, the increasing rate of e-waste generation in the MSW stream resides in the fact that there is increasing 'market penetration' of EEE in the developing countries likewise a 'replacement market' in the developed countries and 'high obsolescence rate' for EEE globally (Oteng-Ababio, 2012a). In terms of EEE consumption and e-waste disposal, the developed world generally records a higher amount than the developing world (Widmer et al., 2005; Kahhat et al., 2008;). The United States of America (USA) ranks highest in that respect (Kahhat et al., 2008). The average life span of a computer in the USA is estimated here to have shrunk from 6 years in 1997 to about 2 years or less by 2005, generating good import business in used computers in developing countries (Oteng-Ababio, 2012a). After consumption, some developed countries are in the habit of transporting and dumping their e-waste to some developing countries for management. Countries like Ghana, the Philippines, India, China and Nigeria have become 'digital dumps' for mining valuables from the e-waste by the informal sector in these countries (Puckett et al., 2005; Brigden et al., 2008).

The informal e-waste management sector is also a major source of livelihood in some Africa and Asian countries (Nnorom and Osibanjo, 2008; Carisma, 2009; Sinha et al., 2009; Dey, 2012; Oteng-Ababio, 2012b). The sector is lucrative, but survivalist in nature (Prakash et al., 2010; Amoyaw-Osei et al., 2011; Oteng-Ababio, 2011). WEEE contain up to about sixty (60) different elements, many of which are valuable such as precious and special metals, and some of which are hazardous. Landfilling option also is

undesirable since trace amounts of precious metals including gold, silver and palladium and large quantities of metals and alloys including copper, aluminium and steel used in electronic are not removed. The ability to engage in recycling therefore reduces drastically, the environmental impact of manufacturing products from raw materials thus reducing cost and waste. More importantly, it reduces the dependence on foreign supplies for valuable materials for production of electronics.

However, these do not come without challenges, particularly in developing countries like Ghana where there is glaring manifestation of uncertainty surrounding the EOL management of electronic devices, lack of formal recycling infrastructure and lack of regulatory framework or ensuing e-waste management which is absent from the lexicon of most policy makers. There is a lack of appropriate recycling facilities because it is very capital intensive and clearly beyond the reach of most governments in developing countries. Currently, there are only three of such infrastructure facilities worldwide. This has created an economic niche for the informal sector recycling option. The viability of this emerging industry has been severally alluded to (Grant and Oteng-Ababio, 2012; Amoyaw et al., 2010; Amankwaa, 2013; Oteng-Ababio et al., 2015), yet neither the gender roles nor power relations have been comprehensively interrogated. In other words, the gender interface of the informal e-waste economy remains as blurred and unexplored as the reasons why their potentials still remains absent on the radar of city authorities. These conundrum must be necessarily unpacked if the United Nations quest for sustainable and liveable urban development is to be realised within the stipulated time frame (2015-2030).

1.1 Problem Statement

In Ghana, policy actions directed at bridging the digital divide have improved access to information communication technology (ICT) and other EEE. For instance, the zero-rated importations of used computers by government of Ghana (GoG) in 2004 improved access to second hand computers (Oteng-Ababio, 2012b). As indicated by Oteng-Ababio (2012a), Ghana's ICT for Accelerated Development Policy introduced 60,000 computers between 2010 and 2011 to schools pupils throughout the country aside the lap tops provided to government workers and tertiary institution students. The introduction of mobile telephony in Ghana since year, 2000 has seen increasing patronage and usage of mobile telephone (Oteng-Ababio, 2012a). The replacement of old fashioned EEE with brand new and or slightly used ones is high. This meteoric increase in consumption of EEE has not been met with the required policy, legislation, regulation or infrastructure to deal with the management of the by-products of this equipment (Oteng-Ababio, 2010). This apparent lacunae has resulted in this proliferation of an informal e-waste management sector who operate without any well laid down standards and procedures (Oteng-Ababio, 2012a; Oteng-Ababio, 2011; Prakash et al., 2010).

Nevertheless, the informal e-waste management sector in Ghana is booming economically, but is a looming environmental disaster. Studies so far have amply revealed that the chain of activities involve thousands of young people who are mostly migrants from Northern Ghana who eke out living by engaging in e-waste management activities (Amankwaa, 2013; Agyei-Mensah & Oteng-Ababio, 2012; Oteng-Ababio, 2012c). What is missing in the current equation is how the emerging "survivalist strategy" interface within the urban space, and the intra-gender dynamics. Among the

obvious unanswered questions so far include what are the gender roles in the emerging trade? Does the e-waste trade pertain to a particular group or gender? Who calls the 'shots' in this industry? What are the informal regulatory mechanisms within the e-waste industry? Answers to these whole questions of informality in the e-waste industry which has currently attracted adverse commentaries from most environmental non-governmental organisations (ENGOs) (see Brigden et al., 2008).

Significantly in general, the essence of a gender-based analysis is critical to waste management in terms of awareness creation, planning practice and policy decision making. The relationship between gender and e-waste management cannot be unilaterally discussed. Gender plays a crucial role in determining the organisation of activities and roles in and outside the household. Thus, every society defines roles and responsibilities expected of males and females in it including the e-waste industry. Hardly has any of the e-waste management studies conducted in Ghana committed itself to understanding gender dynamics within the industry. Previous studies have generally stated that females limitedly play a role in e-waste management without investigating for the exact factors constructing such a phenomenon (Oteng-Ababio, 2015; Amankwaa, 2013; Oteng-Ababio, 2012b). GAD theory reckons that unequal access to economic resources such as land, capital, working materials, time; some institutional and political factors often times constrain women's participation in male dominated jobs (WDR, 2010). Therefore, this study seeks to fill the gender and power relations lacuna in e-waste management literature using the case of Ghana as a way of drawing academic attention to this subject matter. According to Poswa (2004), it has been concluded that solid waste planners should always consider the effect of demographics as an integral part of planning when designing a waste management system.

1.2 Research Questions

A closer examination of male and female participation in the e-waste industry is an important research area worth investigating. Consequently, the broad question of the study looks at the gender and power relations in the informal e-waste industry in Accra and Kumasi. Specifically, the study sought answers to the following questions:

- i. What are the current e-waste management practices in Accra and Kumasi?
- ii. What are the discernible gendered roles in the current practices?
- iii. What are the power relations within the industry?
- iv. What are some of the challenges impinging on an equal participation in the industry?
- v. What are stakeholders' perceptions on how the current e-waste industry can be made gender sensitive in pursuit of a sustainable national and industrial development?

1.3 Research Objectives

The overall objective for the study is to examine the gendered roles and power relations in the informal e-waste management practice in Accra and Kumasi.

Following from the broad objectives stated above, the study's specific objectives include the following:

- i. To examine the chain of activities (vertical, horizontal, forward and backward linkages) within the e-waste industry;
- ii. To establish the gendered roles and power relations within the e-waste industry;

- iii. To analyse the physical, economic and socio-cultural challenges in the e-waste industry
- iv. To give policy recommendations for consideration

1.4 Research Hypothesis

The GAD analytical framework posits that, sex, educational level, religious affiliation, age and marital status constrain equal participation of men and women in sustainable development. On the basis of this GAD statement and knowledge gathered during the reconnaissance survey at study areas in Accra and Kumasi, the following three (3) set of hypotheses were tested:

The first hypothesis states:

H₀: Men do not easily access working resources for e-waste management as compared to women

H₁: Men easily access working resources for e-waste management as compared to women

The second hypothesis is:

H₀: Men do not engage in the most capital intensive jobs of e-waste management as compared to women

H₁: Men engage in the most capital intensive jobs of e-waste management as compared to women

The third hypothesis is:

H₀: Males do not have higher chances of participating in direct e-waste management activities as compared to females

H₁: Males have higher chances of participating in direct e-waste management activities as compared to females

1.5 Rationale and Justification of the Study

For several decades now, MSWM has been a topical issue for urban planners, engineers, academia as well as governments and non-governmental groups in Ghana. These groups have continuously sought for ways of improving solid waste management (SWM) in major cities of Ghana, particularly in the Greater Accra Metropolitan Area (GAMA), the Kumasi Metropolitan Assembly (KMA), the Sekondi-Takoradi Metropolitan Assembly (STMA) and the Tamale Metropolitan Assembly (TaMA).

The 21st century with its cyberspace and technological advancements brings with it another MSWM challenge called e-waste management. E-waste is a hazardous waste substance that poses a threat to human health and the physical environment if not properly treated (Brigden et al., 2008). This makes e-waste management a topical subject of inquiry in the urban development discourse, since the demand for and the use of EEE is massively concentrated in the cities as is the management of its EOL.

E-waste management has the potential to become a multi-million dollar enterprise employing thousands of people. The role of gender in e-waste management is a research area worth considering for diverse reasons including economic, social and environmental. As a result, this research positions itself among the pioneer empirical

studies seeking to investigate into the gender and power relations in the e-waste industry of Ghana.

This study is going to be a reference material for scholars, waste management practitioners, non-governmental organisations (NGOs), civil society organizations (CSOs) and all other stakeholders interested in e-waste management in Ghana. It is hoped that policy makers find this work relevant in their attempt to draft working policies and bills to guide and regulate e-waste management activities in Ghana. This study provides baseline data for future policy analysts on how the e-waste industry contributes to poverty alleviation among males and females in urban Ghana.

1.6 The Structure of the Thesis

This thesis comprises six chapters. Chapter one provides general background knowledge on the study. In this chapter, seven sections were developed. The first section provides introductory information followed by the problem statement. In addition the chapter contains the research questions, the objectives and the hypotheses that were set to guide the study. The final sections consist of the rationale and the justification for the study, as well as the structure of the work. Chapter two reviews the relevant literature related to the study. Three sections were developed in this chapter. Firstly, a review of existing literature on urbanisation, informal sector growth, e-waste management and gender participation in informal sector activities and MSWM was undertaken. The second section reviewed the literature on the theoretical framework guiding this study. Lastly, literature on the conceptual framework of the study was provided.

Chapter three describes the methodology used for the study. This chapter gives in-depth information on the two study areas, sampling and selection methods as well as processes of data collection and analysis for the report. Chapter Four presents findings on the structural organisation of the chains of activities within the-waste industry. Then Chapter Five discusses the demographic characteristics of respondents within the informal e-waste sector of Accra and Kumasi. Here, the (characteristics) features by which these demographic factors influence gender roles and power relations in the e-waste industry are also examined and discussed. The same chapter analyses and discusses economic factors which influence the level of male and female participation in e-waste industry, thereby constructing certain kinds of gender and power relations. Lastly, sources of motivation to work in the e-waste industry, benefits and challenges are also examined. The sixth chapter provides a summary of all major findings of the study. In addition, a concluding section is developed with suggestions and recommendations proposed for policy and planning considerations as well as for future research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

E-waste management has become a topical issue for developed and developing countries alike. The relevance rests on the fact that e-waste is a hazardous substance that requires efficient and effective applications of SWM practices for sustainable development. Despite all the studies on e-waste management, very little attention has been paid to the relationship between gender and e-waste management. As a result, this chapter seeks to thoroughly review published and unpublished works on MSWM within the context of urbanisation with a focus (towards) on understanding e-waste management practices across the globe particularly in developing countries. Lastly, the theoretical and conceptual frameworks to aid this study understand the gender dynamics of e-waste management are presented.

2.1 Gender and Municipal Solid Waste Management

2.1.1 *The State of Urbanisation in the World*

The earliest date at which one can have a reasonable picture of the urbanisation worldwide is 1950 (Bocquier, 2005). By 1950, just under one-third of the population of the world was living in urban areas (Cohen, 2006). 733 million out of a 2,519 million population in 1950 were urbanites. Out of the 733 million, 427 million were living in the developed countries, while 306 were in the developing countries¹. In just over 50 years from 1950, the urban population moved from 733 million to 2.857 billion (Cohen,

¹ Developed countries here consist of Europe, North America, Australia/ New Zealand and Japan whiles developing countries consist of all regions of Africa, Asia (except Japan), Latin America, Caribbean including Melanesia, Micronesia and Polynesia.

2006). Between 1950 and 2003, the world's urban population increased fourfold (Cohen, 2006).

Currently, the world's urban population is more than half of the total global population (Institute of Statistical, Social and Economic Research (ISSER), 2011) estimated to be 7.172 billion by the United States Census Bureau (USCB, 2014). By 2030, the urban population in the world is projected to reach 4.945 billion inhabitants (Cohen, 2006). It is the developing world that has been largely contributing to the worldwide urbanisation; this phenomenon is still expected to continue (Cohen, 2004; Cohen, 2006).

Among developing countries, Latin America seems more urbanised than Asia and Africa (Cohen, 2006). Within Latin America; Central America and Caribbean contribute the least to urbanisation, while Venezuela, Brazil, Chile, Uruguay and Argentina contribute the highest. The urban population in Africa is already more than half of the entire population of the continent (Songsore, 2004) despite poor macroeconomic performance and without significant foreign direct investment (Cohen, 2006). However, the poorest countries in Africa like Burundi, Malawi, Ethiopia, Burkina Faso and Uganda experience lower urbanisation growth as compared to the more endowed countries (Cohen, 2006). A large proportion of the population in Africa live in the largest cities which in most cases includes the capital town (Cohen, 2006), like Accra in Ghana.

The GSS defines an urban centre as an area with a population of 5,000 or above. In Ghana, the urban population is already 51 percent of the national population of about 24 million (GSS, 2013). The 2010 population and housing census (PHC) points to a

remarkable point in Ghana's history where urbanites are more than rural folks (GSS, 2013). In Ghana, the two largest cities are Accra and Kumasi. These two cities account for 52 percent of the urban population of Ghana (GSS, 2013). Kumasi is situated in the Ashanti Region (AR) while Accra is situated in the Greater Accra Region (GAR). GAR has reached its saturation point in the urban growth process as its annual urban population growth has been declining from 6.1 percent in 1960 to 3.5 percent in 2010, while that of the AR is steadily increasing (GSS, 2013). Kumasi Metropolitan Area (KMA) contributed 20.2 percent to national urban growth between 2000 and 2010 which was the highest urban growth rate in the country. Interestingly, the industrial hub of Ghana, Tema Metropolitan Area (TMA) of GAR, contributed nothing to national urban growth in the same period (GSS, 2013). The zero urban growth of Tema is attributed to the declining industrial power of the city (Dickson & Benneh, 1988 cited by GSS, 2013).

The urban positions of these two cities, Accra and Kumasi, are connected to their industrial, commercial and economic positions within the national urban economy of Ghana (GSS, 2013). As a result, these two cities attract the largest investments capital, most technological innovations and the largest economic markets in Ghana. The general trend of urbanisation in Ghana is described as more demographic than economic (Songsore, 2004). Urbanisation in Ghana within the last two decades has been fuelled by rural-urban migration, natural increase and the transformation of rural settlements around the fringes of cities into towns (Songsore, 2004; GSS, 2013). The expansions of the peripheries of Accra and Kumasi is alluded to be largely caused by sub-urbanisation of the middle-income residents moving out of inner cities and by the new arrival migrants moving into the cities. The relative importance of each of these various causes

of urbanisation and sub-urbanisation varies both within and between regions and countries (Cohen, 2006). Urbanisation in developed countries is more economically induced, compared to that of developing countries which are more demographically induced.

2.1.2 Global Dynamics of Municipal Solid Waste (E-waste) Management

A significant output of urban lifestyle is MSW ((Hoornweg & Bhata-Tata, 2012). As long as production and consumption continues, waste generation will be inevitable likewise the relationship between urbanisation and MSW generation (Hoornweg & Bhata-Tata, 2012; Madsen, 2006). At the time that the urban population was 2.9 billion, annual MSW generation stood at 0.68 billion metric tonnes per annum; increasing to 1.3 billion metric tonnes as the urban population rose to 3 billion (Hoornweg & Bhata-Tata, 2012). The current rate of global MSW generation stands between 1.7 to 1.9 billion metric tonnes per annum (Chalmin & Gaillochet, 2009) as the urban population stands at 3.6 billion. By 2025, Hoornweg & Bhata-Tata (2012) projects that about 2.2 billion tonnes of MSW will be globally generated as the urban population reaches 4.3 billion. The developing world is expected to contribute significantly to urbanisation and MSW generation (Hoornweg & Bhata-Tata (2012).

Due to rapid urbanisation in developing countries, the generation of MSW continues to increase in volume and content. In terms of content, it is rapidly changing from purely organic into a mixed composite of organic and inorganic waste from domestic, industrial and commercial sources. This is really constraining the ability and efforts of most municipal governments to effectively handle one of their primary responsibilities of MSWM (Schübeler et al., 1996).

Municipal solid waste management is the most important service a city provides; in low-income countries as well as many middle-income countries. ... Solid waste is usually the one service that falls completely within the local government's purview. A city that cannot effectively manage its waste is rarely able to manage more complex services such as health, education, or transportation (Hoornweg & Bhata-Tata, 2012).

All over the world, MSW remains a critical component of city authorities' budget especially for developing countries. While cities in developed world spend less than 10 percent of their MSWM budget on waste collection, those in developing countries spend about 20 percent to 50 percent of their municipalities' budget on MSWM to collect about 50 percent to 80 percent of the waste generated (Madsen, 2006; Hoornweg & Bhata-Tata, 2012) leaving low income settlements particularly the slums, un-served or under-serviced (Schübeler et al., 1996). In addition to poor SW collection in such low income areas, having access to basic social amenities like toilets, potable water and drainage systems is limited (Hoornweg & Bhata-Tata, 2012).

Ghana daily generates 10,000s tonnes of waste without adequate management infrastructures to cater for it. The waste generation per capita for Accra and Kumasi are 0.51kg and 0.77 kg respectively (Oteng-Ababio, 2012a). The private sector collects about 1,800 and 1,000 tonnes of SW in Accra and Kumasi respectively (Oteng-Ababio, 2012a). The country has been practicing a public-private partnership (PPP) type of MSWM for more than a decade (Oteng-Ababio, 2007). The local government through its district and municipal assemblies take responsibility for MSWM. The metropolitan, municipal and district assemblies (MMDA) are currently providing the landfill sites and transfer stations for collected waste by private MSWM companies and itinerate

waste collector or pickers or scavengers to transport and dispose them there. Both formal and informal SW managers collect about 60 percent of total waste generated in Ghanaian cities (Huober, 2010). The remaining waste is usually left in open spaces like water bodies, gutters, lorry stations and so forth destroying the cities' aesthetic beauty and also causing flooding, pollution and associated disasters like loss of properties and lives.

Despite yet to be mentioned challenges, the practice of fully integrating informal MSWM sectors in the general MSWM practice of Ghana still remains a challenge (Madsen, 2006; Oteng-Ababio, 2010; Rockson et al., 2013). Major challenges of city authorities in addressing MSWM problems in Ghana are unavailability of properly engineered disposal sites and waste treatment plants; limited number of waste management expertise; inappropriate technical know-how; weak financial capacity of authorities; weak enforcement of environmental regulations; indiscriminate and irresponsible dumping by the citizenry amongst others (Huober, 2010).

E-waste management has become a major environmental research and public discussion issue around the world including Ghana. The use of EEE has become a way of life because of the information communication technology (ICT) revolution. The ICT industry is described as one of the largest industries in the world in terms of employment creation, revenue generation and enhancing productivity in other sectors of national economies across the world (Sturgeon & Kawakami, 2010; Oteng-Ababio, 2012a). From the year 2000 to 2009 alone, the use of mobile telephony rose from about 9,000 to 15,000 in Ghana (Oteng-Ababio, 2012a). Again, the use of a radio, a refrigerator and a television has been on the rise globally (Widmer et al., 2005). However, the increasing demand and consumption EEE has led to high generation rates

of e-waste globally. Despite high EEE consumption, the misuse and misapplication of EEE also shortens the lifespan of EEE to reach their end-of-life (EOL). Again, the deliberate efforts by EEE manufacturers to shorten the lifespan of the goods that they produce are also contributing to high volumes of annual e-waste generated annually in the world (Remesh et al., 2007; Oteng-Ababio, 2012a).

Globally, about 50 million tonnes of e-waste is generated per annum (UNEP, 2005). The 50 million tonnes estimate of e-waste generated yearly by the world can fill trucks stretching half way around the earth (Nordband, 2009). The contribution of different parts of the world to the 50 million tonnes of e-waste generated yearly is not uniform. The United States of America (USA) and Europe generate the largest share of the e-waste compared to the rest of the world (Kahhat et al., 2008).

In terms of e-waste management, the developed world is far advanced in adopting better hazardous waste management practices than the developing world, despite its bad practice of e-waste exportation to the latter countries. The system of e-waste management in developed countries is formalised with appropriate collection and recycling mechanisms in situ. The activities of e-waste industries in developed countries are driven by strict environmental laws and policies often to encourage e-waste treatment under safe, hygienic and organised conditions (Kahhat et al., 2008; Widmer et al., 2005).

In the USA, e-waste disposal to landfill sites is the main system practiced although this is not the best practice. However, Kahhat et al., (2008) points to the fact that there is an existing e-waste free-market in the USA driven by no regulation, but by profit, from collecting and recovering reusable materials from these wastes. This second practice is

also opens developing countries to access e-waste generated in the USA. There are individuals who export the e-waste to developing countries to avoid the huge cost of effective and efficient practice of e-waste management in the USA (Kahhat et al., 2008). Some studies have revealed that about 80 percent to 85 percent of e-waste generated in the USA gets disposed of at scrap yards, harbours and landfills centres in developing countries (Kahhat et al., 2008; BAN, 2005).

For Europe, Japan and South Korea, the take- back system and EPR models are applied to save these countries from their e-waste burden. However, a lot of these e-waste still find their way on the ports and harbours of some developing countries. In Japan, the system of e-waste management is guided by the 'Home Appliance Recycling Law' enacted in 1998 and the 'Law for Effective Resource Utilisation' which started operating in 2001. South Korea and Switzerland have used the EPR law since 2003 and 1990 respectively (Kahhat et al., 2008). Among these countries, Switzerland's mode of e-waste management is been adjudged the best in the world so far.

Under the EPR, producers or manufacturers and importers of EEE in these countries are held primarily responsible for production, consumption and post consumption of afterlives substances of EEE. Common to all countries practicing EPR are the following five characteristics (Widmer et al., 2005): (1) legal regulation to specify how e-waste must be managed; (2) the system widens up covering all stakeholders of the e-waste namely producers, consumers, authorities and managers; (3) the system adopts sustainable ways to finance itself; (4) producers are largely responsible for handling the system and (5) the system ensures compliance. Moreover, Sinha-khetriwal et al., (2005) are of the view that all material loops in the EPR system, where applicable, must be

properly closed to promote sustainability in terms of environmental protection and reduce e-waste resource loss.

In the European Union (EU) region, 25 states have adopted the European Union Waste Electronic and Electrical Equipment (EU WEEE) Directive to regulate EEE product design, e-waste collection, e-waste recovery, e-waste treatment and treatment financing as well as EEE use awareness creation and education (Kahhat et al., 2008). This guideline or directive focuses on primarily promoting material recovery and conservation through recycle and reuse.

Despite these measures in place in developed countries to better manage e-waste, some countries in Europe and some states in USA continue to pass their e-waste through hidden pathways to landfill sites in Asia and Africa for informal treatment or management (BAN/SVTC, 2002). The e-waste from developed countries to developing countries is sometimes mixed up with charitable donations for the latter countries (Carisma, 2009; Grant & Oteng-Ababio, 2012). According to Carisma (2009), e-waste found in Philippines comes from local, regional and international sources. India is also a major e-waste dump site for western countries like the USA (BAN/SVTC, 2002). This dumping phenomenon of e-waste in Ghana, Nigeria and China is common for most developing countries (Nordbrand, 2009; Widmer, et al., 2005; Wilson, 2007; Huober, 2010).

In the developing countries, the commonest method for e-waste management is informal. The informal practice of e-waste management is primarily characterized by lack of appropriate policy, legislation, regulatory instrument and waste management

infrastructure (Oteng-Ababio, 2012b; Nnorom & Osibanjo, 2008, Carisma, 2009, Dey, 2012).

A study by Carisma (2009) illuminates this scenario about the e-waste management practice in the Philippines. The national economy of the Philippines strongly depends on the electronic industry. The e-waste management practice in the Philippines is not guided by the Basel convention as applied by Ghana and India. The country lacks adequate infrastructure to manage the e-waste generated. The country has a low environmental consciousness as in other developing countries. Taking advantage of the availability of cheap labour and a supply of e-waste from both local and international sources, the following have emerged as principal stakeholders of the existing formal-informal e-waste practice management in the Philippines: manufacturers, finished electronic importers, second hand dealers or refurbishers, hazardous waste treaters, e-waste importers and backyard recyclers. The informal e-waste industry in the Philippines is mainly responsible for recycling.

The Nigerian e-waste industry operates more as a scrap dealing business without any organised system or infrastructure just like Ghana (Nordband, 2009). The e-waste industries in both countries mostly operate in small workshops or in open spaces at the landfill sites (Prakash et al., 2010). There is no formalised system for collection, transportation, treatment and disposal of e-waste in Ghana. The informal sector manages all these activities by itself. Upon the recovery of resourceful parts from e-wastes, the unwanted remains are indiscriminately thrown into the environment.

A common characteristics of e-waste management in developed and developing countries is recycling (Sinha-khetriwal et al., 2005; Widmer et al., 2005; Wilson, 2007).

In both developed and developing countries, recycling is done by the formal and informal sectors respectively. Sustainable recycling of e-waste is described to be environmentally friendly, socially acceptable and economically viable as practiced in some developed countries ((Rockson et al., 2013; Sinha-khetriwal et al., 2005). However e-waste recycling in developing world is described as unhygienic, unsafe and hence, unsustainable (Prakash et al., 2010; Oteng-Ababio, 2012a) usually leading social outcry, environmental contamination and public health challenges (Bridgen et al., 2008; Koranteng & Darko, 2012).

2.1.3 Health Challenges Associated with E-waste Management

E-waste contains both hazardous and non-hazardous substance. The element of lead, mercury, arsenic, cadmium, selenium, hexavalent chromium, and flame retardants (Clayton, 2014) above acceptable thresholds in e-wastes are classified as hazardous. E-waste also contains ferrous and non-ferrous metals, plastics, glass, wood, printed circuits boards, concrete and ceramics, rubber and so forth. Iron and steel constitutes about 50 percent of e-waste, followed by plastics (21%), non-ferrous metals (13%) and other constituent like gold, platinum, silver and palladium, categorically called precious metals. The non-ferrous metals are copper and aluminium. Iron, aluminium, gold, copper and the other metals forms 60 percent of e-waste constituents with pollutants taking 2.7 percent (Widmer et al., 2005).

