JANUARY 2014

E-waste in developing country context-Issues, challenges, practices, opportunities: Addressing the WEEE Challenge in Ghana.

Aalborg University
Department of Development and Planning
Master of Science in Environmental Management and Sustainability Science (Jemes)
4th Semester (Thesis Report)

Photo Credit: Google

Author: Samuel Baah Yamoah **Supervisor: Pernille Bertelsen, PhD (Aalborg University)**

Aalborg University
Department of Development and Planning
Skibbrogade 5, 1
9000 Aalborg

Title: E-waste in developing country context-Issues, challenges, practices, opportunities: Addressing the WEEE Challenge in Ghana.

Thesis Period: 1st September, 2013 – 9th January, 2014

EMSS2-4

SAMUEL BAAH YAMOAH

Supervisor: PERNILLE BERTELSEN

Preface and Acknowledgements

The present study, a pre requisite for completing the fourth and final semester of my masters studies in Environmental Studies (Jemes), at the Department of Planning and Development in Aalborg University was conducted between September, 2013 and January 2014. The main focus of this project was to look at the e-waste issues in Ghana, the draft national WEEE strategy yet to be operationalized; the motivations behind drafting it, the possible barriers that could affect its implementation as well as what could be done to ensure that the challenges are handled to ensure a successful implementation of the draft strategy.

This report is addressed to lecturers, students, the general public as well as anyone who may be interested in the theme under discussion in this report.

Thesis Title: **Title: E-waste in developing country context-Issues, challenges, practices, opportunities: Addressing the WEEE Challenge in Ghana.**

Supervisor: Pernille Bertelsen (Prof.)

Department of Development and Planning

Aalborg University (AAU).

Author: Samuel Baah Yamoah

Environmental Management and Sustainability Science

Aalborg University (AAU).

All glory and adulation to God Almighty for seeing me through this master degree program successfully. It has just being by his grace and mercies, and for that I am very much grateful. I wish to also offer a special thanks to my supervisor, Pernille Bertelsen for her dedicated tutoring, constructive criticisms, guidance and invaluable contribution throughout the course of compiling this thesis report. I also wish to thank the following people for the valuable information they provided for use in the compilation of this report:

Mr. Yaw Amoyaw-Osei, Director of Green Advocacy, Ghana.
Mr. Andre L.M. Habets, Dutch e-waste compliance scheme, Netherlands.
Mr. Osei Assibey Bonsu, Environmental Engineer at Kumasi Metropolitan Assembly.
Mr. John Pwamang, Director / Pesticides Registrar, Chemicals Control and Management, EPA, Accra-Ghana.

A special mention of appreciation goes to Felix Kwabena Donkor for his words of encouragement and support. I cannot end this without saying a very big thank you to my sweet and beautiful girlfriend, *Katrine Østerby Eskildsen* and her entire family for the invaluable help and support they offered me throughout the entire duration of this academic journey. Lastly, I wish to acknowledge my mum, my two sisters, and my entire family for their unflinching love and support.

Abstract

Informal recycling of WEEE in an environmentally unfriendly manner in Ghana is already impacting negatively on the environment. Alarmingly, the hazardous chemicals like copper, lead, tin, antimony, cadmium, etc that are released in the course of the open burning of WEEE have already been found in toxic quantities beyond the background levels in soils at e-waste recycling yards at Agbogbloshie in Accra, and at scrap yards in Kumasi and Koforidua (Brigden K et al., 2008; Alloway 1990; Salomons & Forstner, 1984). This phenomenon makes the proper and effective management of e-waste, which will ensure that the recycling is done in an environmentally friendly manner, all the more important.

This report focuses on the draft national WEEE strategy by the Environmental Protection Agency of Ghana, and looks at the drivers that must have influenced its drafting, the possible barriers that could affect its implementation as well as what could be done to ensure its success when it is eventually rolled out. As part of the compilation of this report, the semi-qualitative approach was adopted; employing the use of both qualitative and quantitative data in a bid to prosecute this work. The field data was sourced from informal scavengers and recyclers at Agbogbloshie through a survey whilst the qualitative data was sourced from key respondents through Skype and email interviews. The analysis of the field data was done within the context of chosen theoretical concepts so as to show the relevance of these concepts to this research whilst the data from the key respondents was used to answer the research questions as well as draw valid conclusions. The theoretical concepts upon which this research was based on are sustainable livelihood approach and political ecology.

The main findings seek to provide answers to the posed research questions as well as conclude that in as much as the political backing of government will be crucial to the success of the draft national WEEE strategy, it is also vital that alternatives in the form of jobs especially within the informal recycling sector are created to reduce the over reliance of the urban poor and economically vulnerable on livelihood survival strategies like the informal recycling of e-waste which is impacting negatively of the environment.

Table of contents

List of abbreviations

UK …….. United Kingdom

WEEE …… Waste Electrical and Electronic Equipment

EEE ……. Electrical and Electronic Equipment

EU …….. European Union

OECD …… Organization for Economic Co-operation and Development

UNEP ……... United Nations Environment Program

EC ……... European Commission

US …… United States

UAE …… United Arab Emirates

TV …… Television

PC …….. Personal Computer

DTIE …… Division of Technology Industry and Economics

SAICM ……..... Strategic Approach to international Chemical Management

PCB …… Polychlorinated biphenyl

PBDE ……. Polybrominated diphenyl ethers

DNA …….. Deoxyribonucleic acid

PVC …… Polyvinyl chloride

WHO …… World Health Organization

DHSS …… Department of Health and Human Services

CRT …….. Cathode Ray Tube

ILO …… International Labor Organization

GHS ……. Ghana cedi

PWB …….. Printed Wiring Board

EPA ……. Environmental Protection Agency

CEN …… Compliance and Enforcement Network

NGO …… Non-Governmental Organization

AAU …… Aalborg University

CSO …… Civil Society Organization

NVMP …… Nederlandse Verwijdering Metalektro Producten

ECOWAS …… Economic Community of West African States

AU …… African Union

UN …… United Nations

GDP …… Gross Domestic Product

COHRE …… Centre On Housing Rights and Evictions

SAP …… Structural Adjustment Program

GSS …… Ghana Statistical Service

DFID …… Department for International Development

SLA …… Sustainable Livelihood Approach

IMF …… International Monetary Fund

EPR …… Extended Producer Responsibility

NIMBY …… Not In My Backyard

KMA …… Kumasi Metropolitan Assembly

ADI …… African Development Indicator

WDI …… World Development Indicator

List of Figures

List of Plates

List of Tables

CHAPTER 1

INTRODUCTION

The first chapter of this report focuses on the introductory part of the study which includes the study background, which touches about e-waste in general and narrows it down eventually to the Ghanaian situation, the problem formulation, the research questions within the study context, which will later on be answered in the first part of the conclusion, and the research delimitation.

1.1 Background

There is no standard definition of e-waste. According to the Organization for Economic Co-operation and Development (OECD), e-waste refers to "*any appliance using an electric power supply that has reached its end-of-life*" (UNEP, DTIE, 2007a). The European Commission Directive 2002/96/EC also defines e-waste as any "*electrical or electronic equipment, which is waste … including all components, subassemblies and consumables, which are part of the product at the time of discarding*" (European Commission, n.d. (a)). The disparity in definitions as to what can be classified as e-waste or not is one of the main obstacles to making estimations regarding the quantification of e-waste generation as well as the identification of its flow. Despite this challenge, there is a general consensus that the reason for the trans-boundary shipments of e-waste into the developing, disadvantaged and historically marginalized areas of the world is gradually shifting away from final disposal towards recovery and recycling operations. This is backed by the fact that is it is relatively cheaper to export and recycle EEE related waste in Asia in comparison to recycling it in the United States as espoused by the US Environmental Protection Agency (Lundgren K, 2012). Apart from Asia, West African countries like Nigeria and Ghana especially are also popular destinations for the illegal shipment of e-waste from the developed countries. These obsolete EEEs shipped illegally from the developed economies to Ghana constitute a major portion of Ghana's e-waste stream most of which end up at informal recycling sites like Agbogbloshie in Accra.

1.2 WEEE Generation in Ghana and its Flow Path

It must be emphasized that the e waste stream in Ghana does not just consist of obsolete EEEs that have been shipped illegally from the developed economies. Second-hand EEEs imported into Ghana from Europe and North America as well as brand-new EEEs (mostly imported from Asia, Europe and North America) consumed domestically can also be considered as part of the composition of Ghana's WEEE stream. Quite recently, EEE imports have been coming in to Ghana from Asia, primarily China and the UAE. Some of the imported brand-new and second hand EEEs that are mostly brought in are fridges, TVs, PCs, cookers, microwaves, air conditioners, cell phones, etc. (Schluep, M et al, 2011). To understand the problems associated with WEEE recycling and to be able to find sustainable ways of dealing with it in Ghana, it is equally important to take a look at its flow pattern from Europe, North America, and quite recently Asia as indicated in figure 1.1. Generally, the imported second-hand EEEs usually enjoy high

patronage in terms of sales and consumption as compared to the brand-new EEEs across the country. A major reason for this trend, according to (Schluep, M, et al, 2011) is due to the inability of most Ghanaians to afford brand- new EEEs. Importers have taken advantage of the high patronage that second-hand EEEs enjoy to import large consignments of used and sometimes discarded obsolete EEEs into Ghana primarily from Europe and North America.

Even though the importation of second-hand EEEs from Europe and North America provides respite to most Ghanaians, their short life span in use which rarely goes beyond three years especially for the refurbished ones is a major concern as far as WEEE management is concerned. This is because the rate of generation of WEEE is increased. With no effective and proper means of disposal and recycling, the situation becomes even more precarious; as majority of these EEE related waste get mixed up with household waste eventually ending up in refuse damps or are sold to informal collectors for recycling at scrap yards across the country especially at Agbogbloshie in Accra (Schluep, M, et al, 2011).

Figure 1.1:

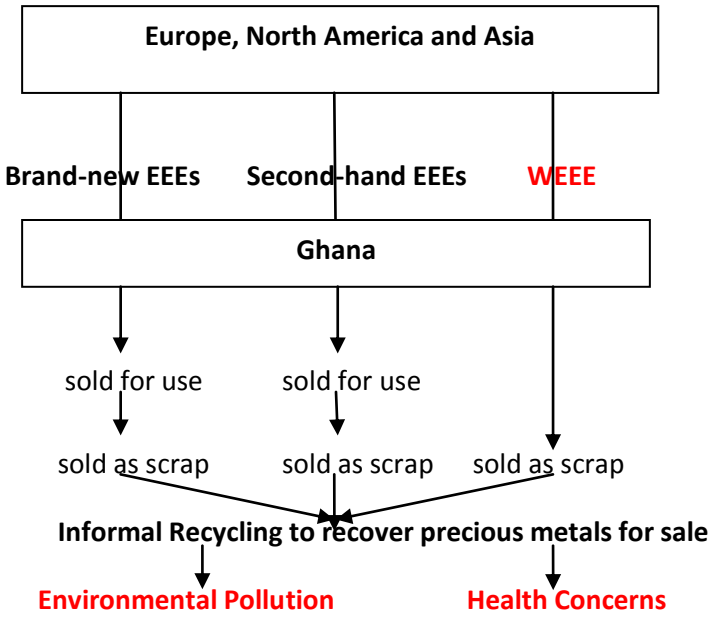

Figure 1.1 Source: Author's own construct with inspiration from literature

1.3 Electronic and electrical equipment (EEE) manufacture, sales and WEEE generation

The global growth in the manufacture and consumption of electrical and electronic equipments over the past two decades has been exponential. This could be attributed to factors such as an increasing market penetration of products in developing countries, the development of a replacement market in developed economies as well as a generally high product obsolescence rate, together with a dwindling in the prices of electronic and electrical equipments (EEEs), and the general growth in internet patronage (UNEP, DTIE, 2007a). As the manufacture and the consumption of EEEs have been on the ascendancy, so has the rate of the generation of EEE-related waste. Presently, electrical and electronic

waste, popularly referred to as e-waste, is one of the fastest growing waste streams in the world; roughly 40 million tons of e-waste is generated annually (Schluep, M. et al, 2009). According to statistics in 2007, in the developed economies, waste from EEEs equaled 1% of the total solid waste generated on an average. This was expected to increase to 2% by 2010. In USA, it accounted for 1% to 3% of the total municipal waste generation. In developing countries, it ranges from 0.01% to 1% of the total municipal solid waste generation (UNEP, DTIE, 2007a). A recent source however estimates that total amount of WEEE generation in EU ranges from 5 to 7 million tons per annum or about 14 to 15 kg per capita and is expected to grow at a rate of 3% to 5% per year (Eurostat, 2012).

The generation of e-waste in developing countries primarily Africa and Asia is two-fold; the first normally, is from the internal generation of WEEE through the consumption of mostly brand-new as well as second-hand EEEs imported from Europe and North America. The second normally comes in the form of the cross-boundary, usually illegal shipment of e-waste from the shores of developed countries into developing countries like Ghana, Nigeria, usually disguised as second-hand EEEs. One of the motivations for the trans-boundary movement of e-waste to the developing countries by the developed nations is to escape the high cost associated with the recycling of obsolete EEEs in an environmentally friendly manner. According to (Strategic Approach to International Chemicals Management [SAICM], 2009), "*as environmentally responsible waste management options are highly technological and require high financial investment, there is currently a high level of trans-boundary, often illegal, movement of e-waste into developing countries for cheaper recycling*".