The informal sector mostly applies crude and primitive management methods to extract metals and non-metal resources from e-waste (Prakash et al., 2010). By applying crude techniques, Koranteng & Darko (2012) states that workers at e-waste landfill sites in Ghana get exposed to different kinds of health problems resulting from their exposure to

pollutants in e-waste. Table 2.2 gives an overview of potential diseases that one can easily suffer from if he or she is working under current conditions at e-waste sites in Ghana. These diseases commonly affect the reproductive, neurological, skin and cardiovascular parts of the body.

Table 2.1: Potential E-waste Related Diseases

Metal	Potential disease
Arsenic	Cardiovascular diseases, cancer, diabetes;
Cadmium	Bone pains and severely weakened fragile bones
Chromium	Skin irritation and rashes
Copper	Throat irritation as well as lung and kidney diseases;
Lead	Causes cognitive and brain impairment, sometimes, paralysis
Silver	Argyria- a condition of the skin developing blue-gray colour forever

Source: Koranteng & Darko (2012)

2.1.4 Informal Sector Participation in MSWM in Ghana

The ‘informal sector’ has become a jargon commonly used by economic and development experts because of the wide array of economic activities that it covers in different parts of the developing world (Charme, 2000). In the developed world, however, informality is a crime (Charme, 2000). Thus, any activity banned by law based on different conditions in the developed world is regarded as informal; thus making them criminal activities. The informal sector in developing countries employs 40 to 60 percent of the urban workforce.

The informal sector engages about 40 percent of Latin America's urban workforce population. It covers a little less than 60 percent of the urban labour force in Asia and 61 percent of that of Africa (Charme, 2000). For the Sub-Saharan Africa (SSA) region, about two-thirds of the urban employment is in the informal sector (Barwa, 1995). Some of the informal sector activities in various developing countries are depicted below in Table 2.3.

Table 2.2: A Cross Section of Some Informal Activities in Developing Countries

<i>Continent</i>	<i>Countries</i>	<i>City</i>	<i>Informal Economic Activities</i>
Africa	Ghana	Accra, Kumasi	Scavengers, Street vendors
	Egypt	Cairo	Scavengers
Asia	Malaysia	Istanbul, and Kuala Lumpur	Home based electronic workers
Latin America	Columbia	Bogota	Street vendors
	Mexico	Madeira	Home garment workers

Source: Adapted from Charme (2000)

There are two opposing ideas on informal sector development. One school of thought believes the informal sector is essential to sustain developmental needs of particularly urbanites in developing world. Thus, the informal sector comes in to provide certain critical needs of urbanites where public and private formal sectors have failed or is unable to cater for such needs (Charme, 2000). This presupposes that the informal sector only comes in when a gap is created by the formal sector to fill. For instance, the informal MSWM sector compliments the formal public and private MSWM sectors' efforts in the city (Madsen, 2006; Oteng-Ababio, 2012b; Rockson et al., 2013). This

informal sector usually renders its services to the un-serviced or underserved neighbourhoods of their cities (Oteng-Ababio, 2012a). A study by Yamada (2013) on urban informal sector employment in developing countries reveals that the informal sector can be described as follows: individuals work in the sector by choice; growth of the sector is mostly driven by the urge to respond to provide a need of the urban population in terms of service provision and small scale manufacturing.

Contrary to this first opinion, the second idea is that informal sector development is an ad hoc economic avenue developed by some unemployed urbanities. It engages such unemployed populace for a transitory moment and provide a meagre income for them to survive in the city until they get a new job (Charne, 2000).

The informal sector in developing countries has been established as a formidable employment avenue for the majority of the urban labour force. Several opportunities in Africa and Asia lie within the informal MSWM sector (Madsen, 2006) like waste collection, sorting, transporting and recycling. It is estimated that about 2 percent of third world countries' population survives by primarily working as scavengers (Rockson et al., 2013 citing Barton, 1998). The collection of waste by the informal sector is called scavenging or waste picking or waste collection (Wilson, 2007; Oteng-Ababio, 2012a; Rockson et al., 2013). The scavengers comb the city from house to house, office to office, landfill site to landfill site, market to market gathering all kinds of MSW for free or for a fee (Wilson, 2007).

Scavenging is a very old business, and in some developing countries commonly done by the poor (Oteng-Ababio, 2010; Rockson et al., 2013). Most scavengers in Ghana are the less privileged in society, such as the uneducated, the unskilled and the jobless (Oteng-

Ababio, 2012a; Rockson et al., 2013). In Hong-Kong, full time scavenging is performed by middle aged people who are mostly poor, uneducated and the less advantaged in this society (Rockson et al., 2013). By working as a scavenger, the socio-economic status of the poor and less privileged is improved without government support (Prakash et al., 2010; Oteng-Ababio, 2012a; Rockson et al., 2013). Waste scavenging is described as a profitable business venture contributing to economic growth and environmental conservation. Through scavenging, substances like plastic, paper, food leftovers, animal remains, saw dust, e-waste, etc are collected for recycling and/ or disposal (Rockson et al., 2013; Huober, 2010).

By recycling, the informal MSWM sector contributes to energy conservation (Madsen, 2006; Sinha-khetriwal et al., 2005; Rockson et al., 2013) and material recovery for reuse locally and internationally (Oteng-Ababio, 2012a; Rockson et al., 2013). Again, via informal recycling, limited amounts of solid waste end up at landfills sites. A study by Anomanyo (2004) cited by Huober (2010) reveals that about 90 percent of metal, 2 percent of plastic and 5 percent of glass wastes were recovered in Accra in 2004 via scavenging for recycling.

The scavengers in Accra earn between US \$ 7 to US \$ 17 daily (Rockson et al., 2013). In fact, Oteng-Ababio (2012a) stipulates that a scavenger in Accra earns about GHC50.00 per day which is about 160 times that of the minimum wage of GHC3.11 as at the time of the study. Irrespective of the costs that a scavenger has to incur on his or her tools, transportation and personal welfare, breaking even is a hallmark of scavenging business (Prakash et al., 2010; Oteng-Ababio, 2012a).

The challenges of the informal MSWM sector in Ghana are enormous. They include the following: low access to capital from formal and informal sources; difficulties in accessing waste as raw materials as well as tools and equipment; fluctuating prices of goods on the market; difficult access to land for business and accommodation, lack of sector recognition by local and national governments; public stigmatization, harassment and persecution; conflict at management sites and a limited growth or advancement in the sector (Wilson, 2007; Pwamang, 2009; Oteng-Ababio, 2012a; Rockson et al., 2012).

It is advised by Madsen (2006) and Rockson et al (2013) that considering the contribution of the informal MSWM in the developing world, city governments of these countries always ought to practice sustainable MSWM practices which must seek ways of putting formal and informal MSWM sectors to work together. For instance, the city government of Cairo, Egypt uses the informal MSWM sector in the Zabaaleen community of Cairo to provide scavenging services to most households in the city of Cairo. Scavengers in Zabaaleen community contribute to the recovery of about 80 percent of organic waste sorted for the production of higher grade compost in Cairo (Rockson et al., 2013). The Egyptian government recognised the contribution of these scavengers in Zabaaleen and supported them with financial aid, capital disbursed through organised local credit and savings group (Rockson et al., 2013). This has helped the informal MSWM sector to contribute effectively and efficiently to MSWM in Cairo.

It is further reiterated by Oteng-Ababio (2012a) that the informal sector is an asset and a potential partner to formal MSWM practices underway in Ghana. Therefore, incorporating the sector into mainstream practice is socially desirable and acceptable, economically viable and rewarding for environmental sustainability. Thus, the marriage

of the formal and informal MSWM industries will help in harnessing the triads of sustainable development as stipulated by many waste management experts.

2.1.5 Gender and MSWM

An e-mail electronic discussion-conference on gender and waste management took place among advisers on urban environment and development around March 1998 (Scheinberg et al., 1999). The objective of this conference was to provide answers to the question of: what the relationship between waste and gender is. This question is based on the argument that since waste turns out at times to become a resource or an asset, gender equality to such resources or assets for development becomes limited, especially for females. Therefore, this subject matter becomes very important area of in the urban economic and environmental literatures. The urban studies is mostly notable for doing these studies because of the large volumes and diverse constituents of urban waste generated on daily basis.

Gender is a socially constructed terminology which takes meaning and shape based on the culture, customs, traditions and practices of a particular group of people (Kabeer, 1994). However, waste takes it meaning in terms of the possessor of the material. Therefore, finding the relationship that gender has with waste is indeed a difficult exercise because it requires multifaceted analysis. With caution however, the discussants of the electronic gender and waste conference were able to observe some relationships between gender and waste management as stated here:

Women and men, girls and boys are engaged in different waste- related activities, partly because of cultural traditions and conventions, partly because of practical interests, such as earning income and maintaining a healthy living environment

and partly because of the wish to gain recognition as a worthy community member. Such waste activities range from managing the resources within the household or family to the more formal municipal activities of collection. They include disposal, re-use and recycling; they comprise as well community decision making and management and the ways in which individuals, communities and governments arrange and negotiate the diverse interests of the public and private sectors (Schneiberg et al., 1999).

The results of the email conference revealed several findings on the interconnection between gender and waste management at different levels of the society. At the household level, women and children have more control and access to waste than men because the former characters are mostly responsible for household waste management. As the waste moves out of the household for disposal or management and turns out to be highly recognised as a valuable resources, females' accessibility is highly constrained for males to dominantly possess them for use (Muller & Schneiberg, 1997; Schneiberg et al., 1999).

In the cities of Central America, SW collection is men's job while Peru and Bolivia have a good number of women involved in SW collection. Street sweeping jobs employ a lot more women in Peruvian cities than men, as per the government policy (Wahab, 2012). In Hyderabad, India, men earn about twice as much as women in waste recycling. Women earn between Rs. 18-40 per day while men earn Rs. 40-70; women recycling glass earn Rs. 20 while men earn Rs. 30 and a child, Rs. 15 per day. In plastic waste management, women earn Rs. 25-30 and men Rs. 35-40 per day. The logic behind the income differences is, that the men work harder than the women. The men carry the waste while women engage in waste sorting (Schneiberg et al. 1999).

Again, van de Klundert and Muller (1998) as cited in Wahab (2012) on their study in Dar es Salaam, Tanzania, that women dominate in community-based organisations (CBOs) waste collection activities. In this study, it is observed that women head these CBOs and employ other females to work with the organisation. Contrarily, men only are hired as waste collectors in Ouagadougou, Burkina Faso because of cultural reasons. In this same town of Ouagadougou, a quarrel ensued when the chance was opened for women to engage in community waste management and business waste management activities (Schneiberg et al., 1999).

In Ghana, the relationship between gender and waste management is similar to that of some developing countries like Nigeria (Muhammad & Manu, 2013). Women usually play life supporting roles for men to usually collect, transport, treat and dispose most of the MSW generated (Muhammad & Manu, 2013). If women directly get involved in MSWM, they usually operate in lower income waste business like plastic wastes as the men deal with high income generating waste businesses like scrap metals (Schneiberg et al., 1999). In general, waste enterprises are often owned by men in Ghana (Schneiberg et al., 1999).

The major reason for the relationship between gender and MSWM is that, a woman's position in SWM is expected if it should ever extend beyond household waste management to reside in community waste management, and not running a waste enterprise (Schneiberg et al., 1999). This is supported by the fact that women are more responsible for cleanliness and hygiene in their homes and community compared to men (Schneiberg et al., 1999). Again, patriarchal social rules, culture, belief and practices sometimes constrain women from participating in the social responsibility of community waste management; least to talk of female participation in formal and

informal waste management businesses (Schneiberg et al., 1999). Such cultures put men in positions of autonomy over females' decisions, actions and choices while dictating for them, the actions, plans and choices that they should be making in and outside of the household. However, a study in Peshawar, Pakistan found out that,

“Men leaders upon becoming convinced of the benefit of female engagement in waste management projects and it's 'safety' for their wives; became much more willing to countenance the women's involvement and even” (Schneiberg et al., 1999).

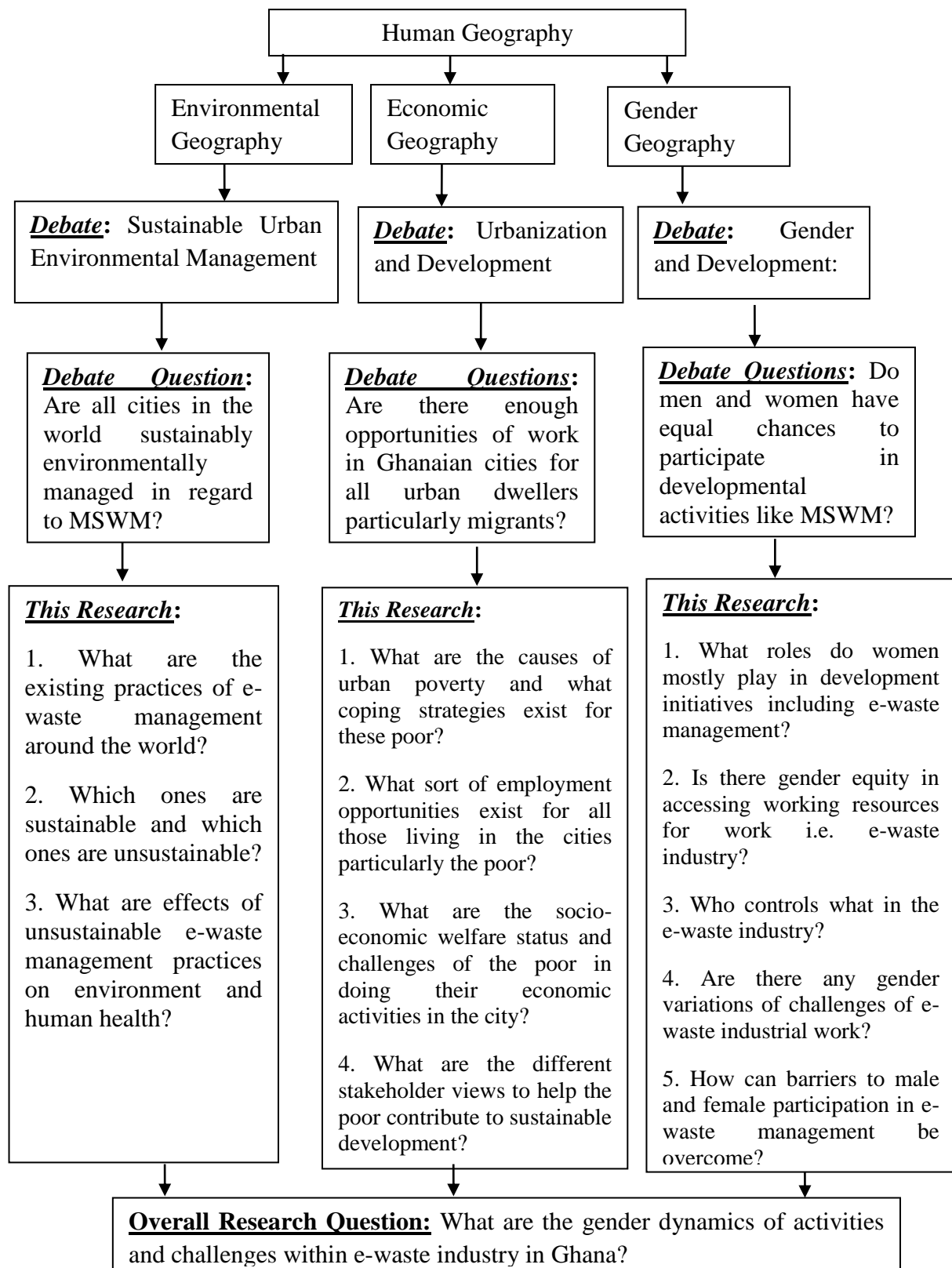
Access and control over waste is not solely determined by biological sex but most importantly, social, cultural, political and economic factors. It has been observed that the unequal status and limited marketing ability constrains female participation in waste business in the developing world (Schneiberg et al., 1999). To address this gendered differentiation of waste management across space and time, experts advise that an affirmative action is required to remove all barriers in the relationship between gender and waste management (Schneiberg et al., 1999); most importantly power relations (Wahab, 2012). As Adama (2007 cited by Wahab, 2012) writes, power is not confined to any single entity of the social system but it is in the social relations, which enable men to mobilize a greater range of assets – political or economic to dominate over women.

2.2 Theoretical Framework of the Study

The need to show the position of this study in the geographical discipline as well as in theory and practice is necessary. The association between gender and environmental management is long and well established in human geography. However, the advent of

another serious environmental problem like e-waste management in the 20th and 21st century gives researchers a reason to consider the gendered perspective like other forms of waste management like community based waste management. In so doing, this study recognising e-waste management as an economic and environmental issue, sought to find the position of gender in the subject as pertinent to sustainable development practice. Figure 2.1 shows how environmental, economic and gender issues are intertwined in theory and practice of e-waste management in Ghana and around the world. The derivation of debate and research questions in Figure 2.1 are based on review of pertinent literature for questions that seek to find answers to the problem of gendering of e-waste management activities and challenges in Ghana.

Figure 2.1: A Theoretical Rendition of Gender Participation in E-waste Management



Source: Author's Own Construct (2014)

E-waste management as an economic, environmental and public health issue has been discussed by several scholars using articulation and disarticulation models (Prakash et al., 2010; Amoyaw-Osei et al., 2011; Oteng-Ababio, 2011; Grant & Oteng-Ababio, 2012; Agyei-Mensah & Oteng-Ababio, 2012; Oteng-Ababio, 2012a, b, c; Amankwaa, 2013). The articulation model was developed by Terence Hopkins and Immanuel Wallerstein in 1970s to differentiate capitalism from nationalism based on a radical assumption of commodity chains (Bair & Werner, 2011). Common to value chain model, articulation model looks at key actors functioning within a local or international commodity value chain (CVC) (Sturgeon & Kawakami, 2010). Chain refers to all the traceable inputs adding on to produce a finished output for consumption. These inputs are prior activities generating raw materials; the raw materials itself; transportation mechanisms; labour input for processing to get finished outputs for consumption; and food inputs for workers. For example, the ultimate consumable of let say clothing has its chain comprising of the manufacture of the cloth, the yarn, the cultivation of the cotton and so forth (Bair & Werner, 2011). Articulated economy is described as viable because of the high level of forward and backward linkages within the same economy (Huang, 1995).

On the other hand, disarticulation model looks at differences in functions performed by different actors along the value chain. This model is developed by Samir Amin. The model accounts for slippage in association between economic growth and human development. Disarticulation leads to marginalisation or exclusion of the majority of the population from the benefits of development by transferring wealth, power and income to a peculiar section of the population within the chain. Disarticulation manifests itself through social and/ or economic exclusion expressed via social gaps (Kostzer, 2004).

In so doing, this study find its right expression of gender by deducing it from the GAD framework. GAD theory is rooted in socialist feminism thinking that capital and patriarchy function together via economic and social media to oppress women privately and publicly (WDR, 2010). Sexism and gender division of work and roles is evident in patriarchal and traditional Marxism societies where male autocracy and imbalance access to economic resources for development subjugate women into economically dependent positions to men (WDR, 2010). By so doing, the women are oppressed and become subordinate to men.

GAD looks at total organization of social, economic and political life and how it has constructed a socially gendered division of work and working roles based on one's sex (Rathgeber, 1990). GAD holistically examines sexism and gendered division of labour and roles in and outside the home. It analyses the nature of women's contribution to development via the context of work done inside and outside the household including non-commodity productive service like child bearing and raising as well as household maintenance done mostly by women (Rathgeber, 1990).

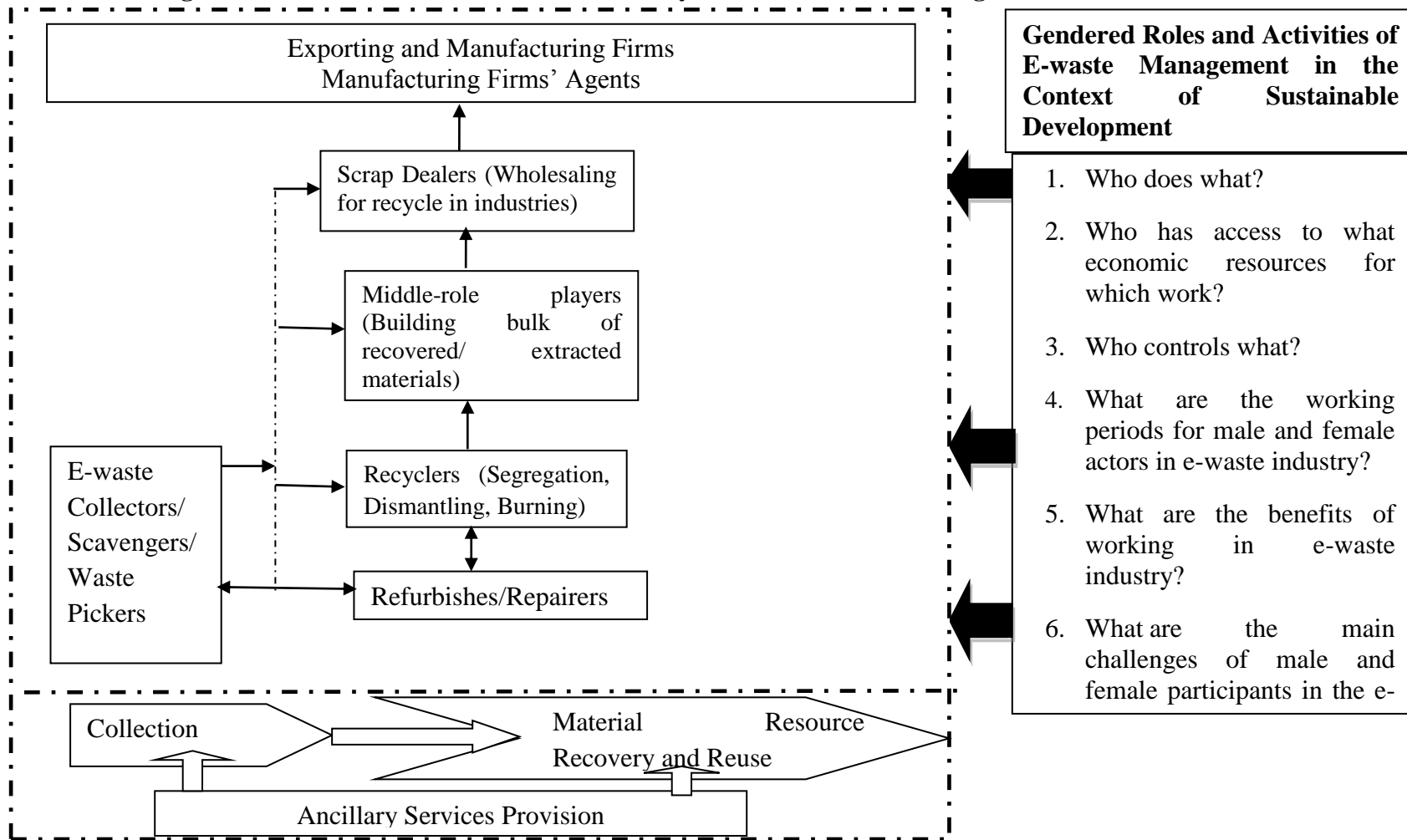
GAD is a diagnostic tool for planners to identify gender-based divisions in productive and reproductive works. The GAD frameworks help planners to identify gender inequalities in developmental projects, activities and/ or plans that perpetuate female subordination or inferiority. Therefore, GAD approach advocates for creating a gender balance between men and women in all developmental plans, activities and projects, as a prerequisite for achieving sustainable development (Dugbazah, 2012). In order to achieve gender equality in development, devoted and concerted efforts are applied through gender mainstreaming techniques to open up fair chances for men and women to contribute meaningfully to development (Dugbazah, 2012).

However, GAD is criticised for not mending itself easily to practical programming and project development because it questions the underlying assumptions of social, political and economic structures that tries to put women secondary to men (Rathgeber, 1990; Dugbazah, 2012). Applying a GAD approach to development planning and programme requires a great degree of commitment to ensure there is structural change and power shift by removing all forms of gender inequalities in social, economic and political sphere of family, work and societal life.

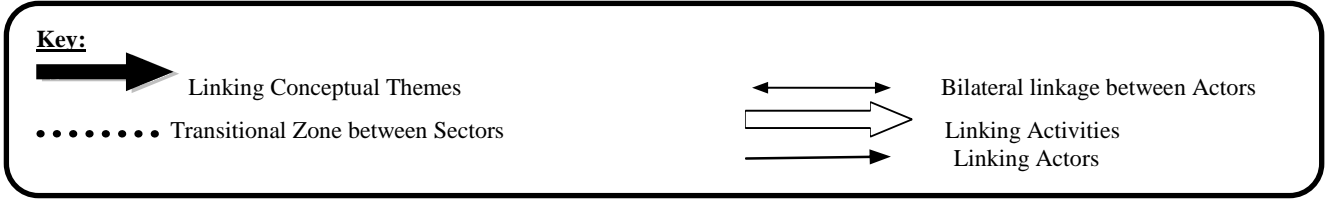
2.3 Conceptual Framework

From the literature, the Ghanaian e-waste industry has a set of actors working complementarily to achieve one ultimate goal i.e., generation of ferrous and non-ferrous metals from production of EEE and non-EEE materials. Based on articulation model, three (3) kinds of activities are discovered in the e-waste industry of urban Ghana. They are collection, material recovery and reuse and metal trading. From the Figure 2.2, one can observe that e-waste management kicks off with collection for material recovery and reuse. Within this phenomenal interaction, several relations and activities gets developed. Among the activities develops here are collection, repair or refurbishing, recycling or reuse, middle-role playing, scrap dealing, metals recovered from e-waste exporting and manufacturing of iron rods and bars from metals recovered from e-waste. There are also those belonging to a group called ancillary service providers who interact directly with all of these e-waste workers.

Figure 2.2: Value Chain Matrix for Gender Dynamics of E-waste Management



Source: Adapted from; Prakash et al., (2010); Oteng-Ababio (2012a, 2012c) and WDR (2010)



2.3.1 E-waste Collection

E-waste collectors are also known as scavengers or waste pickers. These collectors are mostly male young people (Prakash et al., 2010). The aged people who collect e-waste as a trade do so because they may have just come from the villages to the cities with no alternative employment. Thus often times, the aged people at the e-waste sites work as middle-role players and scrap dealers sponsoring the young people with capital to comb the city from door-to-door, corner-to-corner, dump sites and neighbourhoods for e-waste for them (Oteng-Ababio, 2012a). Most workers in e-waste collection are self-employed (Prakash et al., 2010). E-waste collectors travel short and long distance. Some collectors journey on foot from site to the inner city and back with their goods using hand carts and trucks (Prakash et al., 2010). Some collectors travel to far places outside of the city usually by lorry to spend days to build bulk for transportation (Prakash et al., 2010). During the reconnaissance survey, it was gathered that physical demanding character of collection makes it difficult for interested females to participate or do this work for long.

Collectors gather the e-wastes from place to place by mostly purchasing them or using exchanging something with the owner for the e-waste. The latter system is more of barter trading. A study by Prakash et al., (2010) reveals that \$1-2.5 is paid by the collector for an obsolete computer. The risk of been called or judged a thief or looked down by society deters a lot of females from e-waste collection business. Despite the few female representation as told the researcher during reconnaissance, e-waste collectors form the largest share of workers in the informal e-waste sector (Prakash et al., 2010). Collectors form the largest share of the industry because all other actors of

depend on their outputs to be sustained in the business. Again, collection requires little or no capital and tools as compared to the other workers in the industry. As one climbs the industrial ladder, need for capital, tools or equipment and modern technology for work to be sustainable becomes crucial. Therefore, most collectors spend years to gather enough capital and experiences to be efficient as they move up to mostly become middlemen; and later, scrap dealers.

2.3.2 E-waste Recycling

Some collectors engage in recycling at e-waste sites before trading their wares to middle-role players and/ or scrap dealers (Oteng-Ababio, 2012a). Otherwise, the collectors sell their outputs to middle men or women who employ the services of recyclers mostly young people to dismantle and burn their raw materials for furnished products for marketing in or outside the of e-waste sites. The recyclers fall into three (3) categories. We have dismantlers only, burners only and dismantlers as well as burners (Amankwaa, 2013). The recyclers are engaged in basically waste recovery activities. These recyclers are only males in both Accra and Kumasi; information gathered by observation during reconnaissance survey. It also appeared that recycling seemed a lucrative job for children and youths (Prakash et al., 2010).

Dismantlers use bare hands to crash e-waste with tools like hammer and chisel. Recyclers use rudimentary tools without any protective clothing exposing them to all forms of health risks (Amankwaa, 2013). Unproductive recycling poses danger to the recycler and other humans within his or her environment. Open e-waste recycling also has a heavy toll on the environment (air, water, soil and land pollutions) (Amankwaa, 2013).

This recycling process is a major recovery method for generation of different metals from e-waste for reuse or further recycling. The materials recovered from recycling have high marketability with copper selling at \$ 0.22 per half kilo and plastic at \$ 0.01 per kilo (Prakash et al., 2010). Materials recovered from e-waste recycling have local and international value. Most often, the aluminium, plastic casings, printed circuit boards, plastics and scrap metals recovered from e-waste in Ghana are exported mostly to Asian countries (Prakash et al., 2010; Oteng-Ababio, 2012a).

2.3.3 E-waste Repair or Refurbishing

Repairing of e-waste is sometimes termed as refurbishing. Repairing is also another class of recycling activity. Those repairing at e-waste sites focused primarily on working on reusable EEE brought to site by collectors from varying sources including second hand EEE importers (Oteng-Ababio, 2012a). All repairers in Accra and Kumasi were counted as males. The repairers clean and repair non-functional or old EEE to make it functional and affordable for mostly the poor who cannot afford second hand and brand new EEE (Amankwaa, 2013). At times, non-functional materials in possession of repairers are dismantled for functional components to replace defective parts of non-functional EEE likely to be brought to them in future by prospective customers (Prakash et al., 2010). The outputs of repaired e-waste are cheaper on the commodity market compared to brand new factory ones (Prakash et al., 2010).

2.3.4 E-waste Metal Trading and Iron and Steel Companies

E-waste metal trading consists of middle role playing and scrap dealing within the informal e-waste sector and e-waste metal export and metal producing agency trades in the formal e-waste sector. This form of metal trading involves building bulk of the

metals with huge capital over time for sale to prospective and regular buyers usually companies (Amankwaa, 2013). After the e-waste is collected and recycled, precious metals like gold, copper, zinc, steel, cast, hard and soft iron, aluminium and so forth are generated usually for sales to middle-men and middle-women on-site. These middle-role players buys in bits and sells to scrap dealers or directly takes the metals to companies who also buy in bits to get bulk for onward activities. The scrap dealers like some middlemen mostly pre-finance collectors to constantly supply them with e-waste for processing before onward sales (Oteng-Ababio, 2012c; Amankwaa, 2013) to the metal exporters, iron and steel manufacturing company agents or directly sends the metals on trucks to the iron and steel companies located only in Tema.

The iron and steel companies at Tema utilise hard and soft iron recovered from scraps including e-waste to produce iron rods and bars. There are also metal fabricators mostly located close to the e-waste sites who acquire steel, iron, aluminium and cast metals from middle-men and middle-women to produce roofing sheets, cooking utensils, earrings, chairs, balustrade, iron gates, cooking pots and working tools like hammer, chisel and so forth. Most fabricators are males.

2.3.5 Ancillary Service Provision

Provision of ancillary services in the e-waste industry is mostly done by females (Amankwaa, 2013). However, a reasonable number of males participate in this activity to sell certain goods and service like as entertainment (games, video and televised football matches), barbering of hair, sales of coffee and credit card popularly called top up cards. The female ancillary service providers usually render life-supporting services like sales of bathing and drinking water, energy drinks, cooked and uncooked food,

manufactured consumables, second-hand clothing, jewelleryes and working tools (Amankwaa, 2013). There are few shops providing sanitation as well as saving and loans facilities. Those providing the ancillary services either sell on a stationary table-top or on items carried on their heads to comb through the site. However, those males participating in this activity males prefer to put their wares in bags and hanged at their backs with a few displayed in their hands or run their service at a designated point.

2.4 Summary

The current rate of urbanisation and MSW generation in the developed and developing world present valuable resources for development. One of these resources is availability of cheap labour from urbanisation for MSW including formal and informal e-waste management. Informal e-waste management in Ghana and the rest of the developing world is regarded an urban poverty reduction strategy of development. The informal e-waste sector of Ghana is opened several employment opportunities for most poor urban migrant youths of Northern Ghana in Accra, Koforidua and Kumasi. Despite this advantage, the informal e-waste management sector of Ghana is described as highly patriarchal and poisonous to human health and the environment. In line with general assertion of patriarchy, this study sought to assess the gendered roles and power relations in the informal e-waste sector to inform policy regarding sustainable e-waste practice.

CHAPTER THREE

THE STUDY AREA AND RESEARCH METHODOLOGY

3.0 Introduction

This chapter provides an overview on the research localities and methodology. From hierarchical diffusion of innovation and entrepreneurial technologies perspective, Accra and Kumasi happens to be the largest cities in Ghana. By extension, Accra and Kumasi can be described the two major trading centres for brand new and second-hand EEE in Ghana. Hence, Accra adjudged the largest e-waste management hub in Ghana and West Africa is likely to be followed by Kumasi as second in Ghana. This study uses the comparative and mixed research approaches to gather its findings.

3.1 An Overview of the Study Localities: Accra and Kumasi

3.1.1 *Physical Location*

Accra is the national capital of Ghana and capital city of Greater Accra region (GAR). It is also the political seat of government. It is a coastal and mangrove town located within the Southern Zone of Ghana. According to Grant and Yankson (2003), Accra is bounded to the North by University of Ghana; South by Gulf of Guinea; East by Tema Township and West by Korle Lagoon.

Kumasi is about 250 kilometres from Accra. It is an inland and forested city located in the centre of Ghana specifically within the Northern zone. The centrality of the city with roads linking almost every part of Ghana and its neighbouring countries qualifies it to be called a nodal city. Kumasi is the capital city of Ashanti region (AR).

3.1.2 Population Dynamics

Accra and Kumasi are the two most populous metropolitan areas in Ghana; with Accra taking a lead position followed by Kumasi. The population size of Accra stands at 2,240,658 with almost every Ghanaian tribe represented (GSS, 2012). Almost all Ghanaian languages are spoken in the city with the predominant ones being Ga, Akan, Hausa and Ewe together with the national language, English. Most of the foreign nationals in Ghana live in Accra. Kumasi accommodates two-thirds of Ashanti region's population (Amoako & Cobbinah, 2011). The population size is about 2,035,064 (GSS, 2012) with urban growth rate of 2.6 percent (GSS, 2013). Kumasi has an ethnically diversified population of both Ghanaian and non-Ghanaians alike. The major languages for communication in Kumasi are Akan and English.

3.1.3 Economic Activities

A lot of the transnational and multinational companies operating in the country have their headquarters in Accra. Accra harbours majority of the secondary and tertiary sector activities in Ghana. Most of the populace living in Accra are working in the informal sector. Majority of the population in Kumasi are engaged in informal businesses particularly petty trading, small scale manufacturing of cooking ware, footwear and wood as well as food processing, automobile repairs and now, e-waste management.

3.1.4 Waste Management Challenges

Accra generates about 2,000 metric tonnes of solid waste daily; out of which 1,200 to 1,300 metric tonnes get collected (Alhassan et al., 2010). The waste generation per capita is spatially distributed among the different wealth quintile in the city. Those

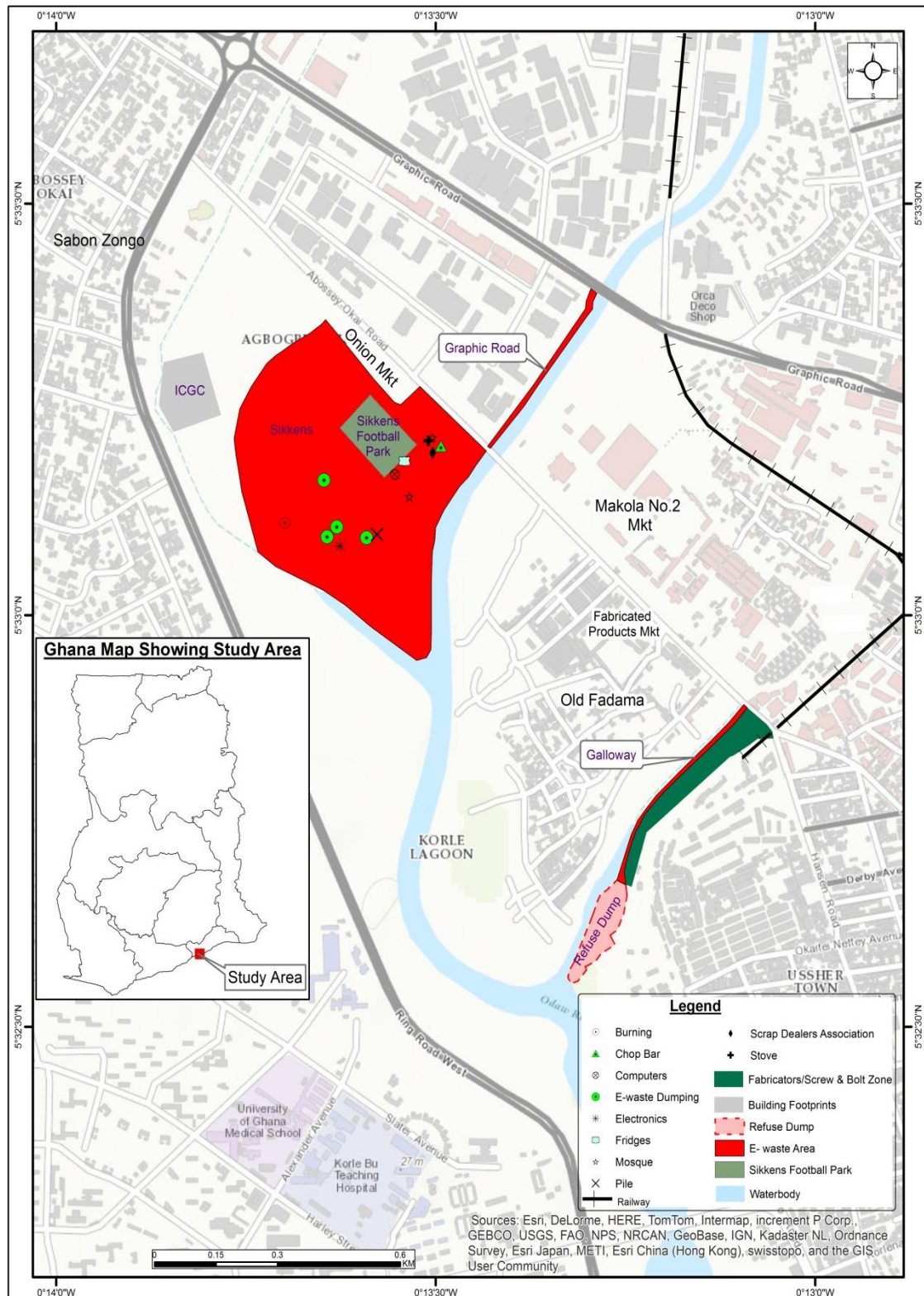
living in low income areas generate about 0.5 kilograms per litre of SW per head while middle income and high income areas generate about 0.24 and 0.21 kilograms per litre of SW per head (Huober, 2010 citing Boadi & Kuitunen, 2003). The situation almost the same for Kumasi. Among the SW generated for management in Accra and Kumasi, e-waste and plastic are common ones treated.

3.1.5 Historical Development of Agbogbloshie E-waste Site in Accra

The largest site for e-waste management in Ghana is at Agbogbloshie, Accra (Amoyaw-Osei et al., 2011). According to the chairman of Accra Scrap dealers Association (ASDA), Agbogbloshie e-waste yard has been in existence for close to 3 decades. It first started as only an automobile or metal waste management centre just as Kumasi until the last 15 years that e-waste joined the existing waste stream managed at these centres.

Agbogbloshie e-waste enclave has 3 major e-waste sites namely Sikkens, Galloway and Graphic Road. Bordered to the north of Sikkens and Galloway sites is Abossey Okai Road. The same road lies south of Graphic Road site. The Odaw River passes through all three sites with the Korle lagoon also located within the enclave. Old Fadama settlement is sandwiched between Sikkens and Galloway sites as shown in Figure 3.1.

Figure 3.1: The Map of Agbogbloshie showing Some E-waste Sites, Accra



Source: Author's Construct (2014)

According to the account given by one of oldest workers at Sikkens site, e-waste management at Agbobloshie started with Sikkens site. After a short while, Galloway site emerged close to the Agblobloshie fabricator's yard. But prior to e-waste management, Sikkens site was a general scrap yard economically linked to Abboso Okai spare parts dealership. Graphic Road site is only an extension of Sikkens site receiving overflow of workers from the latter site i.e. a recent development. Almost all the e-waste collected from different parts of Accra and other regions of Ghana get transported to Agbobloshie for sales and possibly treatment before sales at Tema and/ or overseas.

Agbobloshie is a slum community with a high population density of about 6,000 families or 30,000 individuals (Amoyaw-Osei et al., 2011). This community is less than a kilometre from Accra's Central Business District (CBD) (Amankwaa, 2013). The community is popular for its yam, onion and tomatoes markets, and now the e-waste market, as depicted in figure 3.1. The e-waste market adjoins the onion market and is a few minutes' walking distance from the tomato and yam markets.

Most of the residents of Agbobloshie are migrants from particularly the 3 Northern regions (Northern, Upper East and Upper West regions). Historically, the early 1980s saw bloody clashes between Konkombas and Nanumbas in Northern Ghana, which pushed some Northern indigenes to join their families and compatriots at the Agbobloshie Yam Market (Amankwa, 2013).

Amankwaa (2013) provides another account which led to the development of the Agbobloshie community. He asserts that based at the 1992 Non-Aligned Movement (NAM) conference in Ghana, the AMA authorities at the time relocated squatters and

street hawkers to Agbogbloshie to give the city a beautiful look. Afterwards, several people have continued to move into this part of Accra for settlement and/ or work.

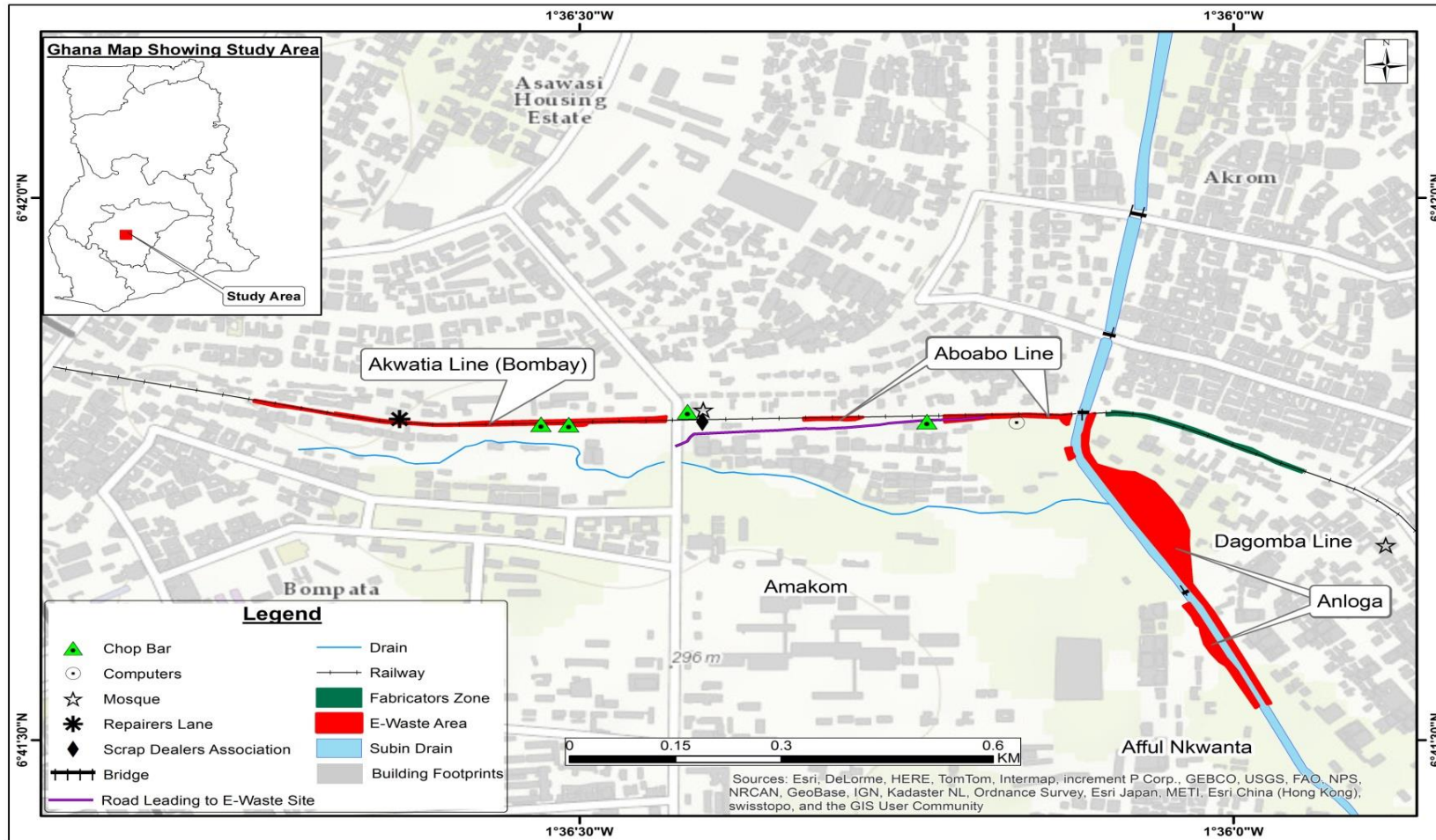
3.1.6 Historical Development of E-waste Sites in Kumasi

The position of the Kumasi e-waste site in the Ashanti region is shown in Figure 3.2. According to the account given by the head of e-waste workers in Kumasi, e-waste workers popularly called scrap dealers first migrated about 23 years ago from Suame Magazine to Akwatia Railway line. Then, they were only dealing with automobile waste. Fifteen (15) years ago, e-waste management joined in the business of automobile waste management at Akwatia Railway Line popularly known as Bombay.

With an increasing working population, Aboabo and Anloga e-waste sites emerged, just as Accra's Galloway and Graphic Road sites. From the two study areas maps, it is observed that abandoned railway lines and unprotected watersheds are the locations that e-waste workers settle in most of the time in Ghana. These areas most belong to the state. This observation will require further studies and interrogation.

Akwatia, Aboabo and Anloga suburbs of Kumasi are all migrants' towns. The first two (2) communities are predominately Northern migrants' communities. In-between Aboabo and Anloga lies Dagomba line. As the name Dagomba line suggests, the area is home to mostly Dagomba migrants. Most of these settlers did not have any relatives or friends to accommodate them and/ or money to rent a room upon migrating to Kumasi.

Figure 3.2: The Map of Some E-waste Sites in Kumasi



Source: Author's Construct (2014)

On the other hand, Anloga in Kumasi has since the end of the Second World War (SWW), been the main settlement for ‘Voltarians’ in Kumasi. Typical of most Ewe communities, Anloga, Kumasi is noted for quality carpentry work, especially furniture.

3.2 Methodology

3.2.1 Sources of Data

The study used two main data sources. They were primary and secondary data. The secondary data were sourced from journals, books, conference paper presentations, articles as well as published and unpublished theses and dissertations mainly on gender, environment, urbanisation, sustainability and research methods. The primary data were sourced from fieldwork questionnaires, in-depth interviews, FGDs, observation notes, pictures and videos.

3.2.2 Research Design

Mixed and comparative research methods were adopted for the study. In applying the mixed method, both qualitative and quantitative data were collected for coding, analysis and interpretation. The individual cases of Accra and Kumasi in terms of background information (demographic, organisation of work, timing), culture (customs, beliefs, practices and social organisation), working techniques and tools, income, and so forth were presented for some comparison. In so doing, the gender relations within the e-waste economies of Accra and Kumasi were ascertained.

3.2.3 Research Strategy

First of all, reconnaissance visits to e-waste sites in Accra and Kumasi were conducted by the researcher for 3 months. Such site visits were organised about 3 times a week. During the visits, the researcher reported to the sites as early 5:30 a.m. to interact with

workers there who are usually collectors who come to the site to rent tools or equipment; or to gather their personal tools for the ‘bush²’. The researcher spent between 8 to 12 hours daily in the field collecting all forms of data, like pictures, video and audio recordings. At the end of the reconnaissance, rich qualitative knowledge on the people, their environment and characteristics of the e-waste economies in Accra and Kumasi had been ascertained.

After the reconnaissance, research instruments for in-depth interviews, focus group discussions (FGDs) and questionnaire administration were developed. The instruments are attached as appendices 5, 6 and 7 respectively. Alongside the qualitative data collection, questionnaires were being administered to willing respondents; first in Accra, followed by Kumasi. Both qualitative and quantitative surveys in each study area was done concurrently with the consent of collaborators. There were some future visits and follow ups during data management, analysis and report writing processes.

The questionnaire survey collected data on demographic and socio-economic characteristics of workers in the e-waste industry. Some of the variable data in the questionnaire included sex, type of work, details of work at site and home, daily income or profit, knowledge of health risks associated with work done and benefits of participating in e-waste business. At this same time, in-situ observations and participation continued until fieldwork ceased.

² Bush here is a terminology used by the e-waste workers at the site for all places that collectors go to get e-waste materials. It can any part of the city, town or village.

3.2.4 Sampling of Respondents

During the reconnaissance survey, the leader of the ASDA stated that about 10,000 workers were estimated to be working at the 3 e-waste sites, as is estimated to be the same for Kumasi. Out of the 10,000 workers in Accra, only 4 were females, compared to 300 females in Kumasi. The survey could sample 108 respondents out of the 164 respondents estimated using the sample size calculator by Creative Research Systems (2012) for the survey based on the 20,000 e-waste working population. Out of the 20,000 workers at the e-waste site, about 10,000 were said to be registered members of the scrap dealers associations; 5,000 for each city. While none of the registered members of ASDA was a female, 30 out of 5,000 registered members of ISDA, Kumasi, were females.

The multi-staged sampling technique was used in picking out respondents for the study to sufficiently gather as many males as females in the different chains of e-waste activities. In the first stage, the entire working population for Kumasi and Accra's e-waste economies were segmented into working groups, namely collection, repairs or refurbishing, recycling i.e. dismantling and burning, middle-role, scrap dealing and ancillary services.

Secondly, proportionate samples for each identified group were targeted for sampling. Based on this proportional classification, as many females as males were randomly selected for interview for each category of respondents. In all, females were only represented in middle-role and ancillary service provision activities. There a lot more females in ancillary service provision than middle-role playing. The rest of the activities were solely occupied by males. In the final stage, 82 respondents were expected to be randomly selected from Accra just as from Kumasi. However, the study could

randomly get only 41 and 67 respondents for Accra and Kumasi respectively instead of 82 targeted respondents. Details of sample sizes by region, job and sex as shown in Table 3.1.

Table 3.1: The Distribution of Respondents by City, Sex and Type of Activity

Type of Activity	<i>Accra</i>		<i>Kumasi</i>		Total (Percent)
	Male	Female	Male	Female	
<i>Collection</i>	7 (19.44)	0	14 (29.79)	0	21 (19.44)
<i>Repairs/ Refurbish</i>	1 (2.78)	0	4 (8.51)	0	5 (4.63)
<i>Recycling</i>	8 (22.22)	0	4 (8.51)	0	12 (11.11)
<i>Middle-role</i>	12 (33.33)	1 (20.00)	15 (31.91)	15 (75.00)	43 (39.81)
<i>Scrap Dealing</i>	7 (19.44)	0	8 (17.02)	0	15 (13.89)
<i>Ancillary Services</i>	1 (2.78)	4 (80.00)	2(4.26)	5 (25.00)	12 (11.11)
<i>Total</i>	36 (87.8)	5 (12.2)	47 (68.66)	20 (31.34)	108 (100.00)

Source: Author's Construct (2014)

3.2.5 Survey Refusal Rate

The overall refusal rate for this survey was about 34 percent. The 50 percent refusal rate for Accra is largely unacceptable compared to Kumasi, 18.30 percent. However, the study had to fall on qualitative field data and secondary sources of information to be able to suitably study the Accra e-waste economy and compare it with that of Kumasi. The high refusal rate in Accra is caused by the salient reason that the Accra's e-waste site (Agbogbloshie) has attracted a lot of public outcry making it difficult for the workers to open up to both known and unknown researchers. It took about 6 months, even much more, for some people in the field to build trust and confidence in the

researcher. The refusal rates are also high because the e-waste workers have limited time on site to spend on a survey. Hence, getting as many people as possible who can be convinced to participate in a study required that the researcher had sufficient money to compensate them for their time. However, the researcher in this context was financially constrained and tried to make do with those she could get freely to work with. The high refusal rate for this research's survey is not new when compared with similar studies. For instance, Agyei-Mensah and Oteng-Ababio (2012) scored a 48 percent refusal rate in a similar study in the same locations. Hence, the researcher was confident that the study would fit into scientific academic standards, despite the high survey refusal rates.

3.2.6 Selection of Interviewees and Discussants

Information on collected qualitative field data is captured in table 3.2. 15 in-depth interviews and 3 FGDs were conducted in both regions. There were 3 FGDs conducted out of the 4 planned ones, because it became nearly impossible to bring five or more female e-waste workers in Accra together for about 30 minutes. The FGDs were targeted as e-waste workers, while the in-depth interviews targeted leaders of multi-stakeholder groups of e-waste management in Ghana.