1.4 WEEE management strategies

With the manufacture, sales, distribution and consumption of EEEs expected to increase globally, it is imperative that corresponding means of dealing with the waste generated from the consumption of EEEs through effective and innovative waste management is still encouraged globally. For instance, according to a research in 2010, the global electronic manufacturing services industry is expected to grow by almost 9 % annually throughout a five-year period ending in 2015, at which point the market would be worth almost $ 300 billion (Market Line, 2010). The trend of the increasing patronage and consumption of EEEs is expected to be felt in Ghana too over the next couple of years as the demand for EEEs by the general populace increases in a bid to close the digital gap between itself and the developed world (Schluep, M et al. 2011).

When it comes to the issue of the management of WEEE, the emphasis should not just be on the need to dispose them off and recycle them; emphasis and much more prominence should be directed at making sure that this is done in an environmentally sound manner. This is to ensure that the negative impacts associated with the recycling of WEEE are reduced to an appreciable level and below background levels with respect to the hazardous materials present in them. In most developed countries, the use of technology is employed in the management of WEEE through recycling. Apart from the use of technology for the recycling of WEEE in an environmentally sound manner in most developed countries, other waste management strategies, especially based on the adoption of economic instruments as well as the implementation and enforcement of laws and directives governing the

management of WEEE are also frequently employed in Denmark (Danish Environmental Protection Agency, 1999). With respect to the use of law and directives in the management of WEEE, the EU, for example has for some time now given directives to its member states to encourage them to produce EEEs with very little or no hazardous chemicals, with limited exceptions to the use of six substances in EEEs manufactured or imported in the EU after July 1, 2006 (Bibler A. et al, 2005). In the US, as of 2012, about 25 states had already passed WEEE recycling laws in a bid to ensure the effective management of EEE related waste;18 of which included placing bans on land filling of WEEE, with Pennsylvania to follow suit this year (Electronic take back coalition, 2012).

Unfortunately in Ghana such afore-mentioned efforts at ensuring the management of its EEE related waste is not in place. Apart from the fact that facilities for the recycling of EEE related waste in an environmentally sound manner do not exist, specific policies and the corresponding legal framework to ensure that there is a sound management of Ghana's EEE related waste are also non-existent (Schleup M et al, 2011). This situation coupled with a high unemployment rate has led to the festering of an informal recycling sector that is now very much established in different parts of the country with the largest one at Agbogbloshie in Accra. Other major cities like Kumasi, Koforidua and Takoradi are also synonymous with informal recycling activities in Ghana. According to Schluep M et al., 2011 (pp 3), "*given the absence of controls and regulations, it has become an open and ready source of employment and point of entry for economic migrants, usually with no education and employable skills drifting mainly from the northern parts Ghana. Thus, the industry keeps expanding. Unfortunately, the industry even attracts children who also find themselves some work; commonly found scavenging at such sites rather innocently*".

1.5 WEEE recycling in Ghana

As patronage and the consumption of EEEs (brand-new/second-hand) continue to rise culminating in the production of large volumes of EEE related waste, effective means for the disposal and recycling of the generated WEEE needs to be taken into consideration so as to reduce the negative effects the current means of recycling (open burning of the WEEE) has on the environment and the health of those involved. The informal recycling of EEE-related waste, however usually does come with a cost to the environment as well as human health especially with the open burning of the EEE-related waste in a bid to recover the precious metals in them as illustrated overleaf in plate 1.1.

Plate 1.1 Credit: Öko-Institut e.V

However, when the disposal and recycling of e-waste is done in an environmentally responsible manner, the negative impacts on the environment are reduced appreciably; however waste management strategies usually employed to realize this make use of highly technological innovations that normally require a high financial investment (SAICM, 2009). As documented by Smith, Sonnenfeld & Naguib Pellow, 2006; Lundgren K, 2012, this could be one of the underlining factors responsible for the illegal trans-boundary movement of WEEE, disguised as second-hand EEEs especially from Europe and North America in order to take advantage of cheaper recycling cost and also to shift the burden of disposal to the receiving countries. This assertion is supported by the fact that about 80 per cent of all EEE-related waste sent for recycling in developed countries finds its way into informal e-waste recycling sites in developing countries, most notably in Ghana, Nigeria, India and China (Lundgren K., 2012; Amoyaw-Osei, 2013 (Amoyaw interview transcript, pp 1 on CD)).

1.5.1 Informal Recycling (open burning) of WEEE at Agbogbloshie

In Ghana, there are numerous sites known for the informal recycling or recovery of materials from e-wastes but the main centre where majority of the informal recycling of e-waste goes on is the Agbogbloshie Scrap yard in Accra, the capital city. It must be emphasized however, that informal

recycling in Ghana is operated in a highly stratified manner, comprising collection, refurbishments and reuse activities, recycling through open burning of the dismantled obsolete EEE, and the eventual disposal of the non-recyclable parts at the scrap yards (Oteng-Ababio M, 2012) as shown in figure 1.2 below. The main electronic waste that are informally processed at the Agbogbloshie scrap yard are obsolete computer parts primarily the monitors, system units, and obsolete television sets. The main activities at the Agbogbloshie scrap yard are the manual disassembly of obsolete EEEs in a bid to isolate metals (mainly copper and aluminum), and the open burning of certain components to isolate copper from plastics in which they are encased, particularly from plastic coated wires and cables. These wires and cables are usually attached to components of other types of materials, including printed circuit boards, which are also subsequently burned (Brigden et al. 2008).

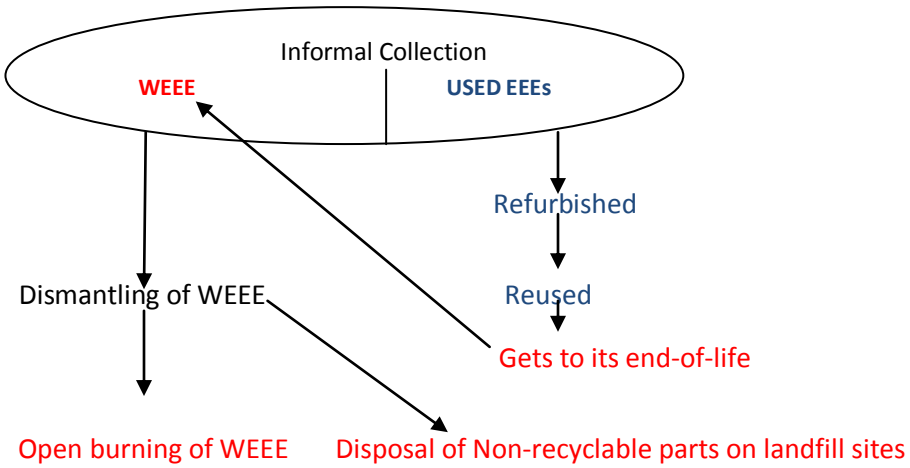

Figure 1.2: Chain of events from informal collection to Informal recycling Source: Author's own construct

Occasionally the accumulated wastes at the scrap yards are normally subjected to open burning in a bid to dispose them off and to reduce the volume of waste at the yards. It is the manual dismantling of the obsolete EEEs and the open burning they are subjected to in a bid to recover the precious metals as well as the open burning of the non-recyclable parts that presents a serious threat to the health of the recyclers, the people who reside and work close to the scrap yards and the environment as a whole. Much of this work is carried out by children, most using only rudimentary tools and with no protective equipment (Brigden et al. 2008). The burning process especially releases dangerous and hazardous chemicals like mercury, lead, cadmium, etc in the EEE related waste into the environment, and consequently resulting in the pollution of the ambient air, water and land. Some known health problems that could affect people exposed to such hazardous substances include acute lung damage stemming from the inhalation of fumes of heavy metals such as lead and cadmium. Others include mental retardation in case of lead exposure in children, damage to blood cells and the kidney and predisposition to cancers (Schluep M et al., 2011).

1.6 Negative Impacts of WEEE recycling in Ghana

1.6.1 Impacts on the environment

The major risks of informal WEEE recycling to the environment and human health emanates from the release of heavy metals, POPs, flame retardants, etc that are used in the manufacture of most EEEs. The recovery of precious metals from e waste through open burning may result in the release of three main chemical elements which can pose major concern to human health and the environment in general. The first group of hazardous elements include lead and mercury that are major constituents used in the manufacture of most EEEs; the second group of dangerous elements include cyanide which is an additive that is usually employed to aid the recovery of precious materials; and the third group represents poisonous substances like dioxin that may be produced as a by- product of the informal recycling procedure (Sepúlveda et al., 2010). The release of these potentially toxic chemicals into the environment may pose serious risks not just to the environment but to the local residents close to the informal recycling yard as well as to the recyclers themselves. When the heavy metals like lead, cadmium, copper and mercury find their way into the environment, it is not just the ambient atmosphere, soil medium, nearby surface waters that can be destroyed over time; ground water is equally at risk of pollution. The eventual outcome for the environment is always a catastrophic one that threatens both the present generations and posterity as well.

Ghana is already experiencing the brunt of informal WEEE recycling through the pollution of its ambient air, water and soils from dangerous chemicals like lead, cadmium, chromium, as well as chlorinated and brominated organic compounds such as PCBs present in the e-waste. Research work conducted on the chemical contamination of the environment at selected informal recycling and scraps yards across the country, notably at Agbogbloshie in Accra, Kumasi and Koforidua supports this view. In an field study conducted in 2008, it was documented that, "*samples of soil/ash from open burning sites generally contained high levels of many metals that are known to be present in electronic devices, some of which have toxic properties. Numerous organic chemical pollutants were also identified. Again, many of these are known to be used in electronic devices, or likely to be formed during the combustion of materials used in such devices*" (Brigden K et al, 2008, pp 6).

In addition to the apparent pollution of the soil at the Agbogbloshie scrap yard, there is also the issue of the pollution of nearby water bodies. For example, the Densu River as well as the adjacent low-lying lagoons which are situated close to the Agbogbloshie scrap yard are also likely to have been polluted with the run off of polluted dusts and soils during heavy downpours (Brigden K et al, 2008).The pollution of the environment through informal recycling of e-waste is however not only restricted to Ghana and some other African countries like Nigeria alone; similar problems can be found in Asia and even in some European countries like Russia. For instance research work conducted on the contamination of soils in scrap yard in China, India and Russia showed a high concentration of metals in the samples collected for assessment (Brigden et al. 2005, Wong et al. 2007, Labunska et al. 2008).

1.6.2 Health Impacts on workers and the Local residents

The recycling of WEEE is a complex and cumbersome process which is normally synonymous with the problems such as presence of increased concentrations of heavy metals in the ambient air, soil and

water bodies which may be situated close by. Inhalation and dust ingestion especially can impose a range of potential occupational hazards including silicosis (Lepawsky & McNabb, 2010). Recycling of WEEE especially in an informal manner through the open burning of obsolete EEEs can expose the workers as well as residents living close by the recycling yards to dioxins, lead, copper, cadmium, polybrominated diphenyl ethers (PBDEs), polychlorinated biphenyl (PCB), chromium (Mvo Platform & Good-Electronics, 2009; Nimpuno & Scruggs, 2011), mercury and other metals and carcinogens (Lepawsky & McNabb, 2010). Most at times, there is also the possibility of workers suffering from electrical shocks when dismantling the obsolete EEEs (Prakash & Manhart, 2010). In general some of the human health risks that can result from the recycling of WEEE especially through the open burning of obsolete EEEs include breathing difficulties, respiratory irritation, coughing, choking, pneumonitis, tremors, neuropsychiatric problems, convulsions, coma and even death (Yu, Welford & Hills, 2006). In addition WEEE recyclers especially those who go about it in an informal way, stand the risk of exposure to other hazards which could lead to physical injuries and chronic ailments such as asthma, skin diseases, eye irritations and stomach disease (Raghupathy, Krüger, Chaturvedi, Arora, Henzler, 2010). Pollution resulting from informal WEEE recycling could also bring about gene-toxic effects on the human body; affecting both the workers and the local residents living close to the recycling sites as well as posterity (Liu et al., 2009). Particulate matter from WEEE recycling vicinities can lead to inflammatory response, oxidative stress and DNA damage in humans (Yang, Jin, Xu & Lu, 2011).In Ghana, because the recovery of precious materials include the manual disassembly of obsolete EEEs in a bid to isolate metals (usually copper and aluminium), followed by the open burning of certain components to separate copper from plastics in which they are encased, there is a high risk of exposure to dioxins because copper is a catalyst for dioxin formation. In addition, most copper electrical wiring is coated with chlorine-containing polyvinyl chloride (PVC) plastic which also contributes to the formation of dioxins (Sepúlveda et al., 2010).

High levels of exposure to lead fumes or dust is also known to cause multiple disorders, including neurological, cardiovascular and gastrointestinal eases (Haefliger et al. 2009), exposure to cadmium fumes or dust can also result in the malfunctioning of kidneys (Hellstrom et al. 2001) and respiratory system (WHO 1992), and possibly lung cancer (DHSS 2005). In most developed countries in Europe, workers in electronics recycling facilities have been known to have averagely higher blood levels of PBDEs than other workers (Brigden et al. 2008; Sjödin et al. 2003; Sjödin et al. 2001). On the balance of probability, however, it is assumed that in the absence of protective gear and other workplace standards, the levels of PBDEs in the blood of the recycling workers in Ghana would be much higher.

Plate 1.2 Google 2013

Plate 1.3 Google 2013

This exposure to PBDEs can bring about endocrine disruptive properties (Legler & Brouwer 2003) and neurobehavioral disturbances like abnormal brain development (Qu et al. 2007; Kuriyama et al. 2005).

Quite apart from the health risks to workers as a result of the open incineration of WEEE dismantling of obsolete EEEs without protective gears in a bid to recover metals such as copper, aluminum and iron, also represent huge risks to the workers. For instance, dismantling of CRT-monitors using stones, hammers, heavy metal rods and chisels, to recover copper, steel and plastic casings, could result in the inhalation of hazardous cadmium dust and other pollutants by the workers (Prakash 2010).

Generally, the above mentioned health related risks are usually associated with the recyclers working on the WEEE recycling scrap yards. It must be emphasized that the informal WEEE collectors on the other hand face negligible health risks from their activities; the only exception is in situations where they are themselves involved in the dismantling and metal recovery process as well (Prakash et al 2010).

The refurbishers, just like the informal collectors also face very little risks from their activities as compared to the recyclers. However, according to a study conducted by Prakash et al (2010), many refurbishers reported the inhalation of fumes during electrical soldering works as a major health threat.

Plate 1.4 Credit: Öko-Institut e.V

1.7 Socio-economic impacts of W (EEE) recycling in Ghana

Even though clearly there is a profit element and a socio-economic dimension to the issue of informal recycling of e-waste in Ghana, the menace associated with it stemming from the application of crude, dangerous and environmentally unfriendly recycling methods has grave adverse implications on human health and the environment as a whole. As already documented, this crude form of recycling EEE related waste in Ghana results in some loss of resources as well as pollution; yet it remains a major source of livelihood for many of the urban poor, especially the migrant youth with very little or no education at all from mostly the three Northern Regions who move to the bigger cities in search of greener pastures (Oteng-Ababio M, 2012). Clearly there is a two face element to the issues of e-waste in Ghana; the threat to human health as well as the environment, and the socio-economic dimension that can still be harnessed properly and extensively to aid in the socio-economic development of Ghana. The need to draft and implement policies that will bring about a scenario in e-waste management capable of balancing these two faces of e-waste; getting the best out of e-waste recycling as well as reducing the impacts on humans and the environment is a challenge that faces policy makers in Ghana and Africa as a whole.

1.7.1 Equal opportunity, gender, ethnicity, and treatment and fair interaction

The WEEE recycling sector in Ghana, however, is mostly a male dominated sector. There are however, numerous young girls between the ages of 9 and 12 who work as collectors at dump sites at Agbogbloshie. The collection and recycling activities in the WEEE recycling sector is dominated by migrant workers from the three northern regions of Ghana who have moved down to the capital, Accra for greener pastures. Similarly, the refurbishing and repair works are also dominated by men. However, few tasks, mostly related to the sales of refurbished equipments and the collection of obsolete EEEs for dismantling and recycling are done by females (Prakash et al 2010).

1.7.1.1 Child Labour

The ILO fundamental convention C182 on Worst Forms of Child Labor was ratified by Ghana in the year 2000. The other ILO convention, C138, relating to child labor with respect to the Minimum Age, has not yet been ratified by Ghana. The attraction of the modestly lucrative informal WEEE recycling sector is so strong to the average poor Ghanaian that sometimes children as young as 5 years and predominantly between 11 and 18 years have been reported to be actively involved in the recovery of precious metals from WEEE in Ghana (Brigden et al, 2008). It is interesting to note that it is not just young boys that have been found to be engaged in the informal recycling of WEEE; young girls between the ages 9 and 12 have also been sighted engaged as collectors, and also in many cases as vendors of sachet water (Prakash et al 2010). According to Prakash S. et al, 2010, pp 29, "*children were seen to be involved primarily in burning activities, but also in manual dismantling of hazardous nature, such as that involved in the recovery of copper containing deflection coils in the CRT monitors"*. The underlying factor that is responsible for the involvement of most children in the informal WEEE recycling sector is poverty as most of them come from very poor homes and backgrounds. It should however be stated that the children involved in the informal WEEE recycling sector are generally self employed, and seldom work for any superior (Prakash et al 2010).

Plate 1.5 Credit: Rachel Field

1.7.2 Remuneration and Livelihood

The informal recycling of WEEE in Ghana is still thriving even though there is a clear element of health and environmental danger to both the workers and the surrounding environs because of the opportunities it offers, especially to the migrant poor from across the country. Prakash et al. 2010, states that because of the informal and unregulated nature of the WEEE recycling sector in Ghana, it is difficult to know the official figures on the income of the workers. Remuneration is basically calculated according to output generated per day and not based on a fixed monthly stipend.

1.8 Informal Collectors

The informal collectors usually move around the city targeting houses, offices, shops, refurbishing centres, etc to collect or buy obsolete EEEs and eventually sell them to recyclers or at times recycle the obsolete EEEs themselves. At other times too, they move around and scavenge obsolete EEEs from the numerous dump sites scattered around the cities. How much a collector earns depends on the volume of WEEE collected from his or her rounds and subsequently sold to recyclers. Averagely, a collector may earn between GHS 100 to 200 (US$ 70 to 140) per month, depending on the total amount of WEEE collected. This earning actually reflects the profit margin generated by a collector at the end of the month (difference between the investment for buying obsolete equipments and the money earned after reselling them to recyclers). With these earnings, they are able to stay in business and to make a living for themselves and their families. In extreme cases, collectors sometimes fail to collect any obsolete equipment in the whole day which makes them end up with no earnings for the day (Prakash et al. 2010).

1.8.1 Informal Recyclers

The activities of informal recyclers usually revolve around the dismantling of WEEE and the subsequent recovery of the desired precious metals through open burning. The recovered materials are then sold locally to interested individuals, industries or to middle men who export them. For recyclers, data suggests that averagely their income or profit usually lies between GHS 250 to 400 (US$ 175 to 285) per month. This income is calculated by subtracting the amount of money paid out to collectors for bringing in the WEEE from the money earned after selling the recovered metal, like copper, aluminum and iron, PWBs, etc to dealers or end-processing units (Prakash et al. 2010).

1.8.2 Refurbishers/Repairers

The activities of refurbishers or repairers usually involve the transformation of old and/ or malfunctioning by replacing or repairing defective parts in a bid to get them functioning again, usually for the general populace. Most often than not, they work on their own with a few apprentices; quite recently, they have been working in tandem with importers of second-hand EEEs by testing, checking up and repairing malfunctioning EEEs before they are sold. Averagely, a refurbisher earns between GHS 275 to GHS 350 (US$ 190 to 250) per month. Others, however, earn less than US$ 100 per month in the refurbishing business (Prakash et al. 2010).

Even though informal recycling provides remuneration and a source of livelihood for the informal recyclers, averagely if you juxtapose how much money they (collectors, recyclers and refurbishers, etc) make from their various activities, and the general economic situation in Ghana, you realize that they still fall well below the internationally and nationally defined poverty lines. Factor in the exposure to hazardous materials which may lead to the development of acute health problems and you realize that the business of informal recycling may not be necessarily very lucrative after all. However, the lure of access to regular cash flow and the ability to support themselves and their families/dependents seems to be a primary reason why they will defy all odds to engage in it, even though majority of them know the potential health risks involved (Prakash S. et al, 2010, 31).

1.9 WEEE Management Legislation in Ghana

Ghana has a number of laws and regulations that are vital to the control and management of hazardous wastes (including WEEE), but they do not specifically address the dangers posed to humans and the environment from waste of such nature. The existing law in Ghana that is closely related to WEEE is the Environmental Protection Agency Act, 1994 (Act 490), which established the EPA, with the mandate to regulate, coordinate and manage Ghana's environment (Schluep M et al. 2011).

1.9.1 Ghana's national WEEE management strategy

As part of Ghana's quest to confront and deal with the problem of the informal recycling of WEEE and its associated problems, the EPA, the umbrella body mandated with the protection and the improvement of Ghana's environment has drafted a management strategy to manage WEEE. The highlights of this strategy are;

- Establish an institutional framework for collaboration in controlling importation of used EEE;
- Create awareness on the dangers of the current handling process, the new hand-in/take back system and on recycling centres at all levels of governance and the public;
- Develop a policy on general importation and management of (W)EEE and on hazardous substances;
- Adapt a business model (acceptable to the WEEE-scrap Dealers Association) for ease of ownership by the Association eventually.
- Develop a legal framework for EEE importation, introduction of EEE levies, mandatory licensing, EEE management fund and for control of WEEE management.
- Establish a formal and efficient WEEE recycling industry, nation-wide
- Strengthen the capacity of the WEEE-scrap Dealers' Association and the training of the membership in safe and efficient handling and good business practices;
- Establishment of regional associations to ensure national integration in the WEEE recycling industry;
- Develop an enforcement mechanism centred around EPA's Compliance and Enforcement Network (CEN)
  (Schluep M et al. 2011)

1.10 Problem Formulation

The recycling of EEE related waste by the informal recyclers in a bid to recover valuable metals like copper, lead, tin, gold, etc releases toxic fumes and chemicals into the atmosphere and the soil (usually open burning of parts of the obsolete EEEs in order to recover valuable metals). The non-recyclable parts, especially the plastic casings of some of the EEES are dumped in open places close to the scrap yard and eventually burnt to dispose them off resulting in the release of poisonous and dangerous chemicals into the atmosphere.

Informal recycling of EEE related waste in an environmentally unfriendly manner in Ghana is already impacting negatively on the environment. Alarmingly, the hazardous chemicals like copper, lead, tin, antimony, cadmium, etc that are released in the course of the open burning of EEE related waste have already been found in toxic quantities beyond the background levels in soils at e-waste recycling yards at Agbogbloshie in Accra, and at scrap yards in Kumasi and Koforidua (Brigden K et al., 2008; Alloway 1990; Salomons & Forstner, 1984). The pollution of the environment through informal recycling coupled with the recruitment and use of young children in this business makes proper and effective management of EEE related waste, which will ensure that the recycling is done in an environmentally friendly manner, all the more important. It is indeed true that there is a profit element and a socio-economic dimension associated with e –waste; at least in the area of providing jobs for the mostly poor migrant youth from the three northern regions of Ghana and beyond (Prakash S et al, 2011). Based on the numerous challenges that informal WEEE recycling presents both to humans and the environment in general, shouldn't it be imperative that finding a solution to the sustainable management of EEE related waste in Ghana is given much attention and priority?

1.11 Research Objectives

The objective of this study is to;

- Analyze the e-waste situation in Ghana; the issues, problems, challenges, and the opportunities it is offering a section of the populace at least in the area of employment opportunities.
- Assess and discuss the socio economic impacts of e waste in Ghana.
- Assess Ghana's draft national WEEE strategy as a framework to dealing with the challenges of e-waste management in Ghana.
- Discuss the challenges that could affect the successful implementation of the national WEEE strategy.
- Identify means by which the prevailing challenges could be tackled to ensure that the implementation of the national WEEE strategy becomes successful.

1.12 Research Questions

For the purpose of this research, the issues about e-waste management in Ghana will be studied, and the main research questions that this research will seek to find answers to are;

- What are the drivers that motivated the drafting and adoption of the national WEEE strategy in Ghana by the Environmental Protection Agency?
- What are the challenges/barriers that could affect the successful implementation of this strategy?
- How can these challenges/barriers be addressed or handled to ensure that the implementation of this strategy becomes successful?

1.13 Research Delimitation

Due to time and resource constraints, the study focuses on the most salient themes related to the research question. Consequently;

- Problems associated with electronic waste management are generally pertinent to developing countries especially in Asia and Africa but for the sake of this dissertation and the time limit at my disposal, the study focused on Ghana's e-waste management issues.
- In addition, because of the large number of potential participants in the study population, the data collection in terms of interviews was limited to members located within Accra the metropolis. The pool of people interviewed as part of the compilation of this dissertation report included scavengers, municipal authorities, NGOs, the general populace and personnel from International bodies.
- The main focus of this dissertation will be on assessing the Ghana National WEEE strategy and finding out about the drivers that necessitated its draft, the challenges that can blight its implementation and what could be done to ensure that these challenges are dealt with to ensure the successful implementation of that strategy. However as stated earlier, for the sake of time, not every point under the strategy is going to be covered in this dissertation; only a select few that is relevant for the purpose of this dissertation will be considered. These are;
- Establish an institutional framework for collaboration in controlling the importation of used EEE;
- Create awareness on the dangers of the current handling process, the new hand-in/take back system and on recycling centres at all levels of governance and the public;
- Establish a formal and efficient WEEE recycling industry, nation-wide
- Strengthen the capacity of the WEEE-scrap Dealers' Association and the training of the membership in safe and efficient handling and good business practices;
- Develop an enforcement mechanism centred around EPA's Compliance and Enforcement Network (CEN)

Chapter Summary

This chapter has given an introduction to the background to this research. In addition, the problem formulation, the research objectives, the research questions as well as the research delimitation were touched on and presented in this chapter.