Table 3.2: Details of Qualitative Data Collection

<i>Type of Data and Respondents</i>	<i>Accra</i>	<i>Kumasi</i>	<i>Total</i>
In-depth Interviews			
<i>Opinion Leaders</i>	1	1	2
<i>Waste Management Department</i>	–	1	1
<i>Head of E-waste Workers' Association</i>	2	4	6
<i>E-waste Smelting Firms</i>	3	N.A	3
<i>E-waste Exporting Firms</i>	–	3	3
Total	6	9	15
FGDs			
<i>Female-Only</i>	–	1	1
<i>Male-Only</i>	1	1	2
Total	1	2	3

N.A means not applicable: There are no smelting firms in Kumasi.

Source: Author's Construct (2014)

3.2.7 Field Experiences

The research fieldwork took approximately a year instead of 3 months as initially planned. Three (3) months was dedicated to the reconnaissance survey using observation and informal interview techniques. Additional 6 months had to be spent by the researcher, from site to site explaining her work to collaborators for confidence and

trust building. Actual data gathering took 3 months. The length of time to build trust and confidence also revealed the need to motivate some sampled respondents with money in recompense of their time to expedite fieldwork exercise.

The essence of spending one year on fieldwork was a result of high refusal from sampled respondents as well as selected discussants and interviewees. In extreme cases, those who refused to be interviewed were preventing other colleagues from granting the researcher an interview. There were certain times that the researcher was physically and verbally attacked. One remarkable instance was where the researcher had engaged leadership of one section of Agbogbloshie e-waste site in a discussion which was been recorded based on their consent. Three (3) young men interfered instructing the leadership to end the discussion meeting with the researcher. These young men assumed that it was for journalistic purpose. When the leaders tried to ignore the young men, the researcher was physically and verbally attacked and sacked out of the site by the 3 young men. The outcome of this experience called for the researcher to be always guided by a dedicated member of the scrap dealers association at both Accra and Kumasi. Those who abused the researcher during fieldwork were informed to be people who felt bitter about how national or state actors as well as international and local media have tarnished the work of informal e-waste management in Ghana particularly that of Agbogbloshie.

The researcher motivated the respondents, interviewees and discussants with tokens of money contrary to research code of ethics to be granted enough time for an interview. But, it came up to the researcher, several other researchers who have studied issues related to e-waste management at the same sites had had to give the workers monies for maximum cooperation.

3.3 Data Analysis

Both inferential and descriptive statistical analyses were done. Coding of open questions in the questionnaire was done for data entry with the CSPRO 5.0 version and the analysis with the Stata 11.2 version. However, some open ended data from the questionnaire were treated as qualitative data. Frequency distribution tables and bar charts are some of descriptive statistics generated, and chi-square test as well as regression analyses were the inferential analyses performed.

A regression analysis was done using the multinomial logit modelling (MLM) method. The MLM was done to test for exact demographic factors constructing the kind of gendered roles and power relations observed in the informal e-waste sector. As structured in equation '1', the objective interest (function) of an individual to participate in informal e-waste business is given as:

$$V_{ij} = B_j X_i + U_{ij} \dots \dots \dots (1)$$

Where; V_{ij} is the indirect utility function of an individual 'i' in e-waste management activity category 'j';

X_i is the individual socio-economic characteristics (e.g., sex, age, education, religion, ethnicity, marital status and household size) and regional attributes like Accra and Kumasi which are dummies;

B_j is a vector of coefficients of the regressor in the model;

U_{ij} is the stochastic component of utility which captures unobserved utility. The error term is assumed to be identifiably and independently distributed across the alternatives.

Given J choices of e-waste activities, if the individual chooses the alternative ‘j’ then the utility level V_{ij} is the highest among the J alternatives (i.e. $V_{ij} > V_{ik}$ for all $j \neq k$). The probability that individual i will choose alternative j category of e-waste activity is expressed as:

$$P_{ij} = \frac{\exp(B_0 + B_j X_i)}{\sum_{j=0}^5 \exp(B_0 + B_j X_i)} \dots \dots \dots (2)$$

$$\sum_{j=0}^5 \exp(B_0 + B_j X_i)$$

Let P_{ij} (j=0, 1, 2, 3, 4, 5) denote the 6 alternatives of e-waste activities such that

j = 0 is the probability of being an ancillary service provider

j = 1 is the probability of being a collector

j = 2 is the probability of being a repairer or a refurbisher

j = 3 is the probability of being a recycler

j = 4 is the probability of being a middle-role player

j = 5 is the probability of being a scrap dealer

In the estimation of the probabilistic situations of e-waste activities, the relative risk ratio (RRR), or the odd ratio for the MLM, is expressed below in equation 3. In equation 3, all parameters B_j of the MLM is based on the maximum likelihood techniques. Under the given scenarios, the log odd ratio is obtained by finding the log of equation (3) as expressed here to be equation (4), which is linear. All the co-efficients for the log odds ratio will be interpreted in terms of their signs and significance.

$$\frac{\text{pr}(y=j/x)}{\dots} = \frac{\exp(B_0 + B_j X_i)}{\dots} \dots \dots (3)$$

$\text{pr}(y = 0)$

$\ln \left[\frac{\text{pr}(y = j / x)}{\text{pr}(y = 0)} \right] = B_0 + B_j X_i \dots \dots \dots (4)$

For the purpose of this study, 3 different estimations were carried out. The first estimation comprises all observations for modelling, with Male Sex (SEX1) for all five categories of e-waste management activities in reference to the base class (Ancillary Services). In subsequent models, the observation outcomes deduced came up by adding the following variables to Male Sex variable (SEX1): Accra enumeration area (EA1) and Age category (19 to 24 years) for Model 2; and Accra EA, Male sex, Age of 19-24 years, Primary and Junior High educational levels, Ewe ethnicity, married marital status, number of productive work hours and catholic religion for model 3.

The reference class for modelling is ‘ancillary service’ because it is the only female dominated activity within the sector and also a traditionally stereotyped job for females. Females dominate in the ancillary service provision, which is a life supporting service, as confirmed by Agyei-Mensah and Oteng-Ababio’s (2012) and Amankwaa’s (2013) studies on informal e-waste management in Ghana. Where females and males are involved in the ancillary service provision, the items that each sex trades in differ greatly. Females mostly trade in food, water, cola nut, basic working tools, banking and savings services, whereas males mostly work as barbers, phone cards and phone accessories retailers, as well as second hand clothes and shoes’ sellers.

The results of MLM is analysed as follows: in all three models, the probability was significant at 0.0000 at 5 percent degree of significance. The pseudo value increases as more variables were been added onto the modelling process. The pseudo R2 increased from 0.1357 for model 1 through to 0.4966 for model 3. These pseudo R2 values

confirm the validity of the model used by the study. Details of the results from the estimations are attached as appendices 3, 4 and 5.

The qualitative data were transcribed for coding to triangulate the analysis from the quantitative results. Vignette boxes have been inserted where necessary. Photos are also used in the report to depict visual interpretation of some results. With the results of the analysis from all the qualitative data, the researcher was able to generate some subjective interpretations to some statistical results from the quantitative data.

3.4 Summary

This study took place at 6 major e-waste sites in Ghana, specifically in Accra and Kumasi. The concurrent mixed research method was used. In all, 108 respondents were surveyed in addition to doing 15 in-depth interviews and 3 FGDs for data collection. The quantitative data was analysed with SPSS 11.2 as the qualitative data was manually transcribed and coded into themes.

CHAPTER FOUR

CHAIN OF E-WASTE MANAGEMENT ACTIVITIES IN ACCRA AND KUMASI

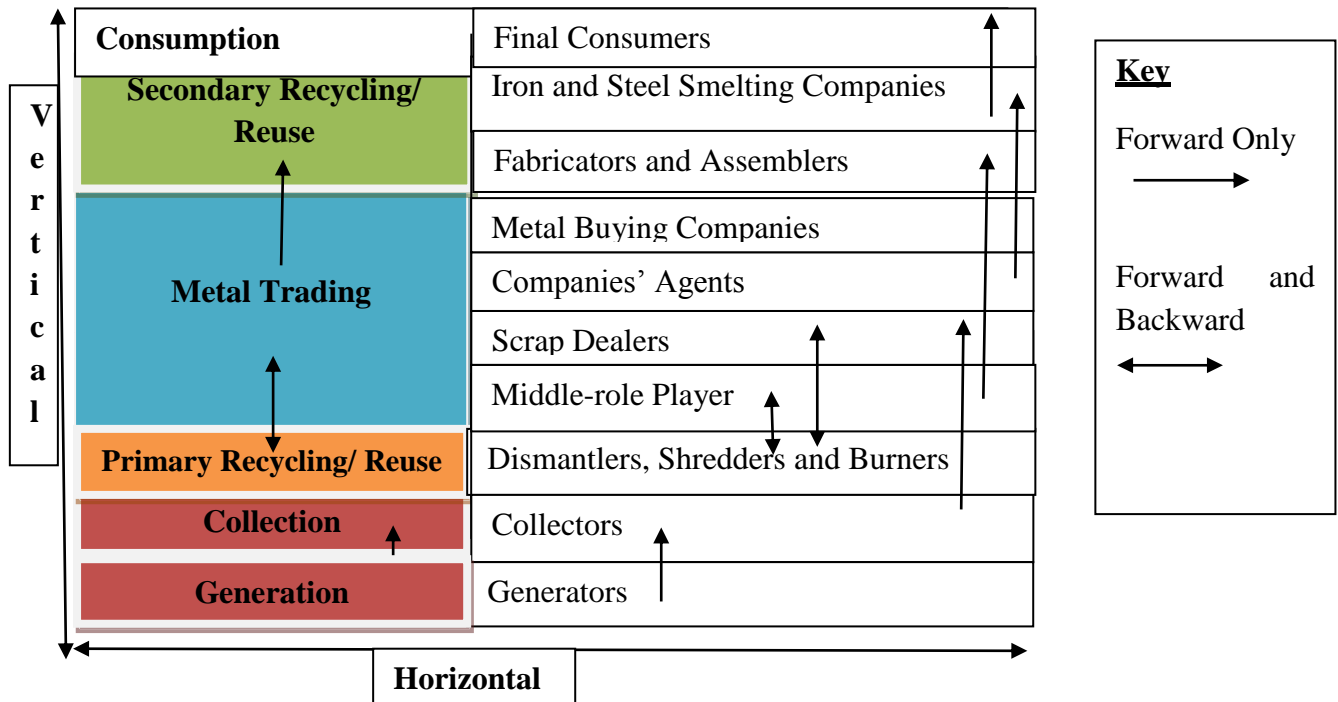
4.0 Introduction

This chapter identified the chain of activities along the horizontal and vertical axes of the e-waste industry in Accra and Kumasi, outlining principal actors, geographical reach as well as forward and backward linkages under the guidance of the articulation and disarticulation model. All e-waste value chained activities along its horizontal and vertical axes are thoroughly discussed in this chapter giving a sexual composition at each stage as well as the roles performed by males and females. At the end, a summary of the findings for this chapter is presented.

4.1 Horizontal and Vertical Linkages in E-waste Management Practice

Following the waste management hierarchy, waste generation ought to be followed by collection, storage, transportation, treatment or management and finally, disposal in the most effective and efficient manner for sustainability. Within the e-waste economies of Accra and Kumasi, collection, transportation and treatment or management connects in some unique ways to produce a web of horizontal and vertical relationships with sustainability unlikely to be achieved judging from the current state. Thus, various actors face a number of challenges along the vertical and horizontal axes of e-waste management; making it difficult to sustainably operate as depicted by high levels of material loss, environmental pollution and social outcry of the industry. Details on the horizontal and vertical relationships built within e-waste management culture of Ghana is depicted in figure 4.1.

Figure 4.1: Horizontal and Vertical Ordered Activities of E-waste Management



Source: Author's Construct (2014)

The vertical linkage outlines interactions between different set of activities of e-waste management along the hierarchy. Most of the relationships observed within the e-waste management hierarchy is vertical in nature. The horizontal linkage shows internal relations between activities at each stage of e-waste management processes. For instance, shredding, dismantling and burning interlocks at the same stage to complete primary recycling process.

Aside primary recycling, horizontal linkage is developed at each stage between e-waste managers and ancillary service providers. None of the activity groups within the chain is non-interdependent on ancillary services providers. Each activity group depends on ancillary services for at least food and water as the work of each group requires lots of energy for high productivity at different rates. As it will be later shown statistically that most e-waste workers are Muslims. These Muslims in times of fast still depend on tea,

drinks and water provided by those in ancillary service provision sector of the industry to remain productive on site during such occasions. Gender segregation in terms of varying distribution of males and females involvement in direct and indirect e-waste management activities persist along the hierarchy to show dominance and power relations.

4.1.1 Collection

Along the vertical supply chain or axis, generation of e-waste by EEE consumers result in collection by those called e-waste or itinerate collectors, pickers or scavengers. Collection seems to be a preserved activity for males. Females who attempt to engage in e-waste collection, give up within the shortest possible time. These young women and girls give up in response to social stigma through mockery. Their male counterparts are often preferred above them. The female e-waste collectors often lack the required physical strength to continuously collect from neighbourhood streets to neighbourhood streets for days, months and years with trucks, bicycles and wheel barrows for transportation to working sites. Most collectors who seems to be making reasonably profits from the business claim to undertake majority of their work on foot.

During collection, workers prefer to walk on foot searching every corn and field for the materials to cart to the site. There is so much physical strength required by anybody who does the work. Therefore, few females who went into collection even in different style from the males discontinued after few month or at most a year. The females travelled either to villages or went into offices in the cities to collect and transport their wares on mini tipper trucks to the e-wastes sites in Accra and Kumasi. Collection also involves pushing trucks and carts around the city and villages over long distances which

is too tiring for the women to do over a long period. These could be major reasons why few energetic women are the ones who attempt to go into e-waste collection.

Major reasons given during FGDs and in-depth interviews by male and female participants as to why females hardly practise collection for long or even at all were: (1) husbands sometimes ask their wives to stop the job; (2) public ridicule of mainly female collectors; (3) health problems; (4) demands of the household competing for these women's attention and (5) high physical strength intensity of the job. Responses were not given in any particular order. But the researcher thinks physical factors primarily constrain females' continuous participation in e-waste collection.

The concentration of males in waste collection is confirmed by similar studies in Central America (Wahab, 2012) and Ouahadougou, Burkina Faso (Schneiberg et al., 1999). Even though female participation in MSWM in Africa, Asia and Latin American seems to be gathering momentum, the same reasons given above amongst others to be constraining active and continuous participation of females in the MSWM industry (Schneiberg et al., 1999).

E-waste collectors refer to all the places in the cities and villages that they go to in search for the materials as 'bush'. The items collected are also called 'condemned'. E-waste collectors mine almost every neighbourhood (low, medium and high income residences) of the two cities and neighbouring towns and villages for all types of e-wastes including irons, deep freezers and refrigerators, air conditioners, fans, televisions, radios, stereo equipment, computers and accessories. Collectors who go to remote areas from the city spend days or even months to build some bulk before transporting collected materials to the e-waste sites. The e-waste generation sources

include second hand EEE shops, homes, offices, auto repair shops, garages, landfills or dump sites, waste transfer stations, open areas and mining centres (Prakash et al., 2010; Oteng-Ababio, 2012a). Often times, waste generators who have credible knowledge of the resourcefulness of their e-waste given out to collectors, negotiate for a fair money to be paid to them. Thus, e-waste collectors often pay menial amounts to e-waste generators in order to easily access the material.

When e-waste collectors or pickers transport collected goods to e-waste sites, they either sell directly to scrap dealers, middle-role players and repairers or refurbishers in either processed or unprocessed state. Most often, the collected materials are brought to scrap dealers or middle-men who are mostly financiers of the collectors. Accounts by most collectors reached by the survey indicated that, their 'masters' give them between GHC50.00 to GHC200.00 daily for 'bush' to collect and transport the materials to them at the sites. Those who go in deep search for e-waste resources in far places to spend days and months receive GHC500.00 up to about GHC2,000.00 from their 'masters'. Those who take as much as GHC1, 000.00 to GHC2,000.00 go to mostly collect from industrial sites like Tema ports and harbour and other mining centres.

Sometimes, collectors predetermine that they shall make a loss if they should transport collected goods to those masters who prefinanced them. Often times in such cases, these collectors sell their goods to other scrap dealers or middle-role players particularly middle-women whom they believe can help them to break even or make a little profit. The underlying reason here is, females have limited access to e-waste materials to buy and trade. Therefore, middle-women who are approached by collectors with e-waste materials to buy and sell at little profit often do not let such opportunities slip by them. In some instance, the women make losses after trading such materials; affecting their

capital for business. The information here were gathered from the survey, FGD and in-depth interviews.

Some collectors process their collected materials by dismantling and/ or burning to retrieve exactly what resource(s) lies in the waste that middle-players and scrap dealers need for further sales. Dismantling and burning are sub-components of primary recycling. Therefore, 'recycling' collectors make higher profit from selling processed e-waste than 'non-recycling' collectors. Howbeit, non-processing collectors save time, energy and money to collect more e-waste from the 'bush' as compared to 'recycling' collectors.

The conversion of e-waste into resource immediately after collection in Accra and Kumasi portrays that e-waste in possession of a collector in this study ceases from being a waste product to become a resource. Thus, it is targeted as a recyclable or reusable substance to protect the environment, conserve energy and improve the economic position of workers (Wilson, 2007; Oteng-Ababio, 2012a; Rockson et al., 2013).

4.1.2 Primary Recycling or Reuse

Primary recycling is about the first set of activities performed after collection to recover any easily extractable resource in e-waste for trading to receive secondary recycling attention if necessary. Recycling helps to prevent wastage of resources and reduce pollution as well as energy consumption. Thus, recycling aims at protecting environment, conserving resources and promoting sustainability. The primary recycling in this context is performed by the informal e-waste sector for onward sales by mostly 'masters' in the same sector to formal recycling companies for further processing. Primary recycling is mostly done with simple tools, bare hands and often with no

protective clothes by dismantlers, sorters and burners (Prakash et al., 2010; Oteng-Ababio, 2010; Agyei-Mensah & Oteng-Ababio, 2010; Amankwaa, 2013). The character of informal recycling is described as primitive and risky (Prakash et al., 2010; Koranteng & Darko, 2012; Amankwaa, 2013).

The primary recycling starts off with dismantling to recover every piece of resource in the collected waste. Most often, the dismantlers are contracted by middle-role players and scrap dealers to first dismantle and sort materials bought from collectors for them. In a few case like that of Kumasi, the same people who dismantle and sort, burn at the same time to retrieve resource components for ‘masters’ to trade. All those who dismantle, burn and sort at all 6 e-waste sites studied are males. The recyclers refer to those who engage them as ‘masters’. Most often, the term ‘master’ at the site is used for middle-men and scrap dealers, who are solely men. By observation and in-depth interview, it came to light that middle-women have never engaged in e-waste recycling. However, most middle-men as compared to scrap dealers usually assist those they have contracted to dismantle and sort their wares for them. None of the scrap dealers interviewed acknowledged of assisting recyclers as rightly observed. The only scrap dealers who ever practiced recycling did so when they first entered the industry as either collectors or recyclers.

After dismantling and sorting, recovered resources like the ammeter, alternator and copper wires are set on fire. The fire helps to get rid of the rubber casing of the said resources. Those who burn just as dismantlers or sorters gets to be financially or materially rewarded by their ‘masters’. The cost of burning, dismantling, shredding or sorting is not standardised. Typical of an unrecognised informal sector, ‘masters’ gauge the quantum of work done with their eyes and financial standing at any given time to

reward these recyclers. The exchange of money or material here is seen as favour from ‘master’ for his ‘boy(s)’ to build sufficient capital for the next level in the business. As a result, people who have helped others climb the e-waste business ladder in this direction have been revered by the recipients. Material forms of rewarding recyclers is seen as barter trading system. Here, the recyclers are rewarded with material outcomes of service(s) provided to go and sell for cash. The researcher however observed that, the financial and material reward of recyclers seems woefully inadequate to take care of risks that their work can expose them to should the worse (i.e., sickness or death) happens.

In Plate 4.1, a few young men are seen in the picture holding their iron rods to burn recovered e-waste items like copper wire, ammeter and alternator in their rubber casings. Burners in Accra sit in groups at the burning spots from morning to mostly one or two hours after noon when the those who dismantle or shred for ‘masters’ begin to report to them seeking for their service. A few times spent by the researcher during waiting time with burners pointed out that, these workers talk about their personal lives and inspire each other whiles sleeping along the line until it gets to the time for them to start work. Immediately materials are brought to anyone of them to burn, they get in their walleting boots; pick their rods, go in search for foam and matches to set on the fire and get ready water on standby to quench the fire when items are burnt to their satisfaction.

Plate 4.1: Burning of Sheathed Wire at Agbogbloshie to Harvest Copper

Source: Field Data (2014)

In Kumasi, dismantlers engaged by e-waste traders (middle-men and scrap dealers) were responsible for dismantling, burning and sorting at the same time. Burning of e-waste in Kumasi was done in a different way as compared to that of Accra. The method of burning e-waste recovered resources like ammeter, alternator and copper wire in their plastic casings are portrayed below in Figure 4.2. The e-waste metals are set on fire in trunks neatly welded together to prevent emanating smoke from spreading into nearby residents or neighbours' house or offices. This practice also reduces the extent to which burners get exposed to the smoke from burning on-site as compared to Accra. It can be observed just as confirmed through in-depth interviews with all leaders of the site, that a local invention of a chimney is adopted to control air pollution and public outcry about burning activities on-site in Kumasi.

Plate 4.2: Burning of Sheathed Wire at Kumasi to Harvest Copper

Sources: Field Data (2014)

Despite the above discussed disparities in the burning strategies of both cities, open e-waste burning still perpetuates and remains hazardous to human health and the environment. Therefore, no amount paid to current burners of e-waste at the e-waste sites can offset the risks that they pose to themselves, neighbour homes, shops and the general environment. Burning e-waste metals reduces its value on the global market as compared to manually or electronically stripped off ones (Chi et al., 2011).

After dismantling and burning, all the resources generated are sorted and packed separately in different sacks by mostly the recyclers for their 'masters' to trade them out to their prospective buyers on the local and international markets. Ferrous and non-ferrous metals are recovered after the above described informal recycling to retrieve bolts and nuts, memory chips and cards, phones, computers, television sets, radios,

stereo equipment, tyres, tyre rims, zinc, brass, heavy and light iron, copper, aluminium, steel and EEE boards. The EEE boards recovered are green boards, television boards, phone boards, DVD board and computer boards (mother boards). Some of those materials recovered at all 6 e-waste sites studied are displayed in Plate 4.3.

In addition to dismantlers, sorters and burners in the informal recycling business are repairers or refurbishers. Unlike repairing or refurbishing which is capital intensive, dismantling, sorting and burning are not capital intensive. One can actually engage in these activities even without capital like collection. One has to be physically strong to participate in such activities. This may also explain why all recyclers and collectors are males.

At the e-waste sites, repairers or refurbishers buy from collectors and e-waste traders, those e-waste with problems that can be fixed for reuse. Upon repairing or refurbishing such items, repairers put those reusable items on the open market on and off e-waste sites for sales to consumers from all walks of life. People from all walks of life throng to the e-waste sites in Accra and Kumasi to buy repaired electronics and electronics' parts for use. Those electronics and/ or parts sold by these repairers are comparatively cheap compared to those sold in other parts of the city. If there are parts or commodities that cannot be fixed for trading, these repairers dismantle to generate stock of constituents that can be used for replacement in other equipment. In a typical repairer's shop at the e-waste site, you can find almost all the electronics including those tools and equipment as shown below in Plate 4.4. All unwanted parts not needed by repairers or refurbishers are sold back into the sector to specifically, collectors or middle-role players.

Plate 4.3: Some Products Retrieved after the Recycling of E-waste Materials



Used Rims



Used Car Batteries



Dismantled Mother Boards



Dismantled Phone Board



Dismantled DVD Board

Sources: Field Data (2014)

Plate 4.4: A Repairer's Workshop at Galloway Site, Agbogbloshie



Sources: Field Data (2014)

4.1.3 Metal Trading

Along the vertical supply value chain, middle-role players usually sell their outputs to scrap dealers and fabricators usually in small quantities and volumes as compared to scrap dealers with the largest capital base on-site mostly selling to metal buying and iron/steel companies. To sell their goods faster, scrap dealers and middle-role players usually transport the goods themselves to high paying buyers for further sales and/ or production.

As gendered as the e-waste industry is, middle-men and scrap dealers solely males, prefer to sell their e-waste metal outputs to exporting metal buying companies and individuals, compared to the iron and steel recycling industries. As the middle-women sell their products to scrap dealers and fabricators. Thus, male e-waste workers have close connection with consumers outside the site as compared to female counterparts.

The middle-women are most often closely connected to fabricators and scrap dealers on and off sites. The financial status of male e-waste metal traders (i.e., exporters and metal processing companies) is so many times higher than female counterparts (i.e., fabricators and scrap dealers) This relationship is so because females have limited capital to engage in all activities like purchase metals to fill large volumes of shipping containers and/ or trucks for exporters and iron and steel companies respectively as their male counterparts do with mostly sponsorship from their business partners. This relatively low economic position of middle-women deprives them from actively participating in decisions concerning pricing of e-waste metals on the site. Metal price determination is often determined by scrap dealers who are the most economically powerful players of the informal e-waste industry. Again, scrap dealers by virtue of the large scale nature of their business with local and international markets usually have better appreciation of how the dollarization of the Ghanaian economy and the e-waste business to best determine good rates to buy and sell e-waste metal prices on and off sites. Non-consultation of both groups of middle-role players in the industry cuts them off from inputting their unknown costs of generating metals for sales to scrap dealers into the calculation formula for setting metal prices. Therefore, middle-role players who are subordinate to scrap dealers often feel cheated by their superiors and those players beneath middle-role players suggest a tone of unfair settlement from these players atop them despite their appreciation of what is received. Thus, almost every player of the informal e-waste industry sees it as a multi-dollar business that if it had been properly structured, could make lives within it far better than it is now.

In the e-waste industry, the relationship between formal and informal managers is strongly built along trading lines. The informal managers collect to process and trade

out to formal companies who need those generated resources for further processing into semi-finished and finished goods for onward trading. The 5 existing iron and steel companies depend mainly on the informal e-waste sector for cheap supply of their raw materials for iron rods and bars. Otherwise, these iron and steel companies have to import raw materials at comparatively expensive rates for production.