CHAPTER 2

METHODOLOGY

The purpose of this chapter is to describe the research design and the methodological approach that were used in this study. This report is based on a semi-qualitative approach, and here in this chapter, the methodological approach of this work as well as the reasons that informed the choice of such methods will be discussed further.

2.1 Research Design

This research was undertaken using the case study approach. In general, a case study denotes an in-depth research in which focus is placed on a contemporary phenomenon within its real- life context, where the boundaries between the phenomenon and its context are not clearly evident (Yin, 1994). This research aims to produce knowledge that can be used to address similar issues in other real-life experiences. Research where case study designs are used usually employ the use of both qualitative and quantitative data collection methods (Bryman, 2008; Yin, 1994), and this study predominantly employs a similar approach.

Information was collected from key respondents conversant with WEEE management in Ghana, scavengers and informal recyclers of WEEE operating within the Agbogbloshie scrap yard in Accra. The use of both primary and secondary data was employed in this research; the primary data was sourced by means of interviews whilst secondary data was sourced from books, journals and reports from the internet. Because literature and theoretical studies alone are not enough to afford an adequate understanding of the subject under review, field visits were undertaken as part of the interviewing process to gain firsthand information about the subject under review (Kvale, 1996).

2.2 Methodological Framework

The methodological framework for this research was fashioned along the semi-qualitative method in a bid to arrive at its objectives. Qualitative procedures differ markedly from the methods of quantitative research. This is because qualitative inquiry uses different knowledge claims, methods of inquiry, and methods of data collection and analysis. Even though the processes are quite similar, qualitative methods of inquiry rely on text and image data, have unique steps in data analysis, and draw on varied strategies of inquiry (Creswell, J.W., 2009). The qualitative method of inquiry primarily involving the use of key informant interviews with certain stakeholders within the WEEE management as well as the waste management enclave in Ghana as a whole was then combined with data sourced through field visits to the Agbogbloshie scrap yard. The collection of the field data was undertaken by a research assistant back in Ghana. The field visits was to afford the interviewer firsthand experience of the situation at the Agbogbloshie scrap yard to enable him take notes and make observations that would be recorded alongside the interview. The review of literature on waste management practices across the

globe as well as on works already done in the area of WEEE management in Ghana were also factored in the writing of this dissertation report.

2.2.1 Case study

Different definitions abound regarding the definition of a case study. However, (Benbasat et al. 1987), Yin (1984, pp 23) define a case study as an empirical inquiry which "*investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used.*" This research aims to produce knowledge that can be applied in the sustainable management of WEEE in Ghana; which in itself is a real life issue, as well as to address similar issues in other real-life experiences. Hence the use of a case study approach for conducting this research.

According to Flyvbjerg, 2001, a case study can be used to obtain scientific knowledge that could also be used to solve problems in other real-life situations apart from the one under review. As such, it is imperative that a critical case scenario is chosen so that the information acquired in the course of the research could be used to find solutions to other real-life problems. Given that the issue of the informal recycling of WEEE in Agbogbloshie is not the only problem that Ghana is facing in the area of solid waste management, the choice of a case study design for this dissertation makes it all the more relevant. This is because as stated earlier, the knowledge gained in the execution of this research could also be applied to solve other problems as far as solid waste management in Ghana is concerned.

2.2.2 Literature Reviews

A literature review is a critical and in-depth analysis of a part of an already published body of knowledge through summary, classification, and comparison of prior research studies, reviews of literature, and theoretical articles (University of Wisconsin Writing Center, 2012). The review of literature was one of the sources of gathering information used in the execution of this research, and the compilation of this dissertation report. Literature and documentary reviews formed an important part in the writing of this dissertation report because it afforded me the opportunity to fish for data and to do a critical appraisal of the documents reviewed with respect to the subject under review. A couple of the documents that were used for review are; Ghana e-waste country assessment (2011), socio-economic assessment and feasibility study on sustainable e-waste management in Ghana (2010), Poisoning the poor; electronic waste in Ghana (2008), and other sources and documents that have been indicated in the bibliography section of this report. These documents provided a deeper insight into understanding the status quo of the WEEE management situation in Ghana. Most of these literatures were sourced from AAU online library archives, Google scholar, and documents that were provided by the EPA of Ghana.

2.2.2.1 Data Collection

The primary data used for conducting this research report were sourced primarily from interviews conducted with key informants within the WEEE management sector in Ghana, civil society, the media, and informal WEEE recyclers at Agbogbloshie in Accra.

The secondary data for the analysis chapter however, were sourced from already existing literature on WEEE management in Ghana written by EPA, Ghana, Green Peace and Green Advocacy. The documents on e-waste management used in this report gave an extensive insight into the status quo of the WEEE situation in Ghana.

2.2.2.2 Field Work and Personal Observation

The field visits that were undertaken at the study site (Agbogbloshie) as part of the data collection for this dissertation were done by a hired research assistant. This was primarily due to my inability to make the trip down to Ghana by myself. However, communication was maintained with the research assistant all throughout the period of the data collection and beyond. This was to relay important information and any updates on the current direction and status quo of the research to aid him in the data collection.

2.3 Sampling

The choice of a study sample is a vital step in any research since it is rarely practical, efficient or ethical to study whole populations (Marshall, M.N., 1996). Therefore in carrying out research, it is always important to sample the population from which data is to be collected. The sample size in any research work is important as it could have a bearing on the analysis and consequently on the validity of the results obtained. According to Marshall, M.N., 1996 (pg 522-523), the bigger the sample size, the smaller the chance of a random sampling error, but because sampling error is indirectly proportional to the square root of the sample size, there is normally little to be achieved from using very large samples. This is especially so in qualitative research work where data saturation is considered an important parameter in determining the sample size limit of a research.

The judgement (purposeful) sampling method was used for this research because it has the advantage of enabling the researcher to target subjects (informants) who have specific experiences and special expertise in the subject area under discussion (Marshall, M.N., 1996, pg 523). Given the fact that resource constraints as per time and funds limited the use of a very large sample size, it was imperative to make use of this sampling technique so as to get enough expert opinions on the subject matter. This was to ensure that the results of the study are very credible and valid. The choosing of informants from the Environmental Protection Agency in Ghana as well as Green Advocacy Ghana was inspired by the purposeful sampling technique. Overall, four key informants were interviewed either through Skype or by email whilst a total of twenty-five scavengers/informal recyclers were interviewed as part of the field data collection.

2.3.1 Choice of Interviewees

The choice of respondents for the interviews was carefully done and was informed by assessing documents on the global and national efforts at handling the WEEE situation in Ghana. For instance, the choice of Amoyaw Osei of Green Advocacy, Ghana and John Pwamang of the EPA, Ghana was inspired because of their individual and respective contributions to write ups about the effective management of

WEEE in Ghana. Another reason why Amoyaw-Osei of Green Advocacy was chosen as a key informant to contribute to this research lies in the importance of CSOs, in driving social change across the world in pursuit of development. The EU commission postulates that an empowered CSO is an important component of any democratic system because it fosters pluralism, contributes to the adoption and implementation of effective policies by articulating citizen concerns and fostering participatory governance (EU commission, 2012).

The interview with Osei Assibey, an environmental engineer of the Kumasi Metropolitan Assebly was inspired by the fact that the he has an in depth knowledge and expertise in the field of solid waste management and as such could still contribute something to this research in terms of knowledge and information needed to execute the final report. The inclusion of Andre Habets of NVMP Association (Dutch E-Waste Compliance Scheme) was also inspired because of his involvement and experience in WEEE management in the Netherlands

The scavengers/informal recyclers (twenty-five) were interviewed because of their first hand knowledge and in-depth understanding of the WEEE situation in Ghana. Another reason why they were included in the data collection process was because of their importance to any attempt by the government of Ghana to push through the national WEEE management strategy since they are major stakeholders in the informal WEEE recycling sector.

2.3.2 Interviews

An interview, in the context of an academic research is a formal way through which verbal evidence or data is solicited from a knowledgeable informant (Remenyi D., 2012). Some of the ways through which the data is obtained are focus groups, conversations, presentations, live and pre-recorded speeches, etc. Transcription of the sourced data or evidence is normally done after the interview has been conducted before the analysis of the data is undertaken. Academic research interviews are normally different from other types of interviews especially job, celebrity and broadcast interviews. They are usually not as simple as they might appear to be, as constantly seen on television and radio interviews (Gubrium and Holstein, 2001). Silverman (1997) postulates that an '' *academic researcher will find it challenging to conduct successful interviews and therefore it is important to understand the issues involved and to carefully prepare for an interview*''. As part of this, it is imperative that the consent of the interviewer is sought in advance and preparations done because it is essential to the interaction and outcome of an interview (Kvale, 1996).

As per the execution of this research work, the semi-structured interview format was used. Britten N, (1999) defines semi-structured interviews as interviews that include several key questions that help the researcher to define the areas to be explored, whiles at the same time allowing the interviewer or interviewee to diverge in order to pursue an idea or response in more detail. The preparation was done using Kvale's (1996) first two steps in his seven stages of preparing for an interview investigation. First and foremost, the topic and purpose of the research was formulated, clarified and the scope narrowed down to ensure clarity. Secondly, the design of the study was undertaken encompassing all the seven

stages of preparing for an interview investigation as espoused by Kvale. The number of informants as well as which particular informants to be contacted was also taken into consideration in the course of planning for the interview. After this preparation, the consent of the interviewees was sought in advance for the booking of appointments before the conduct of the actual interviews.

Seven Stages of Preparing for an Interview

Level of Planning	Details of what is done
Thematizing	Formulating the purpose of the investigation and describing the concept of the topic to be investigated before the interviews start.
Designing	Planning of the study taking into cognizance all the seven stages of preparation before the interview starts.
Interviewing	Conducting the interviews based on an interview guide and with a reflective approach to the knowledge sought.
Transcribing	Converting the interview from the oral format to textural format before analysis is done.
Analyzing	Deciding on the basis of the purpose and topic of the investigation, and on the nature of the interview material, the method of analysis to use.
Verifying	Ascertaining the generalizability, the reliability, and the validity of the interview findings.
Reporting	Communicating the findings of the study and the methods applied in a format that lives up to scientific criteria, taking the ethical aspects of the investigation into consideration, and producing a readable and credible report.

Credit: Kvale 1996

2.3.2.1 Key Informant Interview

This is a loosely structured conversation with people who have specialized knowledge about the topic or theme under review. Key informant interviews allow the researcher the chance to explore the theme or subject under review in depth because it normally leads to the unearthing of information that would not have been revealed in a survey. They also offer the researcher the opportunity to have access to other key informants as a result of recommendations about other potential key informants which may be given to the researcher by the informant (Education Development Center, 2004). With respect to this research, key resource persons from a number of institutions were interviewed as part of the data collection process.

2.3.2.2 Interview/Research Assistant

The help of an interview assistant was sought to conduct the interviews at the Agbogbloshie scrap yard and other parts of Accra. This was due to my inability to go to Ghana and conduct it myself due to the lack of funds. However, to ensure that the quality of work with respect to the data collected is not compromised, an experienced and responsible person with a background and experience in handling similar works was chosen to conduct the interviews on my behalf. The interview assistant was duly briefed before he undertook the task of interviewing, and also debriefed afterwards, all through Skype. This was made possible because of global technological advancement through internet connectivity; probably a few years back, it will have been much more difficult to pull this through.

2.3.2.3 Telephone, Video and Internet Interviewing

Because most of the key informants were in Ghana, the interviews with them were conducted mainly through telephone, video and internet (Skype) as well as through the use of electronic mail. Under normal circumstances, a face-to-face interview with the key informants should have been the preferred and best option as it will have afforded the option of obtaining extra information from visiting the premises or organization of the key informant.

2.3.2.4 Interview in a Different Language

The interviews for the scavengers/informal recyclers of WEEE were done primarily in the local language (Twi) as well as in English Language. This was to ensure that the questions posed to them were understood very well to be able to get the best of responses. The questionnaires were first drafted in English, translated into the local language and administered and then the questionnaire with the answers given, retranslated back into English for use in the analysis chapter.

2.4 Confidentiality Assurance to Protect Informants

The pledge of informant confidentiality is a particularly vital issue in academic interviews for research as it ensures that the informant is protected from harm or other forms of persecution as a result of participating in the research (Remenyi D., 2012). Confidentiality assurance was given to all the informants especially the key informants. In addition the anonymisation of the transcripts from the skype and **telephone** interviews, and the safe handling of the data given were also promised as this has a lot of benefits. This is vital as it ensures that the professional relationship between the researcher and informants are kept in touch possibly allowing the informant to be at ease and contribute wholeheartedly to the cause of the research (Remenyi D., 2012).

2.5 Transcription

The aim of an interview is to obtain data from which a transcript will be produced to help in prosecuting the analytical part of the research (Remenyi D., 2012). The interviews done using skype were all recorded in audio format and transcribed into textural format before they were used in the analysis chapter. Copies of the recorded interviews and their transcripts are included in appendix A in the appendix chapter in this dissertation report.

2.6 Qualitative Research and Ethics

Ethical issues are present in any kind of research and this normally creates tension between the set goals of the research, which is to make conclusions on a particular study that could be used to make informed generalizations in order to solve similar problems, and the rights of the participants to maintain their privacy (Orb A., Eisenhauer L., and Wynaden D., 2001). Ramos (1989) described three types of problems that may affect qualitative studies; the researcher/participant relationship, the researcher's subjective interpretations of data, and the research design itself. The challenge for researchers now depends on making sure that these ethical issues are handled well in the course of the research so that the set goals are achieved without compromising the rights of the research participants. To achieve this, certain ethical principles have to be followed at all stages of the conduct of the research. This will help in the resolution of most initial and ongoing issues that may arise in the course of conducting the research (Orb A., Eisenhauer L., and Wynaden D., 2001).

The inherent challenges in qualitative research can be mitigated by awareness and use of well-established ethical principles, specifically autonomy, beneficence, and justice in the conduct of the research (Orb A., Eisenhauer L., and Wynaden D., 2001). This has been echoed by a number of other authors on works bordering on the ethical issues in qualitative research. Capron (1989) intimated that respect for people is the recognition of participants' rights, including the right to be informed about the study, the right to freely decide whether to participate in a study, and the right to withdraw at any time without being penalized. Autonomy, as an ethical principle in qualitative research is honored by informed consent, which means striking a reasonable balance between over-informing and under-informing the participants (Kvale, 1996). Autonomy also means allowing participants to exercise their rights as autonomous persons who can voluntarily accept or refuse to participate in the study. Consent has been referred to as an act that borders on the negotiation of trust, and it needs to be renegotiated continuously at every stage of the research if the need be (Field & Morse, 1992; Kvale, 1996; Munhall, 1988).

The second ethical principle commonly linked with research is beneficence, which implies doing the right thing for others and protecting them from harm. Beneficence in certain situations may be taken to the extreme as paternalism-an approach which demonstrates the denial of participant autonomy and their freedom of choice by voluntarily excluding them from participation in a research without seeking their view, because they may be too vulnerable. In such a situation, the researcher is protecting the elderly women by not including them in the study; at the same time, it can be argued that the right of the participants to decide for themselves, and for their experiences to be heard has not being taken into consideration by the researcher (Orb A., Eisenhauer L., and Wynaden D., 2001).

The principle of justice refers to equal share and fairness and it is one of the most vital and clear cut feature of this principle is the need for researchers to avoid exploitation and abuse of participants. The researcher should be able to recognize the vulnerability of participants as well as acknowledging their contribution to a study when he need be. For instance, in the course of analyzing data, if it becomes imperative that a concept or a heading of the report will be based on the contribution of a participant,

ethically it behoves on the researcher to seek permission before using the concept, so as to acknowledge the participant's contribution (Orb A., Eisenhauer L., and Wynaden D., 2001).

2.7 Work Journal

A work journal was created to enable the judicious and prudent use of time and other resources. It also helped serve as a means to keep records of random but useful thoughts and ideas pertinent to the theme under review which were incorporated into my report. A tentative timetable that served as a time keeping guide for the conducting of this research, and the writing of the accompanying dissertation report was contained in this work journal.

2.8 Research Limitations

The main limitations of this research are listed below.

1. The apparent lack of funds that restricted me to go to Ghana to undertake the on field data collection slowed down the speed of work. This is because the research assistant tasked with the data collection had to shuttle between his own work commitments and collecting the data from Agbogbloshie.

2. The fact that I was not able to go to Ghana also made it difficult to get in touch and schedule interview appointments with the key informants. Eventually some of them responded but a couple of them either backed out or did not reply even to the questions that were emailed to them. This also affected the speed and timing of the research as well as the final report.

3. Getting information through interviews especially from the informal scavengers, dismantlers and recyclers, according to the research assistant was quite difficult since they were of the impression that he was from the government. In addition, the research assistant was not allowed to take photos of some of the informal recyclers in operation as they were of the impression that he was from the government.

4. Despite the fact that English is the official language in Ghana, not all the respondents at the informal recycling site had a perfect working knowledge of English. This affected the data collection and made it slow and cumbersome as questions had to be translated into the local language before being asked.

5. The informal nature of the sector meant there was always the possibility of some 'fabricated-responses' from some interviewees, leading to reliance on expert judgment to arrive at most of the conclusions.

Chapter Summary

This chapter presented the research design and the methodological approach that were used in prosecuting this research. In addition, the reasons behind the choice of the design and the methodological approaches were explained and discussed further.

CHAPTER 3

STUDY CONTEXT

This chapter introduces Ghana as a country and shows some of the nation's vital economic indicators. The history of how Agbogbloshie, the most popular hotbed for informal WEEE recycling came into being is also presented. The chapter concludes with an overview of Ghana's informal urban economy and informal WEEE recycling in Ghana.

3.1 Country overview

Plate 3.1 Credit: Google

Accra, which is the capital of Ghana is also the seat of government administration as well as for the majority of the indigenous and multinational companies especially those in the service sector. The Takoradi and the Tema ports located in the Western and Greater Accra regions respectively are the main entry ports for goods by sea. The Tema port however, is the main entry point for EEE importation and other goods mainly to Accra, Kumasi and other parts of Ghana. Most of the imported EEEs (brand-new and second-hand) find their way into shops and outlets in the capital Accra, where the most significant dumpsites for WEEE are also located. The most popular and prominent of them is the Agbogbloshie scrap yard which is home to majority of the informal recycling of WEEE in Ghana. Kumasi which is the

second biggest city after Accra is also a popular destination for the imported EEEs, and has its fair share of WEEE dumpsites.

Ghana belongs to a number of international organizations such as the Commonwealth of Nations, the Economic Community of West African States (ECOWAS), the African Union (AU), and the United Nations (UN). Ghana is the second largest producer of cocoa in the world and is also home to the Volta Lake, which is the largest artificial lake in the world. Ghana is also endowed with a lot of minerals like gold, diamond, manganese and bauxite whose exports serve as a major source of foreign exchange for the nation.

Below is a summary of the most important indicators for development regarding Ghana

Total Population	25,366,462 (2012 estimate)
Number of households	5.5 million (2008 estimate)
Population below International poverty line (population below $1 per day/population below $ 2 per day)	30%/54% (2008 estimate)
General Unemployment rate in Ghana/Youth Unemployment Rate	10%/16% (2000 estimate)
Land area	227540 km2
Ghana's urban informal sector employment rate	56.5% (2008 estimate)
Gross domestic product (GDP)	40,710,447,429 US Dollars (2012)
GDP per capita	1605 US Dollars (2012)

Table 3.1 Source: ADI/WDI

3.1.1 Case Study Site

3.1.2 Agbogbloshie

There are a lot of places in Ghana noted for informal WEEE recycling but the biggest of them all is at the Agbogbloshie Scrap Market in Accra where majority of the informal recycling work is carried out. The settlement of Agbogbloshie or Old Fadama has an estimated population of about 79,684 people on an area of about 31.3 hectares, and currently less than a kilometer away from the Central Business District of the capital Accra (Schluep M., 2011; Oteng-Ababio M., 2012). Agbogbloshie is situated on the upper reaches of the Korle Lagoon in Accra, and close to the Odaw River, which runs between the e-waste

recycling area and the market as shown in figure 3.1 (Schluep M., 2011; Oteng-Ababio M., 2012). The general perception about the population of Agbogbloshie, is that it is primarily inhabited by migrants from the northern regions of Ghana who were displaced by the fighting that rocked the area in the early 1990's. In reality, however, the development of this enclave can be attributed to the effects of a far more complex settlement pattern and not just the result of the conflict-triggered rural-urban migration from the northern regions of Ghana (COHRE, 2004).

According to COHRE (2004, pg 21), ''*there are at least four different economic and social driving forces behind the establishment and growth of Agbogbloshie*''. These are:

- Population spill-over associated with the size and growth of the adjacent market.
- Migration from the northern regions of Ghana triggered by the tribal conflict in the mid 1990's.
- Social downward movement in accommodation by those forced out of more expensive accommodation in Accra, due to the financial impact of the Structural Adjustment Program in the early 1980's (SAP).
- Demand for land by those seeking economic / business opportunities in an area free from the bureaucratic constraints and high rentals that exist in most recognized formal areas in the capital Accra.

Over the years, Agbogbloshie has grown into a slum with people from all different parts of Ghana, and even neighbouring West African countries like Nigeria and Liberia who are actively engaged in informal economic activities of which informal WEEE recycling is a major feature (Scluep M. et al, 2011; Oteng-Ababio, 2012).

3.2 The Informal Urban Economy and Informal WEEE recycling in Ghana

By and large, research conducted in most African countries have revealed that individuals and households of all social and economic backgrounds that fall within the urban class do engage in multiple economic strategies to earn a living in a bid to make ends meet (Briggs and Yeboah 2001; Owusu 2007).

Map of Site and its Environs

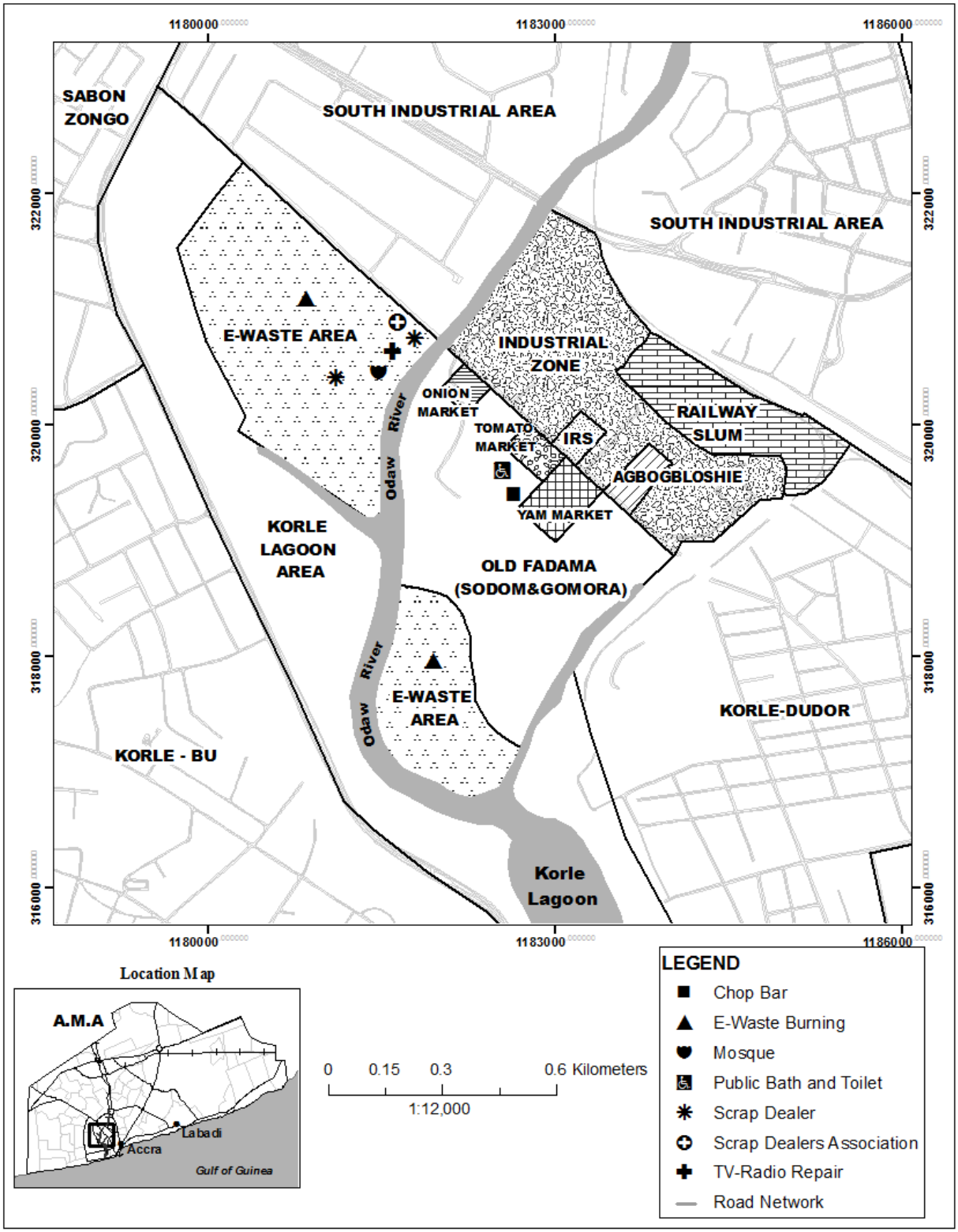

Figure3.1 Source: Martin Oteng-Ababio

The adoption of these multiple micro level economic strategies were inspired by the macro level economic changes that were primarily brought about by the economic crises of the 1970s and 1980s that led to the adoption of neo-liberal reforms (Oteng-Ababio, 2012). As a result of this shift in global economics, poverty increased, livelihoods were negatively affected because of the response of most government's which led to the introduction of policies such as liberalization of trade, privatization of state owned enterprises, and the introduction of cost recovery measures under a negotiated World Bank Structural Adjustment Program (Jeffries 1992; Rakodi 2002; Owusu 2001). The introduction of the afore-mentioned policies led to a reduced role in terms of economic management by most African countries which led to an escalation of prices of critical urban services while the real salaries of formal sector employees stagnated and in some cases, even declined (Aryeetey and Ahortor 2005; Baa-Boateng and Turkson 2005; Aryeetey and Codjoe 2005). Apart from the manifestations of these negative economic effects in most African states, others such as the freeze of employment, public sector labor retrenchment and limited job creation potentials of the private sector also became a common feature during that period of economic downturn (Lourenço-Lindell 2004).