At the same time, all metal exporters in the country depend on the informal e-waste sector to get needed resources for their businesses to prosper. Since these exporting metal companies pay promptly and offer higher prices for e-waste metals, based on international selling prices, than most iron and steel recycling companies in Ghana, the informal e-waste metal traders preferably used to sell almost every metal generated to the exporters. As a result, Ghana's cabinet came up with the Prohibition of Export of Ferrous Scrap Metals Regulations, 2013 (i.e. L.I. 2201) to protect such companies. This law in effect, enjoins informal e-waste managers to only trade ferrous metals generated from their businesses to only ferrous metal processing companies in Ghana. From the researcher's interaction with informal e-waste sector, L.I 2201 was viewed as a national strategy to collapse the sector by kicking out illegitimate e-waste exporters irrespective of how much support this sector received from them. Hence, the names and locations of most exporting companies were vehemently withheld by the e-waste workers when inquired by the researcher to use snowballing method to reach out to them and capture their views on the study conducted.

The only names mentioned were BLANCOMET Recycling Company in Accra and Kumasi, 'AND' Metal Company Limited (Kumasi) and Balagi Metal Company (Kumasi). Through informal discussions, the researcher got to know that most exporting metal buying companies are located in the GAR specifically in Tema SGS, Accra New

Town and Avenor neighbourhoods. The refusal of informants to give locational details made it impossible for the researcher to track these e-waste metal exporters for further discussions. Again, the researcher was constrained by time to go in deep search of these companies which were difficult to find and would seem difficult to grant her interview even if they were found within the shortest possible time.

These companies whose names and directions were freely given most likely depicts that they may certainly be registered and have duly been licensed to operate. It is again perceived that these companies may be most legally compliant with LI 2201 among their peers. The interactions with those named companies revealed state actors like Factory Inspectorate Division, Ghana Fire and Emergency Service, Ghana Revenue Authority and Ghana Police Services pose unwarranted threats to them irrespective of their acquired license to work in Ghana. This is interpreted to mean that these companies seemed uncomfortable with regular visits by state actors to their premises as they thought locally owned businesses did not attract the same of level of attention from state actors. To these international business men in Ghana, state agencies unnecessarily trail their businesses for money compared to local counterparts. Since this study did not set off to investigate into state agencies-business relationship, the accused state agencies were not contacted for any explanations.

According to the manager of a Russian company called Blancomet Recycling Company in Kumasi, there were 75 employees of whom 13 were females. The company engages the services of male employees in acid leaching from car batteries using cutlass, plugs, hammer, chisel and screw drivers; driving the company's cars to transport goods and using a truck on the company premise to offload and on-load goods. Whilst the female serve in capacities such as metal cleaners, cooks, administrative assistants and

secretaries. The different roles performed by males and females here was justified to be highly dependent on physical strength. Hence, managers said they deliberately recruit males believed to be strong to handle machines and direct waste management activities while females are employed to do housekeeping roles like cleaning, cooking and caring as Ardayfio-Schandorf and Kwafo-Akoto, (1990) had generally observed.

From the in-depth interviews with heads of these companies, it was highlighted that most employees were young adults, mostly single with some form of junior, senior and post-secondary education including HND, Teachers and Nursing training certificate holders. The work in this category would require people who can read and write to strictly follow instructions to the letter as any mistake could lead to serious consequences like health problems including death and business closing down as compared to informal counterparts who did not necessarily need to be literates. As a result, managers in some of these companies have set rules of deducting a certain amount from one's salary as many times in the month that you will fault. For instance, each time you are seen not wearing your protective gears on the compound of the companies, GHC1.00 was to be deducted from your salary. In the case of the informal sector, wearing of protective gears is seen as a luxury and waste of man-hours.

The metal resources traded by the exporting companies are iron, EEE boards, memory chips, car batteries, stainless steel, nickel, zinc, brass, aluminium and copper. This confirms that all metals except iron in particular for indigenours metal processing companies is passed from the informal sector to exporting companies for consumption outside Ghana. Blancomet Recycling Company, like most other export driven metal companies, were not trading in iron. Some of these companies who used to export iron metals had to desist from this act to avoid coming into conflict with the laws of Ghana

and state protection agencies particularly the Customs and Preventive Services at Tema and Takoradi ports and harbours. As an export metal driven metal company, the scrap metal law bans the exportation of iron and steel from Ghana. All these exporting companies were exporting other metals aside iron and steel for the logic that there were no local industries to utilise these metals. It is cautiously interpreted here that there are aluminium processing companies in Ghana. But this research did not set out to look into this matter in terms of its relationship with e-waste management. However, one reason from the empirical data collected is that most stakeholders of the e-waste industry including locally trading ones i.e. Balagi and 'AND' alleged that it was more profitable to sell e-waste metals offshore, compared to inshore.

Just as Blancomet, Kumasi seemed to be receiving enough metals from e-waste managers from local scrap yards for their work, local iron and steel recycling metal supplying companies like 'AND Metal Company Ltd' and Balagi Metal Company (both in Kumasi) also thought they received sufficient supplies to break even. These companies have cars operated by male employees to sometimes go and transport iron metals particularly owned by scrap dealers from e-waste sites to the company garage. On the other hand, small scale informal e-waste managers like collectors and middle-role players incur the full cost of transporting their metals to metal buying companies at all times compared to scrap dealers.

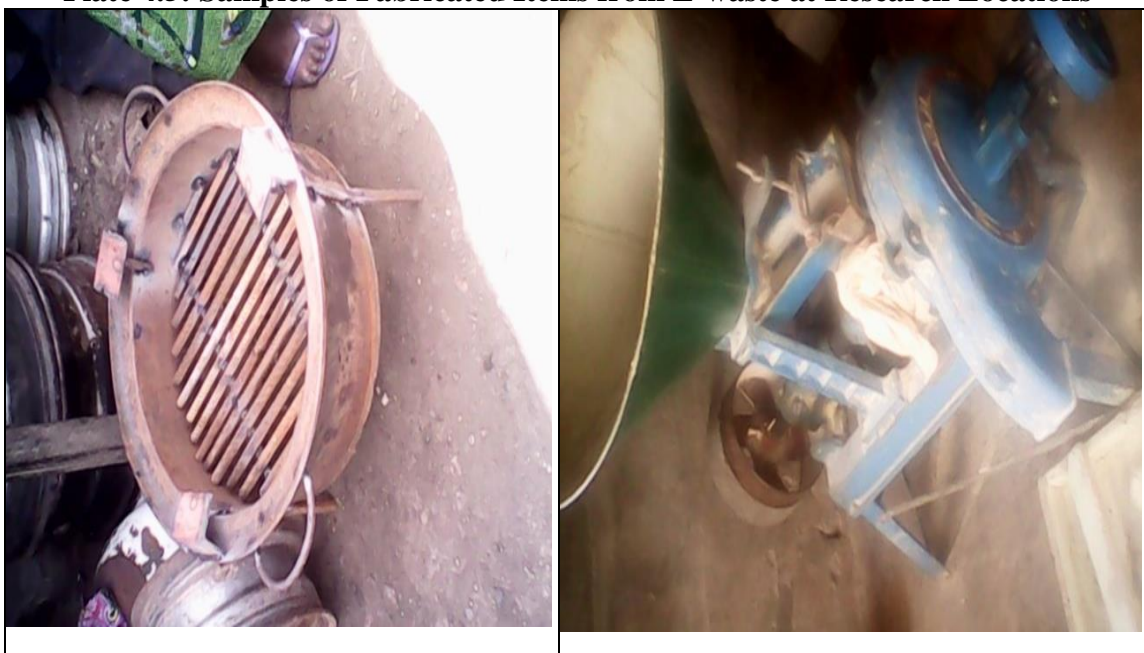
When the iron gets to these companies, they are billed by males only for local trading to iron and steel recycling companies. Balagi Metal Company moreover, had a well organised recycling department for billing and smelting iron metals into iron plates and other simple 'galamsey' mining tools for sale to mostly galamsey operators. The head of Balagi Metal Company stated that the recycling department had been closed down

for some time because of electricity and financial difficulties facing the company. Major challenges facing these metal buying companies are the high cost of business operation; the high impact of the Ghana Cedis depreciation on their business; high tariff prices draining away revenue; power shortages badly affecting businesses; and unwarranted public sector officers interference with business.

4.1.4 Secondary Recycling or Reuse

Secondary recycling or reuse activities of the e-waste industry is performed by fabricators and iron and steel companies. The fabricators convert the primarily recovered metals into finished products like balustrait, grinding and milling machines, cooking pots, block moulding machines, head pans, ovens, grilling machines, rollers, hammer, chisel (see plate 4.4 below). Outputs of fabricators like hammer and chisel get back into e-waste management system for collectors and dismantlers to easily access them for their daily works.

Plate 4.5: Samples of Fabricated Items from E-waste at Research Locations



Source: Field Data (2014)

Fabricators usually buy aluminium, copper, light iron (popularly called falafala), casts, bolts and nuts and tyre rims from middle-role players mostly middle-women to add value into the finished products mentioned above. Fabricating work involves standing for long hours, kneeling, bending and use of powerful tools and heavy equipment including fire and electricity. The strength intensity of this business also makes it attractive to lots of males. In Accra, only 2 females were counted to be undergoing training to become welders while the activity in Kumasi reckoned no female participation. Fabricators include welders, machinists, sheet metal workers and mill makers. The fabricator zone on e-waste sites employs hundreds of people including Ghanaians and Non-Ghanaians.

The secondary e-waste recycling activity performed by iron and steel companies falls in the formal e-waste sector. It is only after the informal collectors and recyclers have performed their roles that scrap dealers get the raw materials required by these formal recycling companies for either direct distribution to the companies or indirectly supply to the companies through their distribution agents. There are five iron and steel smelting companies which are operating fully at their optimal capacity in the country. These are Sentuo Steel (formerly known as Wahome), Ferrou Fabrik Steel, Tema Steel Company Limited (TSCL), Rider Steel Company Limited (RSCL) and Special Steel Company (SSC). In addition to these 5 companies, there is United Steel which was under construction and expects to start with production in 2015. All these recycling companies are located in the Tema Metropolitan Assembly (TMA), specifically Tema Heavy Industrial and Free Zone Areas. Few comments on how scrap iron gets into these recycling centres for processing into iron bars and rods is captured in vignette box 1.

Vignette Box 1: Production Process of Iron Bars and Rods in Ghana

The smelting companies in Ghana depend on organised and unorganised scrap collectors to get several tonnes of iron metals for production of iron rods and bars despite the rich deposit of iron ore in the land. Individuals and companies transporting iron metals to the smelting companies mostly do so with tipper trucks.

A few meters from the entrance of the smelting companies, weighing platforms are constructed in premises to first record the weight of the car containing iron metals. After offloading, the empty car goes to park back on the weighing platform for the emptied weight of the car to be recorded. The difference between the 2 recorded weights reflects metal only weight to be paid for by the company to the seller.

The smelting companies receive stocks of heavy and light metals from scrap dealers unbilled. Most scrap dealers mix heavy metals with light ones for profitability. The companies first bill the light iron before melting in the blast furnaces for passage into the continuous casting machine (CCM) to generate molten iron for cutting and cooling into iron bars. Billing of light iron before melting helps to save energy.

The last segment of production in the smelting firms is the rolling mill. At this stage, the bars pass through overheated furnaces for melting and cutting into desired sizes and shapes of the company. It then rolls into a chamber for transportation into the packing room.

Source: Field Data (2014)

Each of the five (5) active smelting companies employs hundreds of male workers for production and management purposes. The few females in the companies play stereotyped roles like cooking, cleaning and secretarial duties just as the metal trading companies for similar reasons. An in-depth interview with a management of Rider Steel revealed that, three (3) females employed by the company are two (2) infirmity nurses and a laboratory technician. No woman is directly involved in the production of iron rod and bars in any of these companies because of the intensity of work which is far above the average strength of a woman and also associated with many health dangers. Working in the production department involves standing and working intensively for about 8-12 hours daily including weekends and night shifts which would obstruct most female reproductive roles. The WDR (2010) highlights that time constraint is a major reasons why females easily get secluded from several jobs and opportunities at the

workplace. This certainly also applies to the formal and informal e-waste industry in Ghana.

All the metal buying companies as well as iron and steel smelting companies at the top of the e-waste value chain in Ghana are owned by Asian nationals of Lebanese, Indian and Chinese origin. Thus, no Ghanaian national is participating as owner of any formal e-waste activity. The state which also owned Wahome, now called Sentuo Steel Company Limited is no more. In essence, Ghanaian dominate the informal e-waste sector as foreign nationals dominate the formal e-waste sector in Ghana. Aside the iron and steel components recycled locally, the rest of the e-waste metal and non-metal resources recovered from the waste stream are mostly exported to USA, Russia, Canada, Latin America, Europe, China and India. Thus, growth of the local economy of the Ghanaian e-waste industry hinges strongly on growth in their foreign business counterparts. Demand for e-waste metals, particularly copper, iron, brass and steel by particularly middle-role players, scrap dealers, fabricators and assemblers, metal buying and iron smelting companies boost e-waste collection and its other horizontally linked activities i.e., dismantling and burning. These intra-connectivities and inter-connectivities within the e-waste industry gives it high profitability and employability characteristics.

4.2 Summary

The e-waste management industry in Ghana is popularly known as the e-scrap or e-waste industry. It has both formal and informal sectors. The formal sector consists of registered metal buying, metal exporting and metal processing companies connected to the informal players through local agents. The informal sector comprises of e-waste

collectors, primary recyclers who dismantle, shred, burn and sort and metal traders (middle-women, middle-men, scrap dealers and agents of formal companies). The informal-formal linkage in the e-waste industry transcends the local continuum into international business via e-waste trading. The informal sector of the industry is not formally recognized as an urban economic activity as state led activities have high interest in protecting the formal over informal actors. Albeit, the formal sector has its own challenges which is principally pointed to be caused by state institutions and actors.

The e-waste industry is seen as a market driven reuse and recycling industry developed along the commodity value chain (CVC). The CVC is a trading system that increases economic integration of production and marketing described from generation of e-waste through collection, primary recycling, and metal trading to secondary recycling. Although a rigorous and complete track of the value chain is not done by this study, it has been observed here that CVC helps to unlock the employability, profitability and gendering of labour within industry along its vertical and horizontal chains taking note of forward and backward linkages. The tracking by this study shows how value is added to waste to generate resources in an intra and inter connectivity circuitry to show how the formal and informal e-waste sectors strongly closely links to help the industry gain its strength.

The gendered outlook of e-waste management involves females in both formal and informal sectors but in a limited capacity of only metal trading, housekeeping and as office management. The physical strength intensity of collection, transportation and treatment of e-waste; as seen as the major activities of e-waste management disadvantage women to men. Aside these physical attributes of the job, the Centre for

Scientific Research (CSIR) Ghana has observed that women particularly pregnant ones easily fall vulnerable to hazardous conditions of Agbogbloshie e-waste site as compared to men counterparts. Again, females in metal trading cannot equally compete with male counterparts due to capital limitation. Therefore, any attempts in Ghana to mainstream gender into e-waste management planning should be mindful of the physical, economic, social and health conditions of the business which highly constrain dominant female participation.

CHAPTER FIVE

GENDER DYNAMICS IN THE CHAINS OF E-WASTE ACTIVITIES

5.0 Introduction

This chapter tries to find out the exact factors determining gendered roles and power relations of e-waste economies in Accra and Kumasi. By so doing, the multifaceted factors (demographic, physical, economic, political and so forth) influencing construction of roles and power relations in the informal e-waste sector are examined for plausible explanation. The benefits and challenges of being an e-waste worker is also analysed and discussed.

5.1 Determinants of Gendered Roles and Power Relations

5.1.1 *Demographic Factors*

5.1.1.1 *Age of Respondents*

The modal age for 108 respondents of the study falls at range 25 to 30 years. In Accra and Kumasi, the highest rate of respondent participation fell within 25 to 30 years for both males and females. None of the e-waste participants surveyed was older than 53 years and younger than 10 years. This suggests that relatively young and relatively old people do not work in the informal e-waste sector in both cities. The reason may be due to high physical strength intensity of the job. There were about 74 percent of respondents aged 19 to 36 years. This confirms a high youth participation in the informal e-waste management sector in Ghana, as told by Prakash et al (2010), Agyei-Mensah and Oteng-Ababio (2012), Oteng-Ababio (2012a, b, c) and Amankwaa (2013). The definition of a youth in Ghana is any person between the ages of 15 to 35 years. Details of the age distribution of e-waste workers in Accra and Kumasi is depicted in Table 5.1.

Table 5.1: Age Distribution of Respondents by Sex and City

Age (Years)	Accra		Kumasi		Total (%)
	Male (%)	Females (%)	Male (%)	Female (%)	
18 years and Below	4 (11.11)	0	4 (8.51)	1 (5.00)	9 (8.33)
19-24	5 (12.20)	0	5 (10.64)	3(15.00)	13 (12.04)
25-30	14 (43.90)	4 (80.00)	16 (34.04)	9 (45.00)	43 (39.81)
31-36	6 (17.07)	1 (20.00)	15 (31.91)	2 (10.00)	24(22.22)
37-42	5 (12.20)	0	5 (10.64)	2 (10.00)	12 (11.11)
43 and above	2 (4.88)	0	2 (4.26)	3 (15.00)	7 (6.48)
Total	36 (100.00)	5 (100.00)	47 (100.00)	20 (100.00)	108 (100.00)

Source: Fieldwork (2014)

Just as this study observed and previous ones have done, often times, the very young females, of about 10 to 17 years at e-waste sites, start off as ancillary service providers' assistants and a few, middle-women's assistants in only Accra. The middle-women in Accra had 1 or 2 female employees, mostly younger than them. These female employees go ahead of their female 'masters' every morning to clean up and open the shed to display items for sale. None of the middle-women in Kumasi had an assistant. The keen competition between male metal traders and middle-women in Kumasi could barely allow the latter group earn more than enough sales to pay those that they were likely to employ. Almost every food vendor at e-waste sites in Accra and Kumasi engaged younger females as their assistants. With time, these assistants get to well

know the geographical terrain, and get to understand the trade that they are involved in and also acquire capital to start their own business, usually a similar one either on or off site. This statement was elicited through in-depth interviews. However, informal interviews with these female assistants who were often Northern migrants revealed that they had come to work at these sites to earn some income and return to their towns and villages to learn a trade and/ or marry.

Males usually start off in the informal e-waste business as collectors, dismantlers or burners as earlier discussed in Chapter Four (4). These people are mostly aged 19 to 36 years. As they spend a considerable number of years in the business, they grow to become mostly middle-men and scrap dealers unless they choose to leave the business for various reasons like travelling to overseas, death, ill-health, to work in another industry and/ or for family related issues.

5.1.1.2 Education and Literacy Background of Respondents

None of the female participants of the study had acquired secondary or post-secondary education. The highest level of education for the females was Junior High School (JHS) at 20 percent for Accra and 5 percent for Kumasi. There were 26.10 percent males in Accra with secondary and post-secondary education compared to 9.52 percent recorded for Kumasi. On the average, males had acquired higher levels of education in Accra and Kumasi than females. Details of educational background of respondents is displayed in Table 5.2.

Table 5.2: Highest Level of Education of Respondents by Sex and City

Highest level of Education	Accra		Kumasi		Total (%)
	Male (%)	Female (%)	Males (%)	Female (%)	
No School	5 (13.89)	4 (80.00)	12 (25.53)	8 (40.00)	29 (26.85)
Primary	16 (44.44)	0	16 (34.04)	11 (55.00)	43 (39.81)
JHS	6 (16.57)	1 (20.00)	15 (31.91)	1 (5.00)	23 (21.30)
SHS, Vocational/Technical/ and A levels	8 (22.32)	0	3 (6.39)	0	11 (10.19)
Tertiary	1 (2.78)	0	1 (2.13)	0	2 (1.85)
Total	36 (100.00)	5 (100.00)	47 (100.00)	20 (100.00)	108 (100.00)

Source: Fieldwork (2014)

The sexual difference in terms of highest levels of education received should not be surprising. It is typical of African countries for the male child's education to be considered a topmost household priority compared to that for his female siblings (Ardayfio-Schandorf & Kwafo-Akoto, 1990). This is cautiously interpreted that the female irrespective of the level of education would play housekeeping role. This mostly denies females of education or higher education compared to male siblings who are believed to grow to become bread winners of their household (Ardayfio-Schandorf & Kwafo-Akoto, 1990). The last two demographic surveys in Ghana show that there are as many female household heads doubling as bread winners in urban Ghana as there are males. However, the FGDs and in-depth interviews showed that most participants in the

e-waste industry generally had limited or no education just as quantitatively observed. To the study participants, e-waste business did not necessarily require any form of education for especially those in collection, dismantling, burning, repair/ refurbish, middle-role playing and scrap dealing as belonging to the informal sector. Rather, those in the formal e-waste sector require a little bit of education to be easily employed in the sector.

5.1.1.3 Nationality and Ethnicity of Respondents

In terms of nationality, about 93 percent of respondents were Ghanaians and 7 percent, Nigerians. In Accra, there were about 83 percent of respondents, Ghanaians and 7 percent Nigerians. In comparison with Accra, Kumasi had 99 percent Ghanaians and 1 percent Nigerians. The Nigerians in both cities' are mostly indigenes of Owori, Ebone, Iketi, Imo and Anambra states hence mostly Igbo and five Yoruba as both quantitative and qualitative data confirm. An informal discussion with a Yoruba man at the Agbogbloshie e-waste site confirmed that Igbo men are most notable for e-waste business in both Nigeria and Ghana. In the in-depth interviews with leaders of ASDA and some workers' based FGDs, it was reckoned that Burkinabes also work at the Agbogbloshie e-waste site. The invisible presence of Burkinabes as compared to Nigerians at Agbogbloshie e-waste is indicative of how prominent e-waste management is in Nigeria compared to Burkina Faso.

There were also Lebanese, Indians and Chinese located off site sponsoring scrap dealers in Accra and Kumasi with capital for a regular supply of e-waste metals for export to mostly Asian countries for mostly reuse and recycling. This information was gathered through the in-depth interviews and FGD with the informal workers. All these foreign

players of the industry were males. Detailed distribution of ethnicity or tribe of respondents is shown in table 5.3.

Table 5.3: Ethnicity of Respondents by Sex and City

Ethnic Grouping	Accra		Kumasi		Total (%)
	Male (%)	Female (%)	Males (%)	Female (%)	
Dagomba	24 (66.67)	4 (80.00)	44 (93.62)	5 (25.00)	77 (71.30)
Frafra	0	0	0	15 (75.00)	15 (13.89)
Akan	1 (2.78)	1 (20.00)	1 (2.13)	0	3 (2.78)
Gonja	0	0	1 (2.13)	0	1 (0.93)
Nanumba	1 (2.78)	0	0	0	1 (0.93)
Sisala	1 (2.78)	0	0	0	1 (0.93)
Ga	1 (2.78)	0	0	0	1 (0.93)
Ewe	1 (2.78)	0	0	0	1 (0.93)
Igbo	6 (16.67)	0	1 (2.13)	0	7 (6.48)
Yoruba	1 (2.78)	0	0	0	1 (0.93)
Total	36 (100.00)	5 (100.00)	47 (100.00)	20 (100.00)	108 (100.00)

Source: Fieldwork, 2014

From table 5.3, it is estimated that about 90.76 percent of respondents were from all the three regions in Northern Ghana, because they belonged to the Dagomba (71.30 percent); Gonja (0.93 percent), Nanumba (0.93 percent), Sisala (0.93 percent) and

Frafra (13.89 percent) ethnic groups. The ethnic diversity for Accra was higher compared to Kumasi. There were nine (9) ethnic groups represented in Accra as compared to five (5) in Kumasi (see details in table 5.3). The 9 tribes represented are Dagomba, Gonja, Nanumba, Frafra, Akan, Ga, Ewe, Igbo and Yoruba out of which female participants belonged to only 3 (Frafra, Dagomba and Akan).

The Dagomba tribe had the largest representation in the informal e-waste sector. There were 66.67 percent and 93.62 percent of male Dagombas working on the e-waste sites in Accra and Kumasi respectively. Both male and female Dagombas hailed from Savelugu-Nanton, Tamale and Yendi as birth and previous residential locations.

The second largest tribe represented was the Frafra women. Out of the respondents sampled, 13.89 percent were Frafra from Tongo, Bongo and Bolgatanga townships in the Upper East Region. The third largest tribe represented was male Igbos; followed by Akans; with the rest of the tribes in table 5.3 taking an equal share of respondents. The nationality of respondents matched with results of previous studies on the same sector (Oteng-Ababio, 2011; Agyei Mensah & Oteng-Ababio, 2012; Amankwaa, 2013).

Frafa female participation in e-waste management was peculiar to Kumasi just as Dagomba female participation was higher for Accra as captured by table 5.3. Through in-depth interviews and FGDs, all 300 middle-women of Kumasi's e-waste economy were Frafra compared to 3 out of 4 in Accra who are Dagomba and the last one, Ewe. The Frafra in Kumasi migrated there to work at Suame Magazine as food vendors and head porters likewise their Dagomba counterparts in both cities. The account of some female Frafra in Kumasi showed, that a while after doing the jobs for which they migrated into the cities to do, they decided to attempt e-waste management and have not

returned to the previous jobs due to the lucrative nature of the business. These women encouraged a lot of fellow Frafra females, whenever possible, to migrate into the sector in order to gain economic power to support their families. All the other Dagomba female participants of the informal e-waste sector were ancillary service providers in both cities.

Their main reasons for migrating was to purposely seek greener pastures, believed to be implanted in the economies of Accra and Kumasi. Another account also states, that the e-waste workers were attracted to the two largest cities in Ghana to escape the war, famine, unemployment, underemployment and the extreme poverty characterising Northern Ghana (Amoyaw-Osei et al., 2010).

5.1.1.4 Religion of Respondents

Of all the respondents, 72.64 percent were Muslims. The concentration of Muslims in Kumasi is as high as in Accra, but weaknesses in Accra's data does not succinctly project this view. High Dagomba participation in the industry could justify high Muslim participation as most Dagombas happened to be Muslims. The second most representative religious group was Christianity, particularly Charismatics or Pentecostals. The Frafra are most notable for their Pentecostal or Charismatic religious belief, just as the Igbo were often Catholics. Among the Christian fraternity, there were more Charismatics than Catholics as largely represented by the Frafras and the Igbos respectively. The dominance of Dagomba and Frafra females resonates well with the dominance of female Muslims and Charismatics for Accra and Kumasi respectively. Details of religious distribution can be found below in Table 5.4.

Table 5.4: Religious Affiliation of Respondents by Sex and City

Religion	Accra		Kumasi		Total (%)
	Male (%)	Female (%)	Male (%)	Female (%)	
Charismatic or Pentecostal	5 (13.89)	1 (20.00)	1 (2.13)	9 (50.00)	16 (15.09)
Catholic	6 (16.67)	0 (0.00)	0 (0.00)	4 (22.22)	10 (9.43)
Islam	23 (65.69)	4 (80.00)	45 (95.74)	5 (27.78)	77(72.64)
None	2 (5.56)	0 (0.00)	1 (2.13)	0	3 (2.83)
Total	36 (100.00)	5 (100.00)	47 (100.00)	18 (100.00)	106 (100.00)

Source: Fieldwork, 2014

The perception is that although religious affiliation may not necessarily determine a person's involvement in informal e-waste management, religious alliances are formed based on ethnicity or tribe or nationality. Male Dagomba Muslims usually work close to each other, just as Nigerian Igbos and female Frafras do. The dominance of male Dagomba Muslims in the informal e-waste sector makes it easy for any Dagomba male to enter the sector and start to work in it.

Again, the Muslim men at Kumasi e-waste sites liked to work within the same space as male counterparts of the same faith, hence mostly tribesmen. If you belong to a less considered religion or tribe by male informal e-waste economy participants, you less deserve to share same working space and/ or occupation with these group considered as most powerful. To this extent, scrap dealers and middle-men who usually happen to be Dagombas by tribe and Muslims by religion are seen as the most powerful by virtue of their dominance in leadership and economic positions at e-waste sites. The situation is far worse to the extent that most people in this most powerful group frown upon females' involvement in direct e-waste management (collection, repairs, recycle,

middle-role or scrap dealing). From the FGDs and in-depth interviews, the following remarks were passed: a woman and a man shouldn't engage in same economic activities. Rather, the woman should obey the husband and do something different from what men are doing. Again, it was said that those middle-women contending with males in the e-waste industry, do so to become economically empowered as typical of Frafra, Akan and Ga women in Ghana just as their husbands or other males to avoid suppression. One Dagomba scrap dealer in Kumasi asserted that, the husbands of Frafra middle-women contending with them at the sites are largely responsible for bad behaviour of their wives in their context. He continued to say that Frafra men are weak and cannot control their wives.

Belonging to the same religious or ethnic group could easily allow a woman to attach herself to a male counterpart especially if they are not into the same trade. The reasons why people attached themselves to each other at the sites is to get access to working space. Females are highly secluded from land issues at all e-waste sites in Accra and Kumasi. In Accra, the females are largely Dagombas and could easily share space with their Dagomba male counterpart since they hardly engaged in similar trades' onsite. All the middle-women in Accra had comfort working spaces because they were managing the trades of absentee relatives who were males.

The females participating in direct e-waste management practice in Kumasi were mostly of the Frafra tribe. These middle-women could seldom share working space with the predominant Dagomba male counterparts who looked down upon them. Only few of the Frafra e-waste traders have friends at e-waste sites in Kumasi to sit under their sheds for a rest. Majority of these women survive on the site by staying in open places in wait to buy metals from prospective suppliers until 4 to 6 p.m. in order to get ample time in the

evening to gather all wares bought on the same working day for transportation to their prospective buyers (mostly scrap dealers located off site). Thus, these women lack a storage facility or place on-site for their wares.

5.1.1.5 Marital Status of Respondents

The marital status of about 57 percent of the respondents was married. All females sampled from Accra were married as about 57.89 percent of those in Kumasi were also married. Details of marital status of respondents is depicted in table 5.5.

Table 5.5: Marital Status of Respondents by Sex and City

Marital Status	Accra		Kumasi		Total (%)
	Male (%)	Females (%)	Male (%)	Female (%)	
Married	14 (38.89)	5 (100.00)	31 (65.96)	11 (57.89)	61 (57.01)
Co-habiting	3 (8.33)	0 (0.00)	4 (8.51)	1 (5.26)	8 (7.48)
Single	17 (47.22)	0 (0.00)	12 (25.53)	3 (15.79)	32 (29.91)
Divorced	2 (5.56)	0 (0.00)	0	2 (10.53)	4 (1.87)
Total	36 (100.00)	5 (100.00)	47 (100.00)	19 (100.00)	107 (100.00)

Source: Fieldwork (2014)

Cohabiting was greater for Kumasi compared to Accra, as divorce rate were equal for both cities. Those who were single formed 29.91 percent of the sample size as shown in Table 5.5. Despite the largest share of participants being youthful, it is common knowledge that the culture and religion of most Northerners in Ghana cause them to go

into earlier marriages as compared to Southern counterparts. This explains why most married people are engaged in the informal e-waste sector.

5.1.1.6 Multinomial Logit Modelling of Demographic Determinant Factors

From the above descriptive statistical analysis and discussion of the demographic attributes of respondents sampled for this study, it is confirmed that informal e-waste management practice in Accra and Kumasi is a male dominated activity. However, the results of multinomial logit modelling of statistics gathered resulted in the first estimation that, males are 5 times more likely to be in the middle-role than females, relative to ancillary services base category. Thus, females are 5 times less likely to work as middle-role players of the e-waste industry. Hence, one can deduce that sex of participants influences the choice of e-waste business activity that they may want to do in the informal e-waste sector.

In the second estimation, it is evident that a person's place of work (EA) does not influence the type of work. However, at 10 percent, males are more likely to work as collectors, repairers and middle-role players in Accra EA. In the same scenario, males are about 7 times more likely than females to work as middle-role actors compared to the base category (ancillary services).

Under influence of age, those 19 to 24 years were mostly working as collectors and middle-role players in the informal e-waste sector. However, the case happens to be only significant for the middle-role category. In this case, those in the middle-role group at ages 19 to 24 years are about 5 times more likely to be doing that kind of business than those less than 19 years or more than 24 years of age. More precisely, a lot more males aged 19 to 24 years would like to work as collectors and middle-men than

females. None of the females at Accra and Kumasi e-waste sites work currently as collectors, although it is known from FGDs and in-depth interviews that a few females have at times worked as collectors at the sites.

With more variable added onto the first two model, the result showed that combining ethnicity of respondents with other factors as age, enumeration area, education and religion; ethnicity had a propensity to determine the role that males could perform in the informal e-waste sector differently from females. Thus, apart from middle-role activities which both men and women could perform, in reference to ancillary service provision, the other roles were exclusive for males. Hence, the main demographic determinants for playing the role of a middle-man or middle-woman are: education, ethnicity and marital status. The middle-role continued to be valid for each model because it is the only activity of the chain that engages males and females directly into the e-waste management in Accra and Kumasi.

For exclusively male dominated roles such as collector, recycler (dismantler and burner), repairer and scrap dealer, sex, age, educational level, ethnicity, marital status and religion are major demographic determinant factors. Some variables influenced the relationships at very high exponential values. For recyclers specifically, ethnicity, hours of work and religion were the major influencing factors.

5.1.2 Physical Factor: Strength Intensity

From Table 5.6, about 70 percent of the e-waste workers perceived that their jobs required so much physical stamina and vitality. The sex distribution for those who consider their e-waste activity as so stressful is 73.42 percent for male participants and

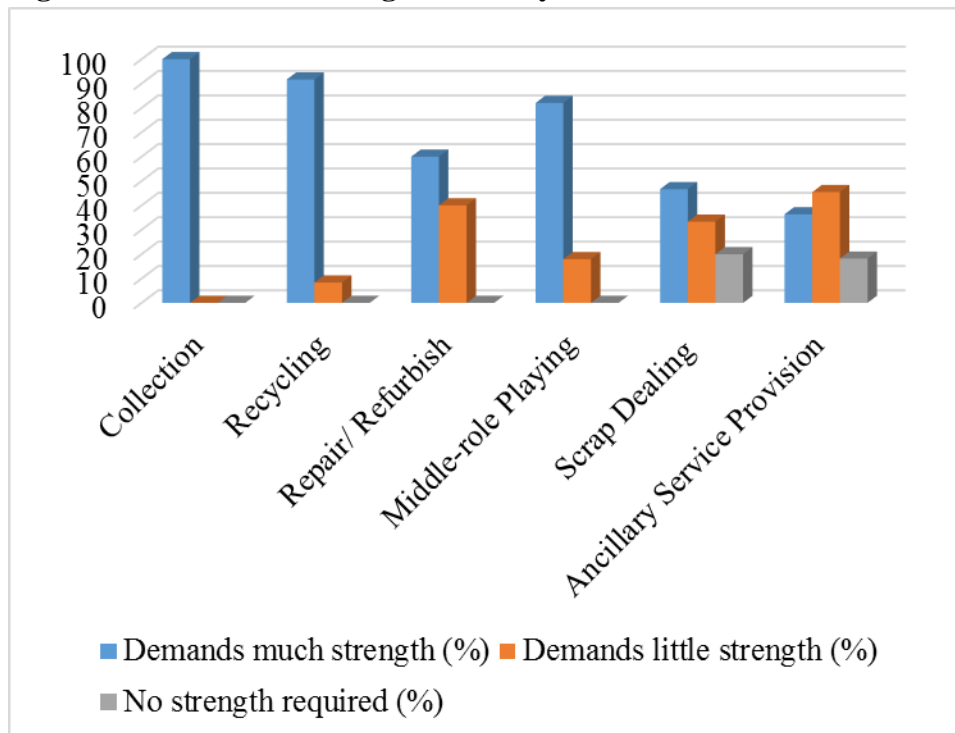
59.09 percent for females despite sex differences in roles played. Majority of males who perceived their businesses as highly strength intensive were collections and recyclers.

Table 5.6: Respondents' Perception about Strength Intensity of E-waste Activities

Response Categories	Male (%)	Female (%)	Total
Demands a lot of physical strength	58 (73.42)	13 (59.09)	71 (70.30)
Demands little bit of physical strength	12 (15.19)	7 (31.82)	19 (18.81)
Does not Demand Physical Strength at All	9 (11.39)	2 (9.09)	11 (10.89)
Total	79 (100.00)	22 (100.00)	101 (100.00)

Source: Field Data (2014)

Howbeit, many females as middle-role players perceived their businesses as strength intensive than male counterparts. This could mean that most women do not have the strength to cope with collection, recycling and middle-role; therefore making it significant to exclude women from such jobs. Howbeit, scrap dealing and ancillary services which were perceived not to be too much physical strength demanding still engage assistants. The perception of working classes of informal e-waste management is depicted in Figure 5.1.

Figure 5.1: Perceived Strength Intensity of E-waste Activities

Source: Field Data (2014)

5.1.3 Economic Determinant Factors

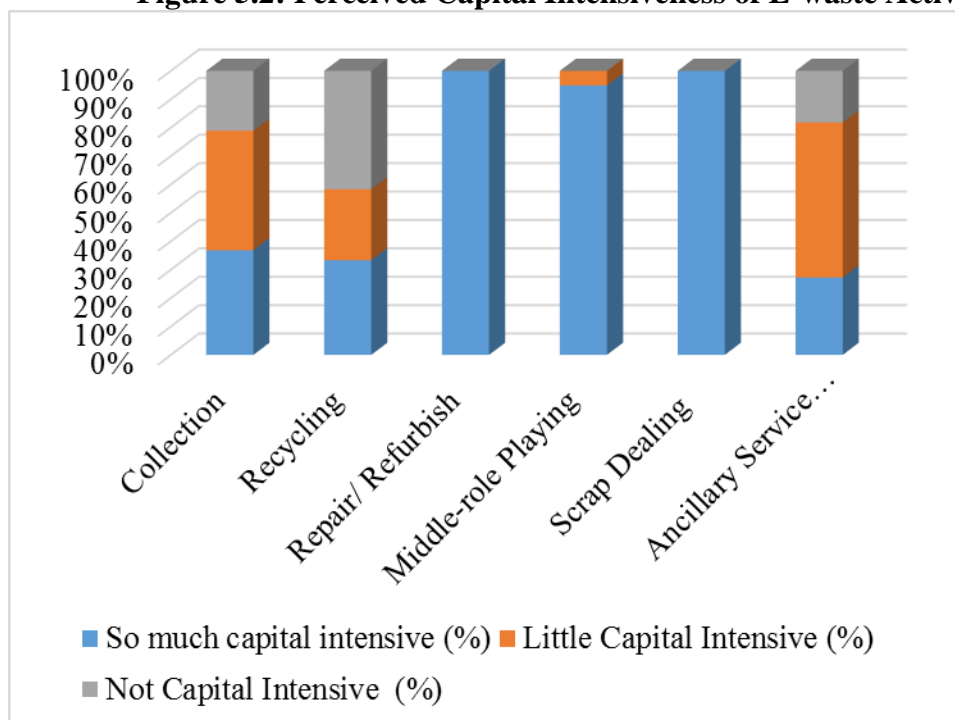
5.1.3.1 Accessibility to Capital or Credit

In this study, about 76 percent of all respondents perceive that e-waste management business is expensive. More than a half of male and female respondents perceive that their e-waste management businesses were capital intensive, as presented in Table 5.7. This means that as many males as females currently working in the informal e-waste management sector believed that they required certain amounts of money perceived to larger than current capital to effectively and profitably run their e-waste business.

Table 5.7: Respondents' Perception of Capital Intensiveness of E-waste Activities

Response Categories	Male	Female	Total
Capital Intensive	58 (73.42)	18 (81.82)	76 (75.25)
Less capital intensive	16 (20.25)	4 (18.18)	20 (19.80)
Not capital intensive at all	5 (6.33)	0 (0.00)	5 (4.95)
Total	79 (100.00)	22(100.00)	101 (100.00)

Source: Field Data (2014)

Figure 5.2: Perceived Capital Intensiveness of E-waste Activities

Source: Field Data (2014)

Among all the activities, scrap dealing is the most capital intensive, followed by repairing, middle-role playing, collection, recycling and ancillary services based on inferences from Figure 5.2. The chi square test of figures recorded in Table 5.8 shows

that there is indeed a significant relationship at 5 percent level of significance between the amounts of capital required for the different types of e-waste businesses.

Table 5.8: Relationship between Type of E-waste Activity and Capital Outlay

<i>Amount (GHC)</i>	<i>Collector (%)</i>	<i>Repairs (%)</i>	<i>Recycler (%)</i>	<i>Middle-role Player (%)</i>	<i>Scrap Dealer (%)</i>	<i>Ancillary Services Providers (%)</i>	<i>Total (%)</i>
0-499	100	80	100	44.12	0	85.70	56.79
500-10000	0	20	0	55.88	100	14.29	43.21
Total	100	100	100	100	100	100	100

Pearson Chi2 (5) = 40.875

Pr = 0.0000

Source: Field Data (2014)

Collectors generally require up to GHC500.00 for their business just like ancillary service providers financial needs. Differences in materials collected and places visited determines the amount of money that a collector may daily require. At the beginning of one's career as a collector, it possible to start without money. This category of scavenger with no start-up capital collect their wares from dump sites and other places where the materials collected is believed to belong to one. Those who target e-waste generators in private and public spaces require significant sums of money to buy the materials from these waste generators.

The dismantlers and burners need no monies daily before they start to operate. Their works are mostly dependent on middle-role players and scrap dealers' ability to acquire e-waste materials for them to process. Those in middle role playing mostly require

about GHC500.00 to GHC4,000.00 to sustain their businesses. As earlier said, scrap dealing is the most expensive and requires about GHC500.00 to GHC10,000.00 to be in constant operation. Hardly, can anyone depending on the lowest limit of GHC500 to GHC1,000 to sustain in e-scrap dealing business. Therefore, most scrap dealers depend on their prospective buyers usually the exporters as earlier mentioned to pre-finance them with more than GHC1,000 for business.

All females sampled started their e-waste businesses with either no fiscal cash or money worth GHC5.00 to GHC600.00 most of whom were collectors, middle-women and ancillary service providers. The highest amount sampled GHC 10,000.00 (infer from Table 5.9). All those whose start-up capital ranged from GHC800 to GHC10,000.00 were males as qualitatively gathered. The relationship between sex and amount of start-up capital for business was not significant at 1 percent, 5 percent and 10 percent as depicted in table 5.9. Rather, relationship between amount of capital and type of e-waste business of respondents had a significant relationship as earlier discussed.

Table 5.9: Relationship between Sex and Capital Needs of Respondents

<i>Amount (GHC)</i>	<i>Male (%)</i>	<i>Female (%)</i>	<i>Total (%)</i>
0-249	25 (38.46)	12 (75.00)	37 (45.68)
250-499	7 (10.77)	2 (12.50)	9 (11.11)
500-10000	33 (50.77)	2 (12.50)	35 (43.21)
Total	65 (100.00)	16 (100.00)	81 (100.00)

Pearson Chi2 (2) = 8.1390

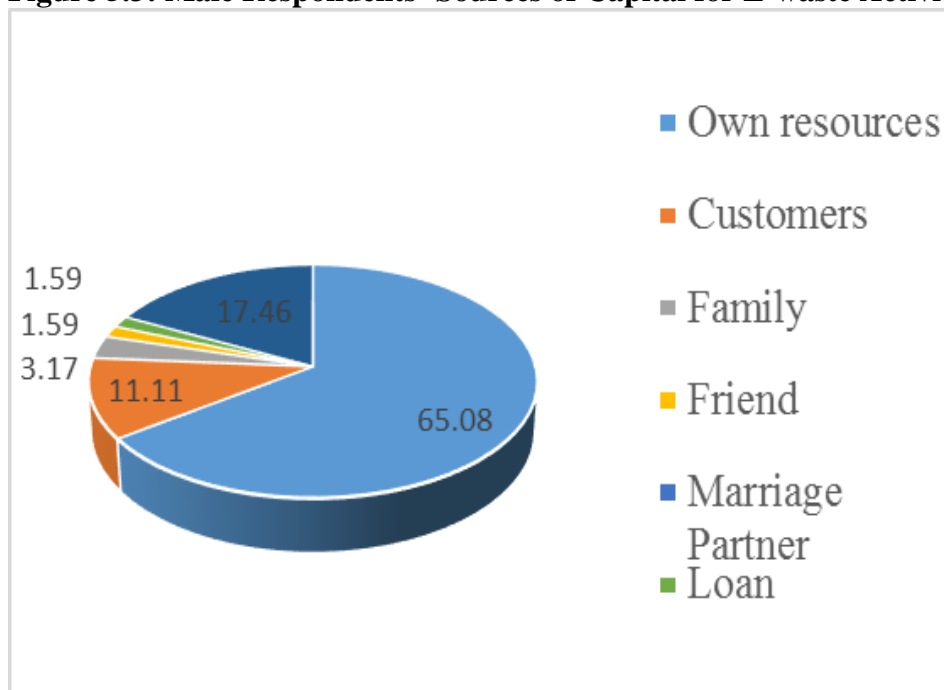
Pr = 0.017

Source: Field Data (2014)

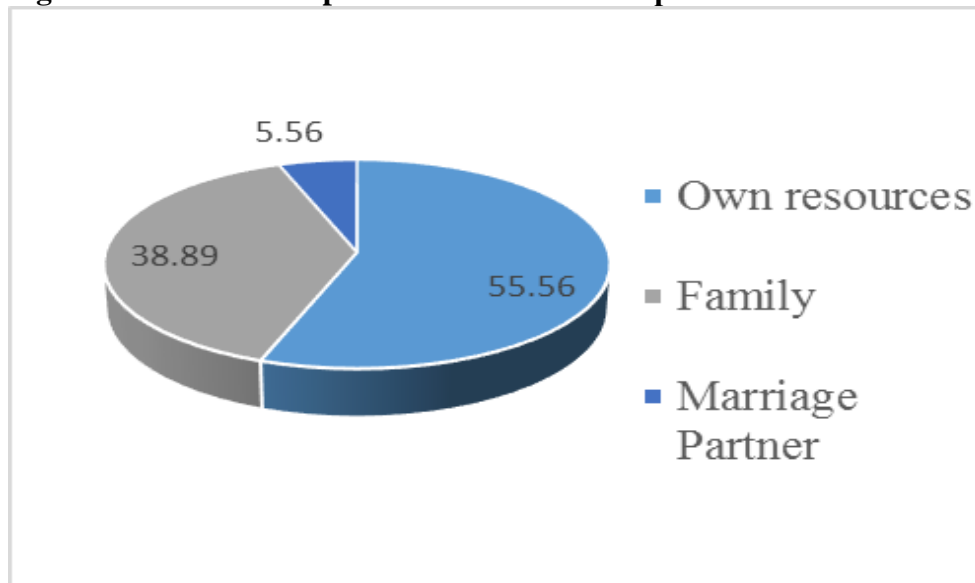
Sourcing for credit or capital for e-waste management business take several forms. The main sources of start-up capital were identified as: customers (mostly middle-men,

scrap dealers, metal buying companies and agents of iron and steel companies), family, friends, fiancé, loan from banks and other credit facilities and personal financial resources from savings and investments. Significant number of females and males depended on own financial resources to run their e-waste business. Inferring from Figure 5.3 and Figure 5.4, no male respondent received financial support from their marriage partners (wives or fiancées) as female counterparts. Females apart from depending on own financial resources, received support from family and spouses to do business (infer from Figure 5.4). It is essential to note here that only male respondents received financial support from non-relatives especially business partners.

Figure 5.3: Male Respondents' Sources of Capital for E-waste Activities



Source: Field Data (2014)

Figure 5.4: Female Respondents' Sources of Capital for E-waste Activities

Source: Field Data (2014)

While some sector participants depended on two or more sources of credit or capital for business, others usually depended on one source i.e., personal resources. Only male participants had easy access to multiple financial sources compared to females. In addition to personal resources, other males could easily access capital or credit from customers, friends, masters and loan facilities from mostly savings and loans, and few banks as compared to female counterparts.

Table 5.10 indicates a strong significant relationship between sex and perception to access financial resources. Many females perceived that their sex as a major factor constraining them from easy access to capital or credit for their e-waste businesses compared to male counterparts. This results resonates well with WDR (2010) which suggests access to capital is highly restricted to females compared to male counterparts for business.

Table 5.10: Respondents' Perception on Gender and Access to Capital

Sex constraining Access to financial Input	Male	Female	Total
Yes	0	10	10
No	76	10	86
Don't Know	2	1	3
Total	78	21	99

Pearson chi2 (2) = 42.1334

Pr = 0.000

Source: Field Data (2014)

5.1.3.2 Access to Tools, Equipment and Raw Materials

The relationship between sex and accessibility to working materials was very weak at 5 percent degree of significance as deductible from Table 5.11 below. The basic tools for e-waste management in the informal sector are hammer, scissors, chisel, screw drivers, anvil, and plier and weighing scales. Middle-women only needed head pan and scales.

Table 5.11: Respondents' Perception on Gender and Access to Working Materials

Sex Constraining Access to Working Materials	Male	Female	Total
Yes	0	1	1
No	76	20	96
Don't Know	1	0	1
Total	77	21	98

Pearson Chi2 (2) = 3.9596

Pr = 0.13

Source: Field Data (2014)

From the FGDs and in-depth interviews, the main reason for this poor relationship between access to working materials apart from scrap metals and sex is high cost of some the materials particularly weighing scales. Again, ignorance of selling points of weighing scale also constrained the workers' accessibility to such equipment. Hence, some middle-men and scrap dealers get them for those who wanted at very high prices. The middle-women therefore regard the purchase of weighing scales to be so expensive and so depend on male counterparts' equipment for their business. Those middle-women in Kumasi use bare eyes to weigh the metals bought from collectors and dismantlers as they did not have good relationship with male counterparts to strongly depend on their equipment. This is actually causing a lot of loss to such middle-women as FGD and in-depth interviews revealed.

Most middle women use metallic head pan as portrayed in plate 5.2 for assembling their metals to a specific storage point in order to build enough bulk before transporting to prospective buyers. The use of head pans by middle-women and mostly female

assistants is described as high strength intensive for an ordinary woman. If carrying the metals on the head is as heavy as they describe it, then it could have serious bodily pains and other health consequences for both mother and babies striped on the backs of some of these women while at work.

Plate 5.1: A Middle-woman Carrying Head Pan Load of E-waste at Anloga Site



Source: Field Data (2014)

The middle-women always sell their metals to scrap dealers who always weigh the metals with appropriate scales to determine the appropriate weight and therefore, the price. The middle-women in Accra usually sell their outputs to prospective buyers at Agbogblsohie's Fabricator yard or Aboso Okai metal traders while those in Kumasi trade the metals at Suame Magazine.

In terms of accessing e-waste metals as a productive or economic resource, there was a significant relationship between sex and perceived accessibility to the e-waste as inferred from the chi square test results in Table 5.12. More males could easily access the e-waste than the females as the perception rates in table 5.12 depicts. About half of female respondents reported of facing some difficulties in attempts to access e-waste for business. The middle-men and scrap dealers usually pre-finance those in collection to be able receive regular supply of e-waste. Therefore, the collectors only supply their e-waste to middle-women when their outputs are not good enough or sufficient to attract the right price from middle-men and scrap dealers on the sites.

Table 5.12: Gender Accessibility to E-waste

Easy of Accessing Working Materials (Scrap items)	Male	Female	Total
Very easy	46	7	53
Neither easy nor difficult	8	2	10
Difficult	5	8	13
Very difficult	2	0	2
Total	61	17	78

Pearson Chi2 (3) = 14.9165

Pr = 0.002

Source: Field Data (2014)

5.1.3.3 Access to E-waste Management Economic Training

During the reconnaissance survey in the last quarter of the year 2013, the researcher came across the first-hand information that with the aid of Green Advocacy Ghana (GAG), a civil society organisation (CSO), some workers at the Agbogbloshie e-waste site were sent to Sweden for a short training on sustainable e-waste management business practice. As a follow up, the study sought to assess how many of the sampled population partook in the training mentioned or similar ones by the state, CSO/ NGOs, the e-waste association or any other entity. The study found out that none of its respondents in Accra or Kumasi has ever had received any of such trainings. The ASDA leadership revealed that neither government nor any NGO/CSO has ever organised a business training for them although Ministry of Health (MoH), Environmental Protection Agency (EPA) and Accra Metropolitan Assembly (AMA) occasionally get in touch with them for other purposes than capacity building. The e-waste industry has

received very limited attention of locally and international CSO/NGO as compared to other sectors of Ghana's informal sector. To most of the research participants, the e-waste business is only known in books and media as environmentally harmful business that government must collapse.

5.1.3.4 Productive Time Requirement

Time is envisaged as one of the economic resources required to effectively remain sustainable in business. There were 91.59 percent respondents who worked all year round in the e-waste industry. The remaining 8.41 percent went back to school or to visit family or farm in their hometowns mostly Northern Ghana. Those who mostly went back to school were all males because the females even if they wanted to quit their work in the e-waste industry for school was not going to be without hindrances from care takers and/ or family members. Again, it is become the tradition for most of these girls to travel to the south do menial jobs for money to acquire the items required for marriage and apprenticeship. These girls do so by most often following family members who have migrated South for varying reasons. It is confirmed by this study that, often times, family members are involved in the decision of majority of e-waste workers to migrate to the two cities for greener pastures including doing e-waste business.