Increased poverty levels, a direct consequence of the growing rates of unemployment in most African countries also became synonymous with the era of restructuring, and this was quite pronounced in the urban areas (World Bank 2001; UN-Habitat 2003). As the adoption and introduction of the SAP weakened the capacity of most African states including Ghana to respond to the rising poverty situation in the cities, various survival strategies geared towards enhancing their ability to withstand, prevail, and manipulate the combined effects of the neo-liberal economic reforms and urbanization of poverty were adopted by individuals and households of varying socio-economic backgrounds (Wood and Salaway 2000; Hapke and Ayyankeril 2004).

Ghana's informal economy, whose recent growth is a direct response to the economic crisis of the 1980s, has become the biggest receptacle for the urban poor (Owusu, 2007). According to GSS (2008), Ghana's informal sector accounts for about 60 percent of the total employment generated in the country, 93 percent of the private sector employment whilst still contributing around 22 percent of real GDP. The agricultural sector, responsible for the employment of about 55 percent of Ghana's population, is being neglected, probably due to the ever dwindling commodity prices (Ibid). Constant and often protracted chieftaincy and tribal disputes in the northern parts of Ghana coupled with an intensified climate variability have made farming not only a tremendously risky and unattractive venture; it is also an underlying factor that triggers the southward movement in search of better livelihood opportunities (Awumbila and Ardayfio-Schandorf, 2008).

To such a vulnerable society, the development and adoption of multiple household strategies as well as the geographic dispersal of family members are part of a variety of strategies for coping with and surviving the effects generated by internal factors such as conflicts, and the adoption of neo-liberal policies (Oteng-Ababio, 2012). Other household survival activities normally adopted by poor families include street trading and hawking, the provision of "street services" such as shoe repairs, vulcanizing, and hairdressing usually with the involvement of younger members of the families (PICTURE TO SHOW). Oteng-Ababio (2012, pp 3), states that ''*the situation has made e-waste scavenging one of the most*

visible manifestations of such livelihood strategies, particularly in the capital city Accra and principally among the transient population from the north''.

However, enough research and scholarly attention has not been committed to the critical and in-depth analysis of the nature and scope of e-waste scavenging and recycling as an efficient livelihood strategy and asset accumulation process. The result is the creation of data deficiency which tends to give justification for the occasional vilification of the practice by a section of the media and environmental NGOs (Oteng-Ababio, 2012, Brigden et al. 2008; Frontline 2009; Afrol News 2010).

Chapter Summary

This chapter introduced Ghana as a country and showed some of the nation's vital economic indicators. Quite apart from that the history of how Agbogbloshie, the most popular hotbed for informal WEEE recycling came into being was also presented. The chapter concluded with an overview of Ghana's informal urban economy and informal WEEE recycling in Ghana.

CHAPTER 4

THEORY

This chapter will identify and review the main concepts, sustainable livelihood and political ecology, on which the theoretical framework of this report is based on. The chapter ends with an outline of the analytical framework detailing how the analysis and discussion chapters were done.

4.1 Theoretical Framework

Livelihood strategies, usually very dynamic and adaptable, consist of different mechanisms that generate the means of household survival (Ellis F., 2000). Informal WEEE scavenging, dismantling and recycling provides a means for survival for a section of the populace in Ghana especially in cities like Accra, Kumasi and Takoradi and therefore fits into the livelihood framework which will be discussed later on. The upsurge in people especially the urban young and poor in choosing informal e-waste scavenging and recycling as a means of livelihood in order to survive the harsh realities of city life can be attributed to the lack of enough job opportunities. Oteng-Ababio (2012) supports this assertion and opines that indeed the inability of the formal sector to generate sufficient job opportunities to meet the soaring numbers of urban job seekers has compelled many who are qualified yet unemployed as well as those with low employability to turn to the informal recycling of WEEE for survival.

In as much as the informal recycling of WEEE at Agbogbloshie serves as a source of employment and livelihood for a section of the populace, it's negative impacts on the environment as well as on the health of the recyclers and dismantlers themselves leaves much to be desired. Major interventions in the form of governance, investment, technology and especially the formulation and implementation of policy are needed to ensure that this livelihood survival strategy is carried on in a sustainable way; hence the Ghana National e-waste Strategy. To ensure the successful implementation of this National e-waste Strategy, a thorough understanding of informal WEEE scavenging, dismantling and recycling as a livelihood survival strategy is vital; hence the use of the sustainable livelihood framework as a complementing theoretical framework to the political ecology theory, which is the main theory for this research work.

4.1.1 Sustainable Livelihood

Department for International Development (1999a) defines sustainable livelihood as that which can withstand and recover from stresses and shocks, maintain or enhance its capabilities and assets both now and in the future, whiles ensuring that the natural resource base is not undermined. The attainment of sustainable livelihood is achieved through the mobilization of the capabilities, assets (including both material and social resources) of an individual, group, organization, etc to make a living. The guiding principle underlying sustainable livelihood approach (SLA) is that people will employ a variety of livelihood survival strategies in their quest to enhance their livelihood assets and reduce their vulnerability (DFID, 2007).

This is similar to what happens in the informal recycling in Ghana where scavengers, dismantlers and recyclers in a bid to increase their livelihood assets and reduce their vulnerability engage in informal WEEE scavenging and recycling, an urban livelihood survival strategy very popular amongst the poor in Ghana. Oteng-Ababio (2012) echoes this assertion and states that a lot of individuals within urban enclaves, especially in developing countries, have resorted to multiple and diverse ways of earning a livelihood; one such strategy is informal WEEE scavenging, dismantling and recycling. The challenge for the Environmental Protection Agency of Ghana is to formulate and implement policies and intervention plans geared at ensuring that this livelihood survival strategy (informal WEEE recycling) goes on but in a manner which will help reduce the vulnerability of the people involved whilst not jeopardizing their health and that of the environment. It must be emphasized however that the formulation and implementation of policies and intervention plans alone, will not ensure that the informal scavenging, dismantling and recycling of WEEE, as a livelihood survival strategy becomes sustainable. It is equally imperative that such policies and social intervention plans are people-centred, flexible, responsive and participatory whilst at the same time striking a balance between vital dimensions of sustainability and recognizing the dynamic nature of livelihood strategies (DFID, 2007).

4.1.2 Sustainable Livelihood Framework and the Informal WEEE recycling

The sustainable livelihood framework can be divided into three main core themes; (1) the asset portfolio forming the core element of livelihood, (2) the Vulnerability Context and Policy, Institutions and Processes, and (3) the loop linking livelihood strategies and livelihood outcomes (DFID, 2007). The vulnerability context of livelihoods highlights the shocks, trends and seasonality with their probable impacts on people's livelihoods; the policies, institutions and processes on the other side, form part of the context of the political and institutional factors and forces in government, together with the private and the civil sectors that influence livelihoods (DFID, 2007). The figure on the next page depicts a graphical representation of the DFID SLA framework, slightly modified for the purpose of this dissertation.

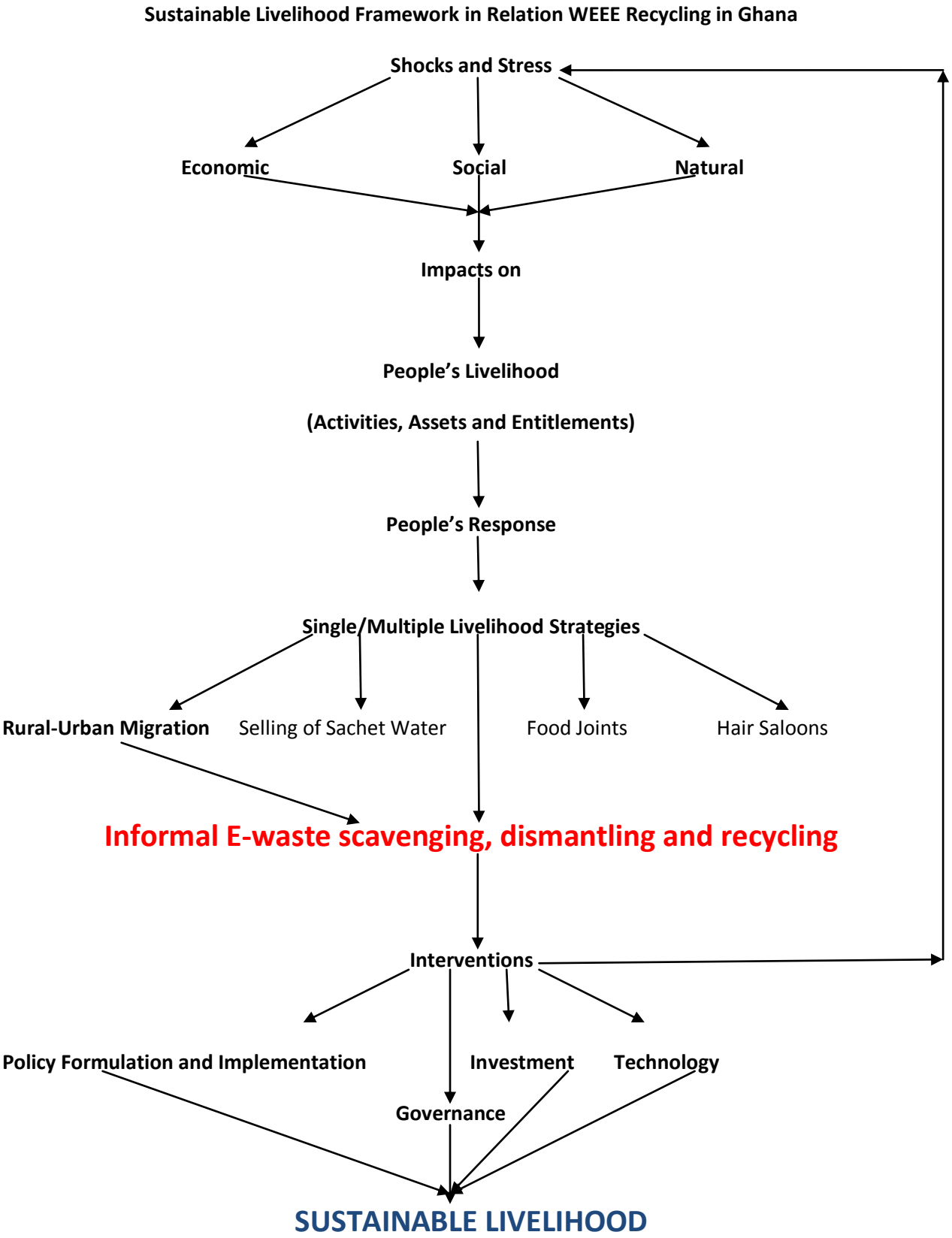

Figure 4.1 Source: Author's own construct with inspiration from DFID SLA framework

Using the SLA framework and modifying it for the purpose of this research, the lack of enough job opportunities represent ***shocks*** and ***stress*** as far as the ***economic dimension*** of the framework is concerned. ***Migration*** from the three northern parts of Ghana to Accra either in search of greener pastures or to escape sporadic tribal conflicts whiles droughts that affect farming as a source of livelihood also falls under the ***social dimension*** of the shocks and stress as far as this modified SLA framework is concerned.

All of the above mentioned shocks and stress (economic, social and natural) affect the livelihood of the people and triggers a series of ***activities*** such as the adoption of multiple survival strategies like selling of sachet water, operating food joints, operating hair salons and especially ***e-waste scavenging***, all of which are a direct response to the shocks and stress to enable them increase their ***assets***, and reduce their level of vulnerability.

Implementation of an ***intervention plan*** capable of addressing both the environmental aspects of e-waste recycling as well as sorting out the socio-economic aspects so that the practice translates into a ***livelihood*** source which can be termed ***sustainable*** is what needs to be done now. This could be achieved by applying a mixture of these; adoption and implementation of good policies, the provision of good governance, the introduction of appropriate technology as well as investment where needed as well as the adoption of a participatory approach, which will bring together all stakeholders in decision making before the rolling out of policies meant to streamline activities in the informal recycling sector.

4.1.3 Political Ecology

The adoption of environmental science without the requisite acknowledgement of how it is affected by social and political factors can undermine the ability to find solutions to and address the prevailing underlying biophysical causes of perceived environmental problems (Bryant and Bailey, 1997).

Political ecology looks at the political dynamics revolving around material and discursive struggles over the environment, its resources and the human agents interacting with it in the third world (Bryant, 1998). Central to political ecology research is the notion that politics should be `put first' in the attempt to get an insight into how the human-environment interaction may be linked to the causes of perceived environmental problems (Bryant, 1998). The perceived apolitical nature of most environmental research in the 1970s ushered into being third-world political ecology as a multifaceted research field (Peet and Watts, 1996a; Bryant and Bailey, 1997); and it has continued to flourish because alternative explanations have failed to account for the political sources, conditions and consequences of environmental change (Bryant, 1992: 13). The historical development of third-world political ecology portrays a research field that aims generally to interlink political-economic and ecological processes, albeit through a multiplicity of approaches (Bryant and Bailey, 1997). As Bryant (1998) will put it, the main underlying assumption with respect to political ecology as a research field is that politics and environment are thoroughly interconnected. Harvey (1993: 25) echoes this and states that *"all ecological projects (and arguments) are simultaneously political-economic projects (and arguments) and vice versa. Ecological arguments are never socially neutral any more than socio-political arguments are ecologically neutral. Looking more closely at the way ecology and politics interrelate then becomes*

imperative if we are to get a better handle on how to approach environmental/ecological questions". Bryant (1998) opines that political ecologists are always eager and try to gain an understanding of the dynamics and features of a `politicized environment' so as to develop ways of solving environmental or ecological problems in society.

According to Bryant and Bailey (1997), political ecologists envisage the physical environment, and its change, directly linked to political and economic aspects and vice versa. They support the assertion that environmental problems are not necessarily hinged on policy failures alone but they are a product of the actions that are informed by broader economic and political maneuverings by powerful actors. Blaike (1995) tries to explain this by using a chain of explanations to strike a link between a specific environmental problem to politico-economic maneuverings. Employing land degradation as an example, (refer to figure below), Blaikie commences with physical changes in soil and vegetation (box A) and their associated economic symptoms (box B), links these specific land-use practices at the place (box C) as well as private and communal decision-making processes (boxes D and E), before concluding with broader contextual actors associated with the state (box F) and the international economy (box G). At each stage in the chain of explanation, the vagueness and complexities associated with understanding and subsequently linking the social and environmental processes are made clear. As a result, the relationship between physical changes and their corresponding economic symptoms on one hand, as well as the prevalent specific land-use practices at that locality on the other hand, are "*open to uncertainty, both between scientists and between them and local resource users*" (Blaikie, 1995: 20).

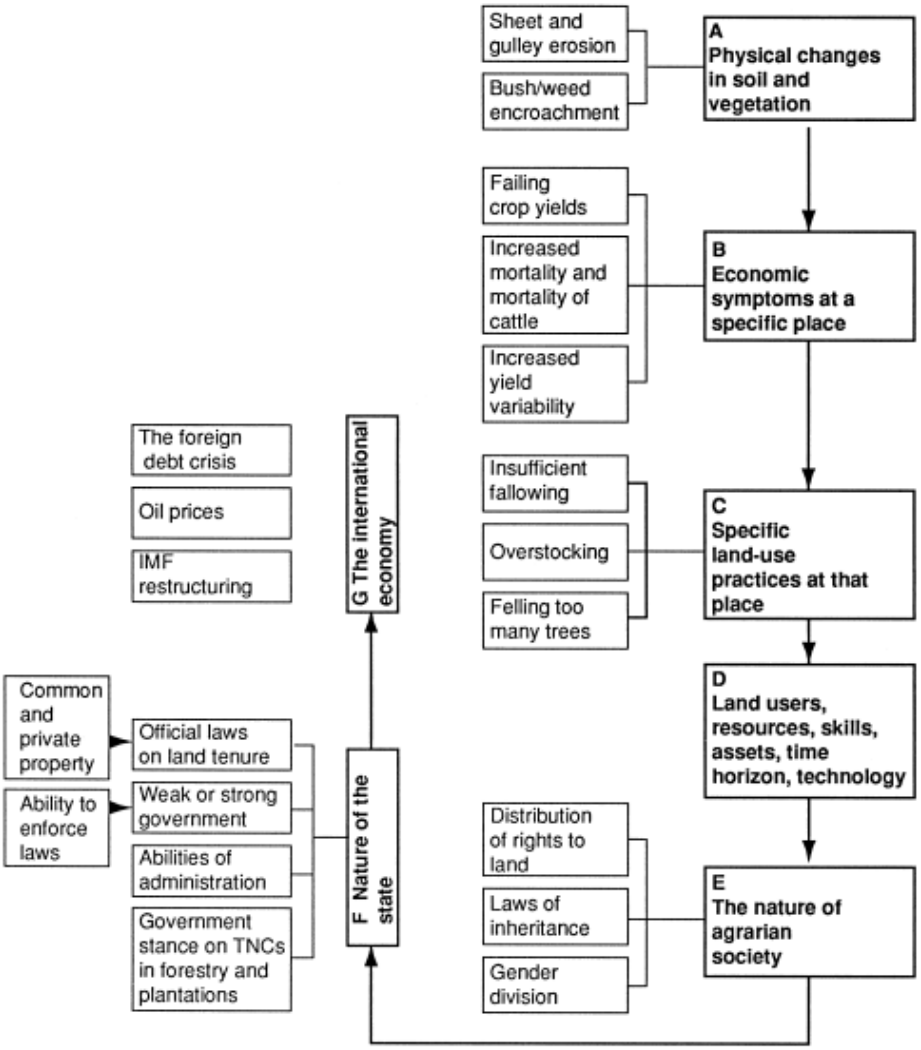

Figure 1 The chain of explanation in land degradation
Source: From Blaikie, 1995: 19, Figure 1.2

Per the remit of this dissertation, and taking into consideration the fact that e-waste scavenging in Ghana is a livelihood survival strategy that has come about as a result of the reaction of a section of the populace to the current prevalent economic conditions (e.g. unavailability of enough jobs) whose genesis could be traced to the IMF inspired political economic decisions (SAP) that were taken by the state in the 1980s as a panacea to solving the economic malaise in Ghana (Oteng-Ababio 2012), political ecology as a concept is considered an appropriate concept to be incorporated into this report. Political ecology will be used in collaboration with other concepts in the analysis and conclusion chapter to draw the link between the emergence of informal e-waste scavenging, dismantling and recycling and the politico-economic decisions adopted by Ghana's in the 1980s and even now. As well as using it to draw the link between the informal recycling of e-waste and the politico-economic decisions by the state, an attempt to offer a solution to this environmental and health problem using it will be explored.

4.2 Analytical Framework

The national e-waste strategy drafted by the EPA of Ghana is the main analytical framework used in the compilation of this project report. The field survey data used for the purpose of compiling this dissertation report is analyzed within the framework of the theoretical concepts presented in chapter four. The qualitative data from the key respondents was discussed within the framework of Ghana's proposed national e-waste strategy, selecting a few objectives relevant for this research with the view to answering the research questions for this project. According to Pwamang and Amoyaw-Osei (2011), the objectives of the national e-waste strategy are;

- Establish an institutional framework for collaboration in controlling importation of used EEE;
- Account for and maintain accurate records on the importation of both new and used EEE;
- Create awareness on the dangers of the current handling processes, the new hand-in/take back system and on recycling centers at all levels of governance and the public;
- Develop a policy on general importation and management of (W)EEE and on hazardous substances;
- Adopt a business model (acceptable to the WEEE-Scrap Dealers Association) for ease of ownership by the Association eventually;
- Develop a legal framework for EEE importation, introduce EEE levies and mandatory licensing, and EEE management fund;
- Apply the EEE management fund for the control and sound management of WEEE;
- Establish a formal and efficient WEEE recycling industry, nation-wide;
- Strengthen the capacity of the WEEE-Scrap Dealers' Association and the training of the membership in safe and efficient handling and good business practices;
- Establish regional associations to ensure national integration in the WEEE recycling industry;
- Develop an enforcement mechanism centered on EPA's Compliance and Enforcement Network (CEN).

It is from these afore-listed objectives that a five-point abridged objective which will be enumerated in the discussion chapter has been created to serve as the outline for discussion for the purpose of answering the research questions of this research. As part of the discussions, the drivers that influenced the drafting of the national e-waste strategy, the barriers that could hinder the successful implementation of the strategy as well as the measures that could be employed to ensure the successful implementation of this strategy with respect to the outlined objectives will be discussed using empirical data sourced from interviews with key informants as well as from already written literature on e-waste management in Ghana. It is expected that in addition to answering the research questions posed, valid conclusions to the effective management of e-waste in Ghana could also be drawn at the end of this research.

Chapter Summary: This chapter has identified and reviewed the main concepts, sustainable livelihood and political ecology, on which the theoretical framework of this report is based on. The chapter ended with an outline of the analytical framework detailing how the analysis and discussion were done.

CHAPTER 5

CASE STUDY RESULTS AND ANALYSIS

This chapter presents the main findings, as well as the analysis of the findings from data that was garnered from the field survey conducted at Agbogbloshie as part of the compilation of this report. A sample of the questionnaire that was used to get the data being analyzed here can be found in the appendix section of this report.

5.1 Field Results From Study Site at Agbogbloshie

As indicated below in figure 5.1, out of the twenty-five (25) respondents (Informal scavengers and recyclers) interviewed at the Agbogbloshie Informal recycling site, 19 (76%) of them came from the three northern regions (Upper West, Upper East and the Northern), 5 (20%) of them were natives of the Greater Accra region whilst 1 (4%) of them originated from the Brong Ahafo region.

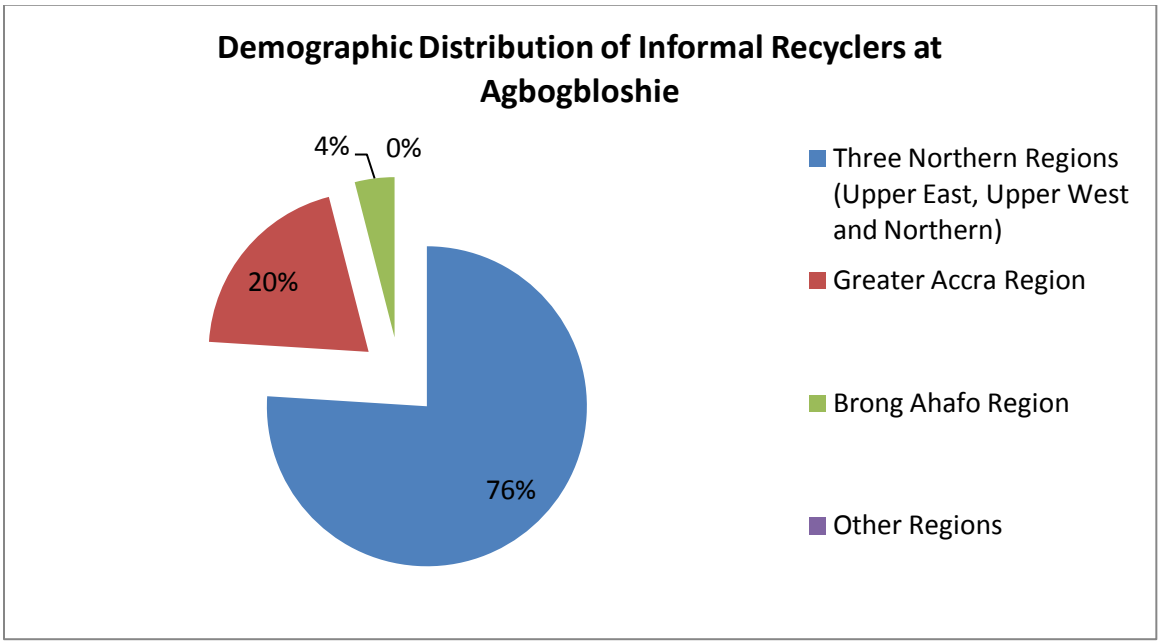

Figure 5.1: Demographic distribution of Informal Recyclers at Agbogbloshie (*Derived from field data*)

This data supports the assertion made by Awumbila and Ardayfio-Schandorf, (2008); Oteng-Ababio (2012); COHRE (2004) that majority of the informal scavengers and recyclers operating at the Agbogbloshie enclave are mostly migrants from the three northern regions of Ghana.

Age-wise, out of the twenty-five (25) respondents interviewed, twenty-four (24) were twenty years (20 years) and above whilst only one (1) of them was between fifteen years (15 years) and nineteen years (19 years).

5.2 Reason (s) for being at Agbogbloshie Informal Recycling Site

Figure 5.2 shows that for the majority of the people at the Agbogblsohie Informal recycling site, the main motivation for being there was to work or try to make a living for themselves through the scavenging and informal recycling of WEEE. Of the 25 people interviewed, 23 (92%) of them indicated that they were primarily at the site to work and make a living for themselves whilst 2 (8%) of them were there because they were either born there or brought by their parents.