The young men who mostly returned back to school in North after reopening complained that they really find it difficult at most times to abandon their lucrative e-waste jobs and go back to the classrooms. Despite the restraints, these students are less often able to go back to classroom when school resumes. Thus, such pupils or students hardly had any member of their family or society supporting them with their education as well as other basic human needs due to poverty. It is firmly established that the main

reason for child and young people migration from North to Southern Ghana is money and freedom to use the monies the way they want as espoused by 9 out 10 males and 4 out of 5 females studied (Kwankye, Anarfi, Tagoe & Castaldo, 2009).

E-waste workers spend about 11 hours averagely at work for about 2 to 7 working days (refer to appendix 1). The females at about 63 percent largely worked for 6 days as males of about 70 percent mostly worked for 7 days as inferred Table 5.13 below.

Table 5.13: Average Working Days per Week of Respondents by City and Sex

No. of Days	Accra		Kumasi		Total (%)
	Male (%)	Female (%)	Male (%)	Female (%)	
2	1 (2.78)	0	0	0	1 (0.93)
6	17 (47.22)	3 (60.00)	7 (14.89)	12 (63.16)	39 (36.45)
7	18 (50.00)	2 (40.00)	40 (85.11)	7 (36.84)	67 (62.62)
Total	36 (100.00)	5 (100.00)	47 (100.00)	19 (100.00)	107 (100.00)

Source: Field Data (2014)

Those women who work for 6 out of the 7 working days of the informal e-waste sector take the 7th day off to do their reproductive assignments like washing of clothes and house cleaning which they are unable to effectively do in the course of the week. The majority of males who spend every day of their week on e-waste sites than females do hardly assist with household duties. The day taken off work to attend to household chores fall mostly on either Saturday or Sunday. Sunday is often the day taken off by

people to do those household activities that they have not been able to effectively do in the week including recreational activities.

Table 5.14: Average Working Hours per Day of Respondents by City and Sex

No. of Hours	Accra		Kumasi		Total (%)
	Male (%)	Female (%)	Male (%)	Female (%)	
0-3	0	1 (20.00)	0	0	1 (1.08)
4-6	2 (5.88)	0	0	1 (7.14)	3 (3.23)
7-9	3 (8.82)	1 (20.00)	2 (5.00)	1 (7.14)	7 (7.53)
10-12	28 (82.36)	2 (40.00)	32 (80.00)	4 (28.57)	66 (70.96)
13-15	1 (2.94)	1 (20.00)	6 (15.00)	8 (57.14)	16 (17.21)
Total	34 (100.00)	5 (100.00)	40 (100.00)	14 (100.00)	93 (100.00)

Source: Field Data (2014)

E-waste work usually start between 5 a.m. to 7 a.m. and ends at most 8:30p.m. From table 5.14 below, about 94 percent males work between 7 to 15 hours as 80 percent females in Accra just as about 93 percent males to 96 percent females in Kumasi. These workers hardly take break times off work. Often times, the dominant populace at the e-waste sites, Dagombas who are usually Muslims break to pray usually by visiting the mosques on-site. Mostly on Friday, the Muslims go to the largest mosque at Agbogbloshie which is off all the sites to observe the Sadat.

5.1.3.5 Reproductive Time Requirement

There were just 19.4 percent of respondent performing daily household chores out of whom 71.43 percent were females often wives with children and the rest, males. The working schedule of both males and females in the informal e-waste sector made it highly impossible for most of them to leave work early to embark on additional chores at the household. The major females' reproductive roles are housekeeping, cooking, clothe washing or laundry, child and older age care. This result resonates well with similar studies as female stereotyped reproductive roles (WDR, 2010). Most females living under marriage settings perform these multiple roles daily or weekly while the unmarried hardly perform any household roles from Monday to Friday. Thus, married women with no household assistance are mostly likely to undergo stress by combining workplace and household roles than other female and male counterparts.

The time distribution for household and workplace roles is indicative that e-waste business is very time consuming for male and female participants. As a result, a lot of female participants with children have contracted families, friends or care takers to assist them with childcare whenever they leave their children home for work. This case is common for Kumasi than Accra.. Thus, most middle-women in Kumasi (all Frafras) spend majority of their working hours on the sites doing very tedious work and retire home very tired to take insufficient rest for next day duties. The sense that Frafra women are more independent in their decision making over their lives than Dagomba counterparts was gathered by the researcher. Hence, it is carefully interpreted that most Frafra women are more likely to have much freedom to choose the work that they want to do and how to run their families with limited control from their spouses than Dagomba counterparts (gathered from the FGD with females only in Kumasi). This is

already confirmed in expression by some Dagomba scrap dealers above. By virtue of this time analysis, the married women involved in e-waste management can be said to be time stressed.

Majority of male e-waste workers happened to be Muslims and hardly do they perform or assist their spouses with household chores. The males expressed their belief in most of the FGDs that females are responsible for household care and maintenance as males are to work to provide money for household needs. The males who assisted at household level mostly supported their wives to fetch water and/ or take the children to school before going to work. For the unmarried males, the major household roles that they performed once in a long time are house cleaning and laundry. It was articulated in two of the FGDs that these single youth males preferred to wear one attire until it is very dirty and they dispose to get another cheap second hand clothe from Kantamanto or Sofoline in Accra and Kumasi respectively for as low as GHC0.50 to GHC3.00 to wear.

5.1.4 Political Organisation of Informal E-waste Economies in Accra and Kumasi

On the political front, none of the females at Accra e-waste sites occupy a decision making position within the highest decision making body at the site i.e. ASDA. The association deliberately seclude women from their activities primarily for cultural and religious reasons common to Northern Ghana and Islam communities' practices. Since all members of the leadership of ASDA are Dagomba and Muslims, they find it improper to engage women in the highest decision making body of the e-waste scrap yard. It was initially assumed by the researcher that information will trickle down through members to non-members including females. On the contrary, in-depth

interviews with female members and non-Ghanaian indigenes (male Nigerians) at the site revealed that they hardly get to know about decisions taken by this body which often directly affects their wellbeing including work. Leaders and members were not sharing information with all other members of the e-waste sites at Agbogbloshie. Information exchange between leaders and members also seemed challenged. It was ironical to know that most females working at the site knew not about the existence of ASDA as the highest decision making body at the site. However, the position of the chairman of ASDA as chairman of the site was not in dispute by any member of all e-wastes at Agbogbloshie.

Contrary to what was happening in Accra, three (3) of the middle-women in Kumasi were occupying leadership positions as women organiser, assistant women's organiser and assistant secretary of the ISDA. The head of ISDA although a Dagomba, Muslim man ensured middle-women join ISDA and also hold leadership positions as espoused in the in-depth interview with him. He also insisted that all members of the various e-waste sites in Kumasi try to join ISDA or form their own association with a well organised governing body but he advised against the membership based on ethnic, religion or gender grounds. Doing so to him, could really trigger mostly conflict in Accra and Kumasi.

The problem about female participation in the politics of ISDA as gathered via FGDs and in-depth interviews conducted in Kumasi is that, female members are not always consulted on every decision made about workers and the workplace. For instance, a decision to acquire a piece of land near the Kumasi city campus of University of Ghana from the Amakom chief was taken without involving a single female of the association. This land has been acquired to accommodate the e-waste workers should the central

government or KMA city authorities attempt to take their land property from the e-waste workers. As a result of non-involvement of females in the decision to acquire the land, none of the females there owns any piece of the acquired land for future operations.

On the contrary, male FGD and leadership in-depth interview in Kumasi also revealed that females hardly get much involved in the association activities due to mostly time constraints as confirmed by middle-women in an FGD. It worth noting here that female participants at Accra and Kumasi e-waste sites are said to have the least political freedom and political influence. Therefore, females in political organisations on-site remain subordinates to male counterparts reinforcing male super ordination in Kumasi just as Accra.

5.2 Challenges Facing Informal E-waste Workers

The main challenges confronting those working as e-waste managers in Accra and Kumasi are: high physical strength intensity of the job; high capital intensiveness of the job; unstable prices of e-waste metals on local and international markets and as such causing economic losses; intermittent state government banning of e-waste metals exportation; public stigmatization, harassment and persecution; and health problems. There was not much difference between males and females responses. The financial losses was explained to often come about when ban is put on e-waste metals exportation for local industries depending on such metals to receive regular sufficient supply.

5.2.1 Access to Information

According to the middle-women in Kumasi, access to information on e-metal prices can help them remain sustainable in e-waste business than they are now. For middle-

women in Accra, the information on price and price change is not difficult as counterparts in Kumasi. This positions middle-women in Accra in advantageous position over female counterparts in Kumasi. A middle-woman in Kumasi expressed in one of the FGDs that

“The men never go to Accra and come back to tell us that prices have gone up. Hence, they continue to buy e-waste metals from us (the females) in the old prices whiles they go to sell at the new prices in order to make excessive profit. Howbeit when prices fall, they quickly come to inform us and reduce their buying rates which is constantly affecting the capital that we use for our businesses. We wish that there could be someone in Accra who would constantly be feeding us with the accurate prices changes”.

This result further reiterates the authority of males over females in the informal e-waste sector of Ghana. Males determine prices based on their close relations with formal markets in the e-waste industry to subjugate females in the informal e-waste sector of Ghana.

5.2.2 Public Stigmatisation, Harassment and Persecution

During reconnaissance and main field study, the researcher gathered that physical locations and constructions of e-waste sites in Accra and Kumasi have helped to turn these places into sanctuaries for criminal activities like smoking of marijuana, heroin and harbouring as well as breeding of armed robbers.

This perception was also confirmed in the FGDs and in-depth interviews conducted at the sites in both cities. Some discussants and interviewees expressed a lot of worry about this disturbing observation that makes e-waste sites regarded as hub for criminals

in Accra and Kumasi. As a result, police and armed forces men were often observed by the researcher on irregular basis patrolling through the sites on foot. It was also confirmed that some criminals lodge in the midst of genuine workers at the site causing innocent workers to sometimes be killed, harassed or maltreated by especially the police and public on and off site.

As a result of this, collectors are often harassed by the public as thieves and robbers for reasons range from accusation of stealing the materials from someone's house within their collection enclaves; deceiving a child to give out the households' EEE materials believed to reach its EOL for some money; for smoking all sorts of harmful substances and engaged in armed robbery or theft mostly outside of the site (from shops, offices, garages, markets and house). It is held by all e-waste workers that both government officials and the general public looked down upon their businesses despite the environmental services that they are rendering nationwide.

On Kumasi e-waste sites, Frafra middle-women faced stigmatisation from counterpart male Dagomba participants. To some of these Dagomba men, it is derogatory for a woman to be engaged in any form of direct e-waste businesses. For these men, the woman's role within the e-waste industry is to provide supporting services. It is expressed by a discussant in an FGD at Kumasi that,

“If a woman wants to participate, it is best she considers playing a supporting role. I will never allow my wife, sister or any female family member to engage in any direct e-waste activity. Islam does not even permit us to do so. You see the women competing with the men in direct e-waste business at this site are all

Frafras. Their culture permits them to leave their husbands, children and family and come do this. No Dagomba man will do this”.

In Accra, the men working at the 3 e-waste sites believe that females seeking to work in the informal e-waste sector ought to provide female stereotyped supporting services or better still change their mind and go into head pottery business as other female Dagombas in Agbogbloshie do.

5.2.3 Environmental Health

Some of the health risks that respondents outlined were: bodily pains, stress, cold/catarrah, skin itches/ rashes, fatigue, malaria, cuts/ wounds/ sores, respiratory difficulties, accidents and death as other studies have socially and scientifically discovered (Koranteng & Darko, 2011; Agyei-Mensah & Oteng-Ababio, 2012; Amankwaa, 2013). Studies have shown that the kind of environmental pollution at e-waste sites in developed countries like Ghana negatively impacts on workers' health (Agyei-Mensah & Oteng-Ababio, 2012). However, about 46 percent of respondents strongly disagreed that their participation in the e-waste business could expose them to any possible health risks; and as a result, 96.87 percent perceived their activity did not pollute or harm the environment in any harmful way (see table 5.15 below).

Table 5.15: Respondents' Perceived Health Implications of E-waste Activities

Response Categories	Male (%)	Female (%)	Total (%)
Strongly Agree	1 (1.33)	1 (4.76)	2 (2.08)
Agree	1 (1.33)	0 (0.00)	1 (1.04)
Neither Agree nor Disagree	11 (14.67)	2 (9.52)	13 (13.54)
Disagree	35 (46.67)	1 (4.76)	36 (37.50)
Strongly Disagree	27 (36.00)	17 (80.95)	44 (45.83)
Total	75 (100.00)	21 (100.00)	96 (100.00)

Source: Field Data (2014)

Respondents' perception of environmental health impacts of their activities is not based on ignorance but sheer refusal to consider an eminent problem. A workers hinted that

“Most of us here are aware of the problems that doing this kind work exposes our health to”. But it is worse to think about it than live with it and never think of dying soon because this is the work that most them do in a lifetime”.

The implication of this phenomenon is that, Ghana, World Health Organisation (WHO) and other development partners must position themselves to stop bad practices ongoing in the current informal e-waste sector in Ghana or be prepared to deal with different health cases that these workers may likely suffer from in near, mid and long term future which can cost large sums of resources (human, medical, time and so forth).

5.3 Motivational Reasons and Benefits of Working in E-waste Industry

5.3.1 Motivational Reasons

Working in the e-waste industry helps with individual and collective socio-economic development especially by helping to alleviate poverty among those from low income households (Oteng-Ababio, 2012a, b, c). To all e-waste workers, a combination of those factors as financial advancement, financial security or wealth accumulation; opportunity for self-employment; feeling of economic satisfaction and high business profitability as compared to previous jobs mentioned in table 5.16 motivates respondents to continue working in the e-waste industry of Accra and Kumasi.

Table 5.16: Tabular Representation of Respondents' Working Experiences

Type of E-waste Activity	Previous Occupation
Collector	Criminal activities, Car washing, carpentry, <u>food processing</u> ³ , students, petty traders, truck loaders, truck pushers, masons, farmers and unemployed
Repairer	Apprentice and Work and Pay employees
Recycler	Electronic repairers, Barber, Carpentry, Credit Card seller, farmer, fitter, apprentice, drum beater, motor bike rider, student, petty traders
Middle-role players	Driver, electronics traders, phone repairers, traders shop assistance spare parts dealers, <u>food processors and food vendors</u>
Scrap dealer	Technician
Ancillary Service Providers	Farmers, <u>Food and fruit vending</u> , student, teacher, trader and unemployed

Source: Field Data (2014)

³ Activities underlined are the type of jobs or works that females were previously doing.

5.3.2 Benefits

5.3.2.1 Income

On the average, respondents earned about GHC 54.00 daily from their participation in the e-waste industry. This average score is high due to over-representation of midstream actors in the entire e-waste industry. Thus, scrap dealers and middle-role players usually earned between GHC50.00 to 150.00 daily. Hardly could a collector earn GHC50.00 daily unless those who spend days and weeks in the bush to gather so much bulk to sell at a time. No dismantler or ancillary service provider mostly earned GHC50.00 to 150.00 daily.

Table 5.17 portrays income or profit per day margins for male and female participants of the e-waste industry. Most females (71.43 percent) earned between GHC 10 to GHC49 daily; the least is more than GHC3 that of the daily minimum wage of GHC7 (Essel, 2015) as compared to few (23.91 percent) males earning similar incomes. Most males earned between GHC50 to GHC150 daily due to their high concentration in middle-role and scrap dealing.

Table 5.17: Respondents' Daily Profit or Earnings of by Sex

Amount (GHC)	Male (%)	Female (%)	Total (%)
10-49	11 (23.91)	10 (71.43)	21 (35.00)
50-89	22 (47.83)	3 (21.43)	25 (41.67)
90-150	13 (28.26)	1 (7.14)	14 (23.33)

Pearson Chi2 (2) = 10.7702

Pr = 0.005

Source: Field Data (2014)

There is indeed a strong significant relationship at 5 percent between daily profits or income of workers and their sex. It is cautiously interpreted that male overrepresentation in the e-waste industry and in the data collection strongly projects this view. Again, females dominate in ancillary services whose profit or income can only be compared collectors, dismantlers and repairers as shown in Table 5.18. The middle-women could not easily get as much profit as counterpart middle-men as in-depth interviews and FGDs unveiled. Gender gap in income is largely as a result of limitations caused by access to scrap metals and appropriate working tools.

Table 5.18: Respondents' Daily Profit or Earnings by Activity Type

Amount (GHC)	Collector (%)	Recycler (%)	Middle-role Player (%)	Scrap Dealer (%)	Ancillary Services Providers (%)	Total (%)
10-79	11 (91.67)	2 (100.00)	23 (67.65)	1 (11.11)	3 (100.00)	40 (66.67)
80-150	1 (8.33)	0 (0)	11 (32.35)	8 (88.89)	0 (0.00)	20 (33.33)
Total	12 (100.00)	2 (100.00)	34 (100.00)	9 (100.00)	3 (100.00)	60 (100)

Pearson Chi2 (4) = 18.3897

Pr = 0.001

Source: Field Data (2014)

5.3.2.2 Savings

About 99 percent of respondents were saving for personal, household and/ or extended family support, and for the future, with a little less than 1 percent not saving. Various reasons like 'to go back home' and 'learn a professional trade'; 'for the future', 'for parents' burial expenses', 'education', 'business expansion', 'remittance to family' and so forth, were some of the reasons for saving. 5 different modes of saving is practised:

about 16 percent saved with banks, like Fidelity, Zenith and Agriculture Development Bank (ADB). All those saving with banks were males. This is possibly so because of high financial capacities of males over females likewise high literacy levels of males over females in the sector. The majority of the respondents (males and females) saved their monies with Microfinance institutions (see table 5.19 below) just as numerous persons in the Ghanaian informal sector (Asiama & Osei, 2007; Osei-Boateng & Ampratwum, 2011).

Table 5.19: Respondents' Savings Practices by Sex

Modes of Savings	Males (%)	Females (%)	Total (%)
Saving at Home	17 (22.08)	5 (20.83)	22 (21.78)
Custodian Savings	4 (5.19)	4 (16.67)	8 (7.92)
No Contribution, No Chop	0 (0.00)	4 (16.67)	4 (3.96)
Microfinance Savings	40 (51.95)	11 (45.83)	51 (50.50)
Banking	16 (20.78)	0(0.00)	16 (15.84)

Source: Field Data (2014)

5.3.1.3 Social Prestige Gains

Apart from the advantages of mostly becoming self-employed and financially secured, one's social prestige is enhanced by rendering assistance to the family and particularly hometown community using savings and income from the e-waste business. Most workers, including a lot of females had their basic needs of feeding, drinking and shelter met. The self-esteem needs were partially being satisfied through the ability of these

workers to provide financial support towards nuclear and extended family members' expenditure on feeding, education and health, either directly or through remittances.

About 78 percent of respondents were financially responsible for most of their households' expenditures. These 78 percent respondents contributed 50 percent to 100 percent of cash to take care of household expenses. 92 percent of them were male and the remaining about 8 percent were females. On the average, about GHC17.00 is daily spent by an e-waste worker's household on food. The minimum recorded was GHC4.00 and the maximum, GHC30.00.

In terms of daily household expenses on drinking water and water for other household chores, an average of GHC1.5 is spent. Almost all respondents reported drinking sachet water with their household members, and pipe-borne water is used for other household chores like cooking and bathing.

For those household with children of school-going age, about GHC2.00 is averagely spent daily on education. While some households were spending nothing on education because their wards were attending public basic schools only; others spent as much as GHC15.00 on education for enrolling their wars in private basic schools. The other group spending nothing on education belonged to the unmarried category with no children living with them. The FGDs and in-depth interviews revealed that most workers of informal e-waste sector planned to adequately educate their wards so that they don't end up working at the e-waste sites.

The average rental cost for a month is about GHC 15.00. The highest amount paid for rent was GHC50.00 per month, and the lowest nothing. Most workers lived in low income residential areas like Aboabo, Akwatia line, Dagomba Line, Anloga for Kumasi

as well as Old Fadama and Konkomba, for Accra. Although some scrap dealers lived in their own houses with paying rent. Others participating in the informal e-waste sector shared a sleeping place in order to contribute to pay the rent. Most females were living in room(s) rented mostly in compound houses structures as youth males rented or owned tents and kiosks with the older ones mostly owning or renting cement-block houses. None of the females owned a house, kiosk or tent. In addition to these expenditures, those living in the low income neighbourhoods spent about 30 to 50 Ghana Pesewas once or twice daily to bath and visit the lavatory at public facilities.

5.4 Summary

From a gendered and power relation perspective, those discriminating social, political, physical and economic factors positioning females as subordinates to males in the informal e-waste management sector is explored and discovered by the study. Informal e-waste management practice as seen in Accra and Kumasi is accepted by both male and female as laborious. This justifies why females dominate in the less tedious ancillary service provision to backbreaking jobs like e-waste collection and recycling which is secluded to males. The metal trading activities of the sector is less strength intensive but more capital intensive. Therefore, it is not surprising that males dominate this job of informal e-waste management sector.

The benefits of working in informal e-waste management sector transcends economics (income generation, improved saving capacities) into achieving high social recognition and prestige. Interestingly more males than females derive greater social and economic benefits from their participation in the sector.

Howbeit, the challenges of public stigmatisation and harassment, high physical strength intensity of e-waste activities, limited government efforts to support informal e-waste management and health problems require urgent solutions to ensure sustainability in the sector. A targeted socio-economic policy to deal with the economic, social, cultural, environmental and political constraints of male and female participants of the informal e-waste management sector in Ghana is required.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

A sustainable MSWM strategy which ignores the socio-economic context in its development is likely to fail (Wilson, 2007)

6.0 Introduction

This study looks at gender roles and power relations within the e-waste industry using two (2) case studies from Accra and Kumasi. It describes the actors, networks and the horizontal and vertical functional linkages within the industry. Again, it examined the challenges of male and female participants in the industry. The underlying factors of gendered roles and power relations discovered in the industry were also discussed for policy recommendation and development planning as the epitaph above promotes. Thus, sustainable waste management planning often ought to consider social and economic context of any problem it seeks to solve for successful implementation of strategic plans. Hence, this chapter presents the findings, conclusions, policy recommendations and suggested areas for further research as observed by the study.

6.1 Summary of Main Findings

Below are the main findings vis-a-vis the objectives of the study:

6.1.1 Horizontal and Vertical Chains of E-waste Activities

The e-waste industry is market driven. In its vertical supply value chain lies collectors, recyclers and repairers or refurbishers, middle-role players, scrap dealers, metal trading companies, agents of metal recycling companies, the metal recycling companies themselves and metal fabricators or assemblers. Those in the metal export and metal

recycling activities as companies belong to the formal sector while all other actors are classed into the informal sector of e-waste management.

The collectors gather the raw materials for primary recycle and reuse by dismantlers, sorters, burners and repairers or refurbishers. The recovered materials are passed onto middle-role players and scrap dealers for trading or marketing to the metal recycling agents, metal exporting firms and sometimes, directly to the metal recycling companies. Often times, metal exporting firms are main targets to be supplied with the metals by middle-men and scrap dealers because of the bonds that exist between these actors. Middle-women usually receive supplies from collectors who plan to get better prices from these women for the same amount of metals that a middle-man or scrap dealer will pay less. The middle women lack the economic and social power to easily reject the metals that these collectors sell to them because their suppliers are highly limited just as their buyers. Thus, within the vertical and horizontal chains of e-waste management, females play limited roles of predominantly middle-role playing as compared to their male counterparts dominating in all activities in both formal and informal e-waste management. Otherwise, those females who choose to participate in e-waste management in Ghanaian cities have mostly one major option of playing the role of ancillary service provider.

6.1.2 Gendered Roles and Power Relations of E-waste Management

E-waste management comprises of collection, transportation, repair or refurbishing, metal trading as well as manufacturing activities. Within this phenomenon, goods and services are exchanged amongst different actors in forward and backward directions. It was highlighted in descriptive and MLM analysis that sex, age, education, ethnicity, marital

status and religion are the major demographic determinants why males dominate in e-waste activities like collection and recycling (dismantling, burning and repairing) including middle-role playing, scrap dealing and as agents for metal buying and recycling companies. These demographic factors portrayed how social and cultural factors combine to create stereotyped roles for males and females at workplaces confirming results of a globalised gender and employment study (WDR, 2010).

For recycling specifically, sex, ethnicity, hours of work and religion were major influencing factors for solely males to be engaged.

Again, it was proven in the descriptive and MLM of demographic factors that middle-role and ancillary service provision are the only two activities that engaged both males and females as workers of the informal e-waste sector. While females dominated in ancillary services, males formed the largest share of middle-role players at all 6 e-waste sites studied. Education, ethnicity and marital status are major demographic determinants for playing the role of a middle-man or middle-woman. Since most women were married, they could not actively play the middle-role as their male counterparts. Males dominated in middle-role playing because they had acquired better education than their female counterparts. Above, metal trading which involve middle-role playing and scrap dealing were the most capital intensive businesses in the informal e-waste sector constraining many women who would wish to participate.

In terms of ethnicity, the predominant tribe in the informal e-waste sector, Dagombas, found it unsuitable for females to manage e-waste. The Dagomba males on-site found it favourable to encourage their female Dagomba counterparts into ancillary service provision than middle-role playing in both Accra and Kumasi. In Accra, there were only

3 middle-women operating as middle-women. These women basically acted as managers of their husband's or male relatives. In Kumasi however, 300 females operated as middle-women. All 300 middle women were Frafras whose culture somehow liberates them from male control to take personal decisions about their life.

It was gathered via in-depth interviews with management of formal e-waste companies that females are employed for stereotyped roles like cleaning, cooking and secretarial duties. The males predominate also at secondary recycling activity of e-waste management where recovered metals by primary recyclers are traded for exportation and/ or production of iron rods and bars, cooking utensils, metallic tools and equipment, etc. The fabricators yard have very few females receiving training as recyclers. The females here usually play roles of cleaning and cooking at the workplace. This study therefore adds to gender literature that, employment and recruitment in both formal and informal e-waste sectors is highly gendered based on entrenched and/ or justifiable reasons.

Again, the study found out that gender and power relationship constructs in the informal e-waste sector were also mainly based on physical and economic factors. For instance, physical strength intensity of collection and recycling attracted mostly males into the business, while sale of food, water and tools, requiring lesser strength to do attracted lots of females. Economically also, females were constrained by time, access to capital or credit, information and working tools to play a role in the highest occupation strata of the sector which is scrap dealing. Since females were cut off from playing the role of a scrap role, their inputs towards price determination of metals were so limited to sometimes negligible levels. This meant that any female with an interest in participating in direct informal e-waste management with in Accra and Kumasi settled for

predominantly middle-woman role despite the amount of start-up capital they had, and their ability to withstand discrimination and disregard by male counterparts.

In fine, socio-demographic, culture, belief systems, norms, access to capital, information, time constraints and physical strength intensity of direct e-waste activities combine to empower males in the informal e-waste sector as the superordinate subjugating females into subordinate positions on the socio-economic and political fronts. Critical among these factors were physical and economic reasons as to why females less dominate in informal e-waste management practice in Ghana.

6.1.3 Benefits and Challenges of E-waste Management

Major benefits of working in the informal e-waste management sector are: an improved financial standing to cater for individual and family needs thereby enhancing a person's social prestige. This is largely possible through self-employment which enhances the workers' abilities to save for mostly their physiological needs. In terms of the support that the workers give to family, neighbours and friends, their esteems needs seem to be quite met. Love and acceptance need is also met by the workers through their relationship with the scrap dealers associations, tribal and religious groupings.

The main challenges facing e-waste workers are: limited financial access for both male and female participants. In this context, the females seem more constrained compared to their male counterparts. Financial difficulties result in limited access to efficient tools and equipment, hence, limiting business growth and advancement in the sector.

There is a general lack of public recognition of the good work done by informal e-waste workers in providing e-waste management service. To these workers, if the government

and the public would appreciate their contribution to the environmental management, the negative public stigmatisation of their work could be reduced.

Almost all workers are predispose to one health challenge or another due to their participation in e-waste management. Some common health challenges outlined are: chest pains, waist pains, back ache, colds or catarrhs, skin itches or rashes, stress or fatigue, malaria, cuts, wounds, sores, burns, respiratory difficulties, accidents and even death.

6.2 Conclusion

Despite the limitations of the study, the following conclusions were reached: e-waste management in Accra and Kumasi dominantly engages skills and services of more young males than females, as most studies have previously observed. The two cities' e-waste management practice is simply a set of supply activities connecting actors locally and internationally to convert wastes into resources along the vertical chain. Within the vertical supply chain, e-waste management is about collection, transportation, primary recycling and/ reuse, metal trading and secondary recycling and/ or reuse activities; forming a hierarchical order with backward and forward linkages.

This research confirmed other studies on MSWM in developing countries in Africa, Asia and Latin America where males dominate in general MSWM and specifically e-waste management. Thus, the hierarchical structure of e-waste management restricts women's involvements as power is confined to males as one moves up the hierarchy due to socio-cultural practices, political and economic reasons. The majority of females at e-waste sites are ancillary service providers who primarily provide life supporting instead of direct e-waste management service. Moreover, males and female participants

of the e-waste industry in Accra and Kumasi were confronted with some social, economic and environmental barriers and challenges that constrained their ability to effectively and efficiently manage the e-waste according to sustainability standards.

To address these challenges and barriers, all recommendations given by this work are worth considering by any development agency, partner, plan, policy, project, programme and strategy that seek a sustainable position for the Ghanaian e-waste industry in development. Recommendations must be well implemented to remove infrastructural, environmental, economic, social, cultural, physical and political barriers constraining any willing person's access to easily participate in e-waste management in Ghana and other places in the world with similar conditions observed by the study. The proper implementation of recommendations would result in: poverty alleviation, boosting industrialisation, ease of entry and participation for males and females in e-waste management in Ghana

6.3 Policy Recommendations

The Director of KMA/WMD supports the idea that informal e-waste management workers must be acknowledged publicly by all cities' governments where such workers operate in their municipalities. State and municipal authorities must integrate the informal e-waste management sector into their annual budgeting plans in order to raise the needed funds to help modernise e-waste sites into industrial hubs with modern infrastructure, operating technologies, worshipping centres, particularly mosques, a life supporting facility and a tools market, capacity building centres, etcetera to cater for the technical, physical, economic, cultural and social needs of these workers. The provision of infrastructure for the informal e-waste workers ought to be gender sensitive in terms

of providing separate dedicated services and structures for males and females working on-sites. For instance, the urinal, toilets, bathroom and changing rooms for females' on-sites should not be closely located to that of male counterparts to encourage usage.

In providing training or capacity building services, the use of local language translators speaking the languages of workers is necessary to ensure acceptance of the training, capacity building and also to increase participation. Such training programmes must cover best working practices, business management, marketing and health and safety precautionary measures and gender equality.

Since most of the people involved in informal e-waste management are Dogombas and also Muslims; their cultural sensitivities regarding male-female interactions in public places needs to be factored into the design of training programmes. It is therefore recommended that such training programmes be carried out separately for males and females participating in the sector.

From the economic sustainability perspective, in view of the financial difficulties faced by GoG and most CSOs/ NGOs in Ghana, banks and financial service providers should try to market their loan or credit facilities to e-waste workers who have the ability to repay in record time. The credit arrangement should be flexible enough to attract all actors in the informal e-waste sector. By so doing, the individual and group packages of credit arrangement should be properly sold to different actor groups of the sector to ensure that they understand the merits and demerits of each package before making a choice. In the long run, business will expand and employment creation increased as well as the socio-economic wellbeing of workers enhanced.

To overcome gender gaps in income and access to capital or credit, financial institutions put strategies to target female players in direct e-waste management for support. This initiative will not only financially empower females in e-waste management particularly in metal trading, they will also become into role models and mentors for other females interested in e-waste management in their spheres of contacts likewise males.

On a broader scale, the iron and steel recycling companies request that the GoG continues to place a ban on export of iron and steel metals from the country. This will help these companies receive enough supply and possibly excess to open up production and hence, industrialisation and employment. In this regard, the GoG can adequately fulfil its mandate by ensuring that she effectively implements the L.I. 2201 called the scrap metal law.

Above all, advocacy on the hazardous waste management bill before members of parliament should be increased by supporting interest CSOs/ NGOs capable of doing such and lobbying for it to be passed into a law. The passage of the bill into law will require enforcement practices to generate sufficient revenues under the polluter pays principle (PPP) to support all actors managing e-waste in the country.

Finally, it is suggested that policy makers responsible for engineering sustainable e-waste management practice in Ghana do so by integrating the above recommendations in into their programmes, projects and strategies to enhance the opportunities for males and females in both formal and informal e-waste management.

6.4 Areas for Further Research

Gender and e-waste business financing; gender contributions to e-waste management; and gendered health issues of e-waste management are suggested themes to receive further academic attention about e-waste management in Ghana. These themes are raised for further interrogation because there is either very limited or no knowledge on them.

Again, the research in context raises named themes above for further studies because this study focused principally on the gendered and power relationships in the informal e-waste sector. Therefore the study could only deal with a dearth of the issues raised above. A better understanding of the research problems raised above will provide a more exhaustive information to all stakeholders for a more sustainable e-waste management practice in Ghana.

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APPENDICES

Appendix 1: Descriptive Statistics of Variables (Total Sample)

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Year of Migration	105	1988.524	195.7914	*	2014
Starting Year of Work	104	2008.317	4.526651	1992	2014
Total Number of Activities Done Per Person in the Sector	107	1.915888	0.8255529	1	4
Total Number of Working Days Per Week	107	6.588785	0.6580886	2	7
Daily Start-Up Time for Business	104	6.461538	0.8581203	5	9
Total Number of Daily Working Hours	93	10.95699	2.141282	3	15
Amount of Start-Up Capital for Business	81	833.0247	1450.432	0	10000
Daily Income or Profit	60	58.86667	33.45296	10	150
Household Size	90	3.355556	1.516287	1	8
Average Hours Spent on Household Chores	**21	2.428571	1.075706	1	5
Daily Average Household Expenditure on Food	78	17	7.636209	4	30
Daily Average Household Expenditure on Water for Drinking and other household chores	50	1.422	0.6860981	0.5	3
Daily Average Household Expenditure on Education	66	2.272727	3.618523	0	15
Monthly Rental Cost	67	15.10448	14.4381	0	50
percentage by Highest Financial Contributor to Household Expenditure	87	92.35632	15.20861	40	100

Source: Author's Computation using Field Data (March-April, 2014)

*** (Signifies Missing Case)**

**** (Signifies a valid underrepresentation)**

Total Observations= 108

Appendix 2: Estimation Results from Multinomial Logit Model using only Male Sex

Type of Activity	Collector		Repairer		Recycler		Middle-role		Scrap Dealer		
	Coeff	RRR	Coeff	RRR	Coeff	RRR	Coeff	RRR	Coeff	RRR	
Male Sex	17.69061	4.82E+07	17.69061	4.82E+07	17.69061	4.82E+07	1.621556	5.060958	17.69061	4.82E+07	
Observation	108										
Popoluation Size	108										
Prob>Chi2	0.0000										
Pseudo R2	0.1357										

Source: Field Data (2014)

Appendix 3: Estimation Results from Multinomial Logit Model using 3 Variable

Type of Activity	Collector		Repairer		Recycler		Middle-role		Scrap Dealer	
	Coeff	RRR	Coeff	RRR	Coeff	RRR	Coeff	RRR	Coeff	RRR
Accra Area	-1.83681	0.159325	-2.5364	0.079151	-0.4645	0.628447	-1.50831	0.221284	-1.49156	0.225021
Male Sex	20.19672	5.91E+08	20.32106	6.69E+08	19.71821	3.66E+08	1.933624	6.91452	20.23803	6.15E+08
Age (19-24)	0.027162	1.027534	-0.08355	0.919846	-0.20461	0.814963	1.55893	4.749756	-2.77734	0.062204
Observation	108									
Popoluation Size	108									
Prob>Chi2	0.0000									
Pseudo R2	0.2446									

Source: Field Data (2014)

Appendix 4: Estimation Results from Multinomial Pooled Model using 9 Variables

Type of Activity Variable	Collector		Repairer		Recycler		Middle-role		Scrap Dealer	
	Coeff	RRR	Coeff	RRR	Coeff	RRR	Coeff	RRR	Coeff	RRR
Accra Area	0.36885	1.44607	-0.30646	0.736045	3.189165	24.26817	1.457937	4.297085	-0.88603	0.412288
Male Sex	27.62617	9.95E+11	25.03642	7.77E+10	23.82521	2.22E+10	6.688617	803.2105	24.12589	3.00E+10
Age (19-24)	2.282627	9.802397	1.373265	3.948222	2.361266	10.60437	3.705472	40.66923	-2.04609	0.129239
Primary Education	-1.33802	0.262365	16.61767	1.65E+07	-0.47167	0.623957	1.227411	3.412382	-0.06374	0.938248
Junior High School	-4.78457	0.008358	15.78271	7150639	-2.39214	0.091434	-1.36655	0.254986	0.642033	1.90034
Ewe Ethnicity	25.32994	1.00E+11	38.8117	7.17E+16	41.31643	8.78E+17	23.6201	1.81E+10	20.24343	6.19E+08
Married Status	-1.35548	0.257825	16.39205	1.32E+07	-3.73621	0.023844	0.731723	2.078659	2.099539	8.162404
Hours of Work	-0.54803	0.57809	-0.75045	4.72E-01	0.0549	1.056435	-0.33054	0.718532	-0.49845	0.607471
Catholic Faith	-18.0074	0.303466	13.33809	620383.1	17.82442	5.51E+07	-1.05309	0.348859	-4.04222	0.017559
Observation	92									
Popoluation Size	108									
Prob>Chi2	0.0000									
Pseudo R2	0.4966									

Source: Field Data (2014)

Appendix 5. Questionnaire Instrument for Field Survey

Good morning/ afternoon/ evening. I am Onallia Esther Osei. I am a graduate student at the Department of Geography and Resource Development, University of Ghana. I am collecting this data as part of my MPhil thesis project titled: “Gender Dynamics of E-waste Management Practice in Accra and Kumasi, Ghana”. This is simply an academic exercise with the aim of directing policy. Your contribution would be very much appreciated. The exercise will take about 45 minutes but your participation is voluntary. Please if there is any question on the topic that you need clarification, you can ask before we start with the interview. Thank you

Clarification Question:

.....

May I start now?

Yes, permission is given

(Signature/ thumbprint)

No, permission is not given

Interview Date: __ __/ __ __/ __ __ __ __

Language used for interview:

English (Pidgin/ Non-Pidgin)

Akan

Dagbani

Ga-Adangbe

Ewe

Konkomba

Other Specify (.....)

Interview was conducted at ... Site

Agbogbloshie (Accra)

Anloga (Kumasi)

Aboabo Railway Line (Kumasi)

Akwatia Railway Line/ Bombay (Kumasi)

Other Specify (.....)

Start Time: __ __: __ __ GMT

PART A: BIODATA		
No.	Questions	Responses
A1i	Name of Respondent	
A1ii	Phone Number of Respondent	
A2	Sex	1. Male 2. Female
A3	Age (at last birthday)	1. Below 18 2. 19-24 3. 25-30 4. 31-36 5. 37-42 6. 43 and above
A4	Place of Residence	
A5	Place of Birth	Name of Town or Village (Name of Region (
A6 (<i>Ask Q6 only if place of birth is different from site location</i>)	In which year did you migrate into city to work?	1. Year __ __ __ __ 2. Don't know 3. Refused

A7	Highest Level of Education	<ol style="list-style-type: none"> 1. No School 2. Primary School 3. JHS 4. SHS 5. Technical or Vocation 6. Tertiary 7. Other Specify (
A8	Tribe/ Ethnicity	<ol style="list-style-type: none"> 1. Dagomba 2. Konkomba 3. Gonja 4. Nanumba 5. Sisala 6. Akan 7. Ga 8. Ewe 9. Other Specify (.....
A9	Religion	<ol style="list-style-type: none"> 1. Christian (Charismatic) 2. Christian (Orthodox) 3. Islam 4. Traditionalist 5. Other Specify 6. None 7. Don't Know 8. Refused
A10	Marital Status	<ol style="list-style-type: none"> 1. Married 2. Co-habiting 3. Single 4. Divorced

		6. Widowed 7. Other Specify (
A11	In which year did you start working at this e-waste site?	_____
A12	What was your first job at this e-waste site?	1. Collector 2. Repairer/ Refusbisher 3. Recycler 4. Middle-role 5. Scrap dealer 6. Exporter 7. Manufacturer 8. Ancillary Service Provider
A13	What is your current job?	1. Collector 2. Repairer/ Refusbisher 3. Recycler 4. Middle-role 5. Scrap dealer 6. Exporter 7. Manufacturer 8. Ancillary Service Provider
A14 <i>(Only ask A14 if job at A12 changed at A13)</i>	What reasons accounted for change of job at A12 to A13 ?	1. 2. 3.
A15	How many days of the week do you work at this e-waste site?	_____
A16	Do you do your e-waste business on weekends?	1. Yes 2. No (SKIP > A18) 3. Don't Know

		4. Refused
A17	Which of these days of the Weekend do your e-waste business?	1. Saturday only 2. Sunday only 3. Saturday and Sunday
A18	Do you do your e-waste business every time of the year?	1. Yes (SKIP > PART B) 2. No 3. Don't Know 4. Refused
A19	During which times of the year do take a break from your operation as an e-waste business man or woman?	
A20	What work do you do when you not in operation as an e-waste business man or woman?	
PART B: E-WASTE CHAINS OF ACTIVITIES, GENDER ROLES AND POWER RELATIONS, BENEFITS AND CHALLENGES OF WORKERS		
B1	What time do you normally start your daily e-waste business?	__ : __ GMT
B2	What are the daily preparatory activities at the workplace before start of e-waste management activity?	
B3	What are your daily roles as..... (Put name of e-waste business there)	1. 2. 3. 4. 5.
B4	How many hours do you spend daily performing all roles at your workplace?	_____ Hours
B5	Do you normally break from e-waste management to do any other thing at the workplace?	1. Yes 2. No (SKIP TO B7i) 3. Don't Know (SKIP TO B7i)

		4. Refused (SKIP TO B7i)
B6	What do you do at such break times and for how long?	Activity: Time: _____ (Hours/ Minutes)
B7i	How much start-up capital did you have to start your business?	GHC _____
B7ii	What were the sources of the start-up capital?	RELATIONS
B8	My e-waste business is:	<ol style="list-style-type: none"> 1. Capital intensive 2. Less capital intensive 3. Not capital intensive at all
B9	My e-waste business	<ol style="list-style-type: none"> 1. Demands a lot of physical strength input 2. Demands a little bit of physical strength input 3. Does not demand physical strength input at all
B10i	Does your sex constrain from accessing Land space for your e-waste work at the site?	<ol style="list-style-type: none"> 1. Yes 2. No 3. Don't know 4. Refused
B10ii	Does your sex constrain from accessing Working tools for your e-waste work at the site?	<ol style="list-style-type: none"> 1. Yes 2. No 3. Don't know 4. Refused
B10iii	Does your sex constrain from accessing Financial capital for your e-waste work at the site?	<ol style="list-style-type: none"> 1. Yes 2. No 3. Don't know 4. Refused
B11	Why do your easily or find difficult to access resources for your e-waste	<ol style="list-style-type: none"> 1. 2.

	business?	3. 4. 5.
B12	My e-waste business causes me to be sick of:	1. 2. 3.
B13i	Does your sex as man or woman influence your choice of e-waste business?	1. Yes 2. No (SKIP>B14i) 3. Don't know 4. Refused
B13ii	How does your sex influence your choice of work in the e-waste management industry?	1. Economic Factor (2. Social-Cultural (4. Other Specify (
B14i	Does any member of your household or family influence your choice of work to go into e-waste management?	1. Yes 2. No (SKIP>B15i) 3. Don't know 4. Refused
B14ii	How were such person (s) influence you?	
B15i	What are your work inputs?	
B15ii	What are your work outputs in terms of e-waste recovered resources?	
B16	How much is your average daily reward (cash/ kind) for your labour as an e-waste business man or woman?	GHC _____
B17i	Are you able to save some of your income?	1. Yes 2. No (SKIP>B18i) 3. Don't know 4. Refused
B17ii	How much have you saved so far and how often do you ave?	GHC _____ Rate of Saving:

B17iii	Which saving mechanism do you use?	<ol style="list-style-type: none"> 1. Personal Saving in a Susu Box 2. Informal Saving 3. NCNC (No Contribution, No Chop) 4. Banking, Specify bank (5. Microfinance, Savings and Loans Comp 6. Other Specify (
B18i	Are you an insurance policy holder?	<ol style="list-style-type: none"> 1. Yes 2. No (SKIP> B19i) 3. Don't know 4. Refused
B18ii	What is the name of your insurance company?	
B18iii	What sort of insurance policy do you hold?	
B19i	Have you been part of any training programme for workers at this site?	<ol style="list-style-type: none"> 1. Yes 2. No (SKIP>B20i) 3. Don't know 4. Refused
B19ii	What was the training about?	
B19iii	Which entity organised the said training programme?	
B19iv	What did you gain from participating in the said training programme?	
B19v	Was it difficult to get the opportunity to participate in the training?	<ol style="list-style-type: none"> 1. Yes (SKIP>B19vii) 2. No 3. Don't know 4. Refused
B19vi	If YES, what difficulties were they?	

B19vii	When was the training organised?	
B20i	Who are your leaders at this site?	<ol style="list-style-type: none"> 1. 2. 3.
B20ii	How would you characterise their leadership style?	<ol style="list-style-type: none"> 1. Very Oppressing 2. Oppressing 3. Mildly Oppressing 4. Not Oppressing at all
B20iii	Are you a registered member of the scrap dealers association in this town?	<ol style="list-style-type: none"> 1. Yes 2. No (SKIP>B21i) 3. Don't know 4. Refused
B20iv	What are your roles as a member of the association?	<ol style="list-style-type: none"> 1. 2. 3.
B20v	What are the challenges you face as a result of your sex as an association member?	<ol style="list-style-type: none"> 1. 2. 3.
B20vi	What are the benefits to you as a member of the association?	<ol style="list-style-type: none"> 1. 2. 3.
B21	I think that my work as e-waste business man or woman pollutes the environment	<ol style="list-style-type: none"> 1. I strongly agree 2. I agree 3. I neither agree nor disagree 4. I disagree 5. I strongly disagree
B22	I think that my participation in e-waste management has worsened my health status	<ol style="list-style-type: none"> 1. I strongly agree 2. I agree 3. I neither agree nor disagree

		<p>4. I disagree</p> <p>5. I strongly disagree</p>
B23	I think that my e-waste business is profitable	<p>1. I strongly agree</p> <p>2. I agree</p> <p>3. I neither agree nor disagree</p> <p>4. I disagree</p> <p>5. I strongly disagree</p>
B24	What motivates you to be an e-waste business man or woman?	<p>1.</p> <p>2.</p> <p>3.</p>
B25	How does your e-waste business benefit you and members of your household and family?	<p>1.</p> <p>2.</p> <p>3.</p>
B26	What are the major challenges as a result of your participation in e-waste management in this city?	<p>1.</p> <p>2.</p> <p>3.</p>
PART D: SOCIO-ECONOMIC INFORMATION ON RESPONDENTS' HOUSEHOLD		
C1	How many members of your household are currently working as e-waste managers?	_____
C2	How many people from family in general works in the informal e-waste sector?	_____
C3	What are your daily roles at home?	<p>1.</p> <p>2.</p> <p>3.</p> <p>4.</p> <p>5.</p>
C4	How many hours do you spend daily performing such household roles?	_____

C5	How does your household chores influence your work as an e-waste manager?	
C6	How does your e-waste work affects your daily household chores?	
C7	Who is financially responsible for significant proportions of your household expenditure and at what rate?	Relationship Rate 1.
	Who are the other financial contributors to household expenditure and at what rates?	Relationship Rate 1. 2.
C8	What kind of housing facility do household members and you live in?	1. Separate House/ Bungalow 2. Semi-detached unit 3. Flat/ Apartment 4. Rooms in a (Same/ Different) Compound 5. Huts/ Shacks 6. Tents/ Improvised home/ Kiosk 7. Other Specify (
C9	How many people do you share a sleeping room with?	
C10	How many people form your household?	
C11	What kind of bathing facility do members of your household and you use?	1. In-house shower bath 2. Open-space shower bath 3. In-house without shower bath 4. Open-space without shower bath 5. Public bathing house 6. Other Specify (
C12	What type of toilet facility do members	1. Flush toilet (WC)

	of your household and you and use?	2. Pit latrine 3. KVIP 4. Bucket/ Pan 5. Public toilet (Flush/ Bucket/ KVIP) 6. Toilet in another house 7. No facility/ Bush/ Beach 8. Other Specify (
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Appendix 6: Instrument Used for In-Depth Interviews with E-waste Management Companies and Metal Exporters as well as the FGDs guide for E-waste workers at the E-waste Sites

Good morning/ afternoon/ evening. I am Onallia Esther Osei. I am a graduate student at the Department of Geography and Resource Development, University of Ghana. I am collecting this data as part of my MPhil thesis project titled: “Spatio-Gender Dynamics of E-waste Management Practice in Accra and Kumasi, Ghana”. This is simply an academic exercise with the aim of directing policy. Your contribution would be very much appreciated. I will like to interview you for about 20 to 30 minutes but note that your participation is voluntary. Please if there is any question on the topic that you need clarification, you can ask before we start with the interview. Thank you

A) Biodata

- 1) Name
- 2) Age in completed years
- 3) Sex
- 4) Level of Education
- 5) Marital Status
- 6) Industrial Position(s) and Roles

B) Industrial Background Information, Challenges and Recommendation

- 1) Name of Individual or industry

2) How long have you or your industry been participating in e-waste management in this city or country?

3) How do you find your business or industry connect to other sectors or businesses in the e-waste management industry?

4) How do you benefit from participating in the e-waste management industry?

5i) What challenges are posed to you, your business or industry for participating in the e-waste industry?

5ii) How can such challenges be resolved?

6) How are men and women actively involved in e-waste management in your company or at the site?

7i) What constrains women from actively participating in e-waste management in your industry or at the e-waste site?

7ii) How can those constrains of women wishing to participate in e-waste management be met likewise those for male participants?

Thank you

Appendix 7: Instrument Used for In-Depth Interviews with the Heads of the Scrap Dealers Associations

Good morning/ afternoon/ evening. I am Onallia Esther Osei. I am a graduate student at the Department of Geography and Resource Development, University of Ghana. I am collecting this data as part of my MPhil thesis project titled: 'Spatio-Gender Dynamics of E-waste Management Practice in Accra and Kumasi, Ghana'. This is simply an academic exercise with the aim of directing policy. Your contribution would be very much appreciated. I will like to interview you for about 20 to 30 minutes but note that your participation is voluntary. Please if there is any question on the topic that you need clarification, you can ask before we start with the interview. Thank you

A) Biodata

- 1) Name
- 2) Age in completed years
- 3) Sex
- 4) Level of Education
- 5) Marital Status
- 6) Position and Roles in the Association

B) Association Background Formation, Composition, Benefits and Challenges

- 1) How long has this association been in existence?
- 2) How is this association related to other scrap dealers association inside and out of Accra?
- 3) What does one require to become a registered member of your association?

- 4i) How many males and females are members of your association?
- 4ii) How many males and females occupy leadership positions in your association and what are their roles?
- 4iii) If women are not members of the association or do not occupy leadership positions within the association, what could be accounting for that?
- 5) What are the benefits of being a member of the scrap dealers association?
- 6) What are the challenges of joining the association and how can they be resolved?
- 7) How are the e-waste managers of your site contributing to e-waste management in Accra and Ghana as a whole?
- 8) What are the opportunities for men and women in the informal e-waste sector?
- 9) What are the differences in challenges facing men and women participating in e-waste management and how can they resolved?
- 10) What is the contribution of the state, NGOs or CSOs to promoting sustainable e-waste management practice in this area?

Thank you.

Appendix 8: Instrument Used for In-Depth Interviews with Those Occupying State Positions as Stakeholders of E-waste Management in Ghana: MESTI, EPA Ghana, KMA/ WMD

Good morning/ afternoon/ evening. I am Onallia Esther Osei. I am a graduate student at the Department of Geography and Resource Development, University of Ghana. I am collecting this data as part of my MPhil thesis project titled: 'Spatio-Gender Dynamics of E-waste Management Practice in Accra and Kumasi, Ghana'. This is simply an academic exercise with the aim of directing policy. Your contribution would be very much appreciated. I will like to interview you for about 20 to 30 minutes but note that your participation is voluntary. Please if there is any question on the topic that you need clarification, you can ask before we start with the interview. Thank you

A) Biodata

- 1) Name
- 2) Age in completed years
- 3) Sex
- 4) Level of Education
- 5) Marital Status
- 6) Position and Roles

B. Organisational Contribution to Addressing the Challenge of E-waste Management in Ghana

- 1) What is your organisation mandate towards e-waste management in the country or city?
- 2) What is your present state of contribution to e-waste management in Ghana or specified city?
- 3) What difficulties do you face in fulfilling your mandate in terms of e-waste management?
- 4) What remedy measures have your organisation been taking to resolve challenges facing major stakeholders of the e-waste management in Ghana or your city?
- 5) What is your view on state of male and female participation in informal e-waste management in the country?
- 6) What can be done to resolve needs of males and females in the informal e-waste sector in Ghana?
- 7) How can your organisation contribute to resolving the needs and challenges of male and female participants in informal e-waste management in Ghana?

Thank you.