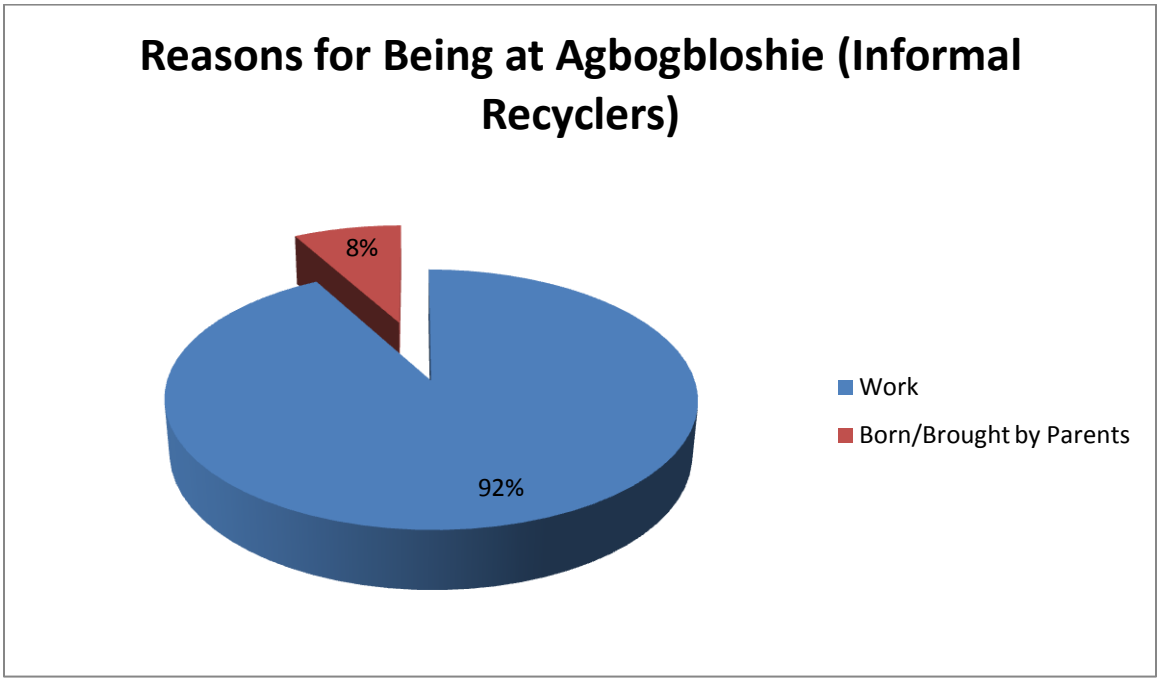

Figure 5.2: Reason (s) for being at Agbogbloshie (*Derived from field data*)

This data is consistent with the assertion made by Scluep M. et al (2011); Oteng-Ababio (2012) that Agbogbloshie has become a slum with people from different parts of Ghana, who are actively engaged in informal economic activities of which informal WEEE recycling is a major feature.

However, it must be emphasized that of the 23 people who responded that their primary reason for being at Agbogblosie was to work and make a living, 17 (74%) of them migrated from the three northern regions, 5 (22%) of them were natives of Accra whilst 1 (4%) of them came from the Brong Ahafo region. This is illustrated in figure 5.3 overleaf. This data is consistent with views by Oteng-Ababio (2012); Awumbila and Ardayfio-Schandorf (2008); COHRE (2004) that majority of the scavengers and informal recyclers working at the Agbogbloshie site are principally from the transient population form the north.

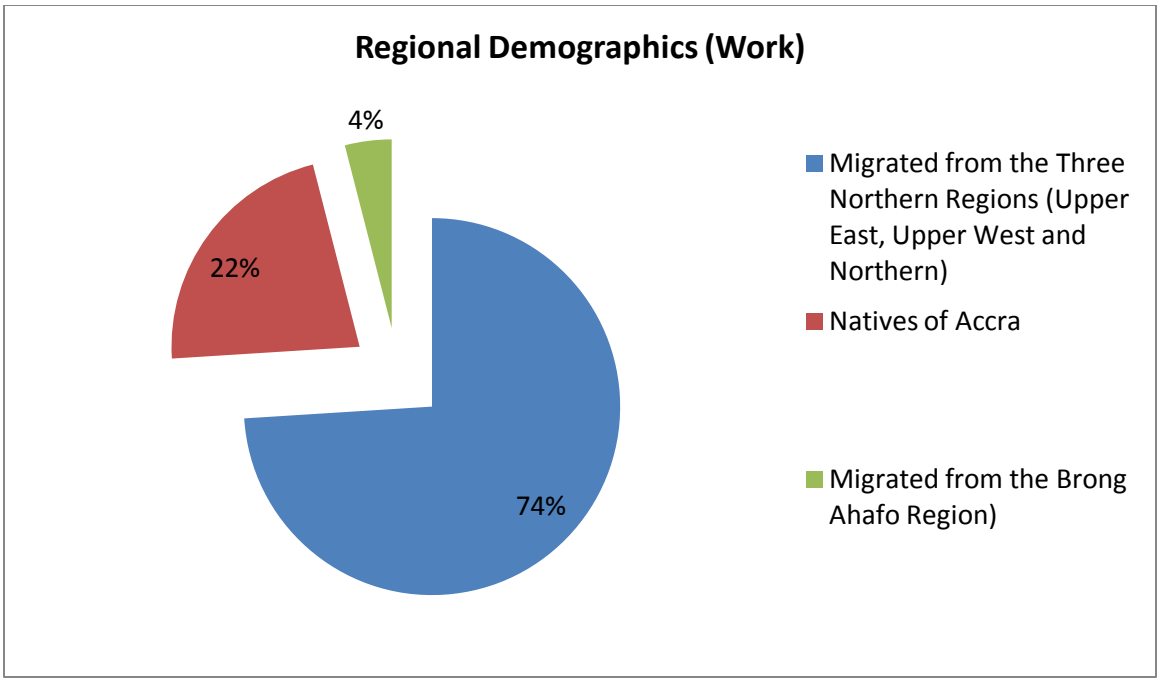

Figure 5.3: Regional Demographics (Work) (*Derived from field data*)

5.3 Reasons for engaging in informal scavenging and recycling

Figure 5.4 shows that the majority of the people working at the Agbogblsohie Informal recycling site find the work lucrative. As indicated in figure 5.4 overleaf, of the 25 people interviewed, 19 (76%) of them indicated that they found it lucrative, 3 (12%) of them indicated that they were doing it primarily because jobs were hard to come by whilst the other 3 (12%) of them responded that for them it was both lucrative and also provided them an opportunity for employment since jobs are hard to come by.

Clearly, the fact that they (informal scavengers and recyclers) consider the job lucrative and as a source of employment, is a major reason why they will brave all odds including the possibility of hazardous chemical contamination to engage in the informal recycling of WEEE. This possibly explains why even though 80% of the people interviewed indicated that they were aware of the hazardous potential of informal WEEE recycling as indicated in figure 5.5 overleaf, yet they still indulged in it.

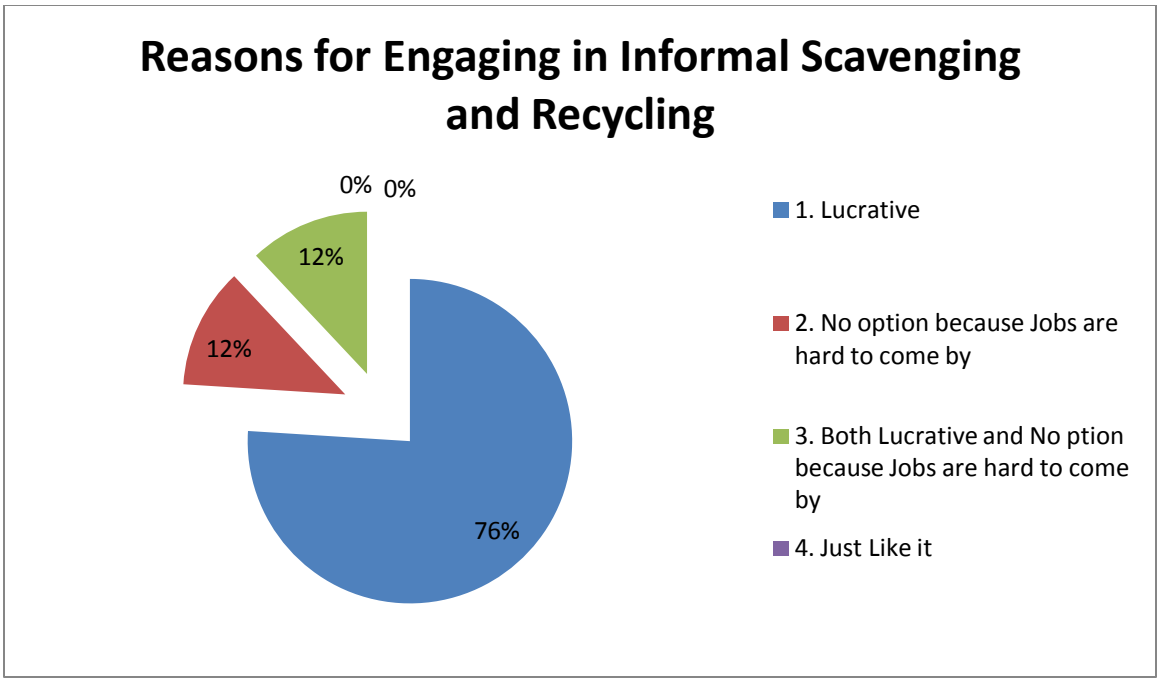

Figure 5.4: Reasons for engaging in informal scavenging and recycling (*Derived from field data*)

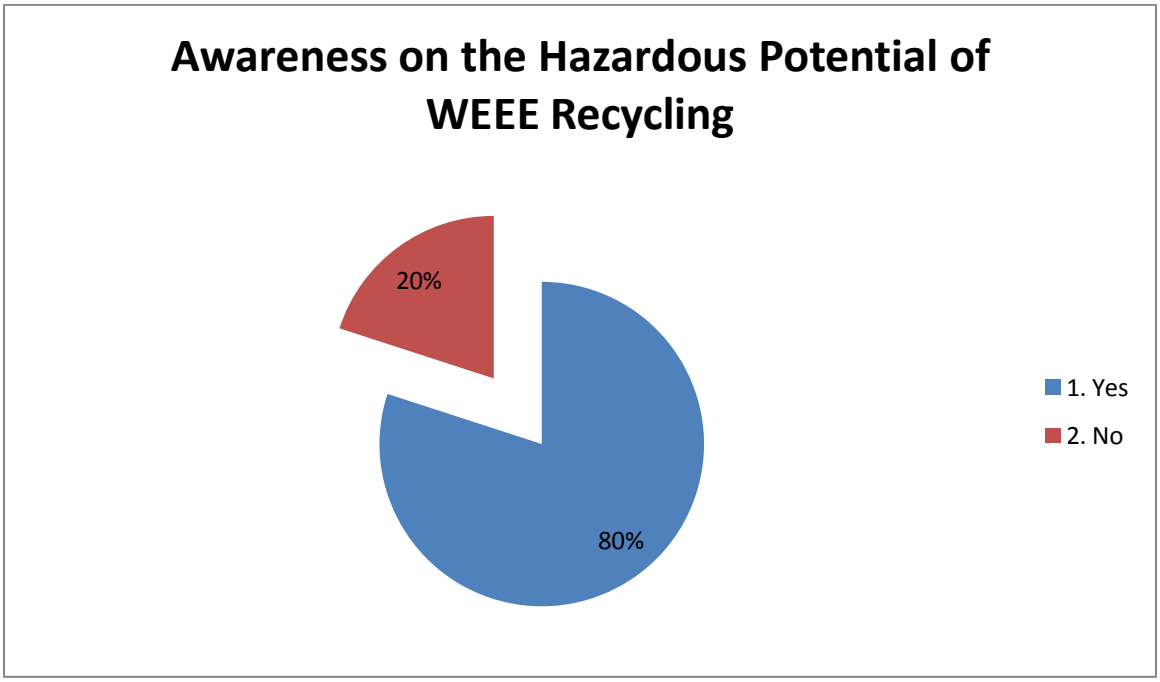

Figure 5.5: Awareness on the hazardous potential of WEEE recycling (*Derived from field data*)

5.4 B. Potential for the Success of Formalizing the Informal Scavenging and Recycling of WEEE

5.4.1 Willingness to Collaborate with or Work in a Recycling Facility

As depicted in figure 5.6 below, of the 25 respondents interviewed with regards to their willingness to collaborate or work with a formal WEEE recycling outlet, 24 (96%) of them responded in the affirmative whilst 1 (4%) of them said no. The 24 (96%) that answered in the affirmative intimated that they will have no problems if they were to sell their WEEE to the recycling outlet for proper and safe recycling as it will spare them the trouble of having to go through the informal recycling themselves.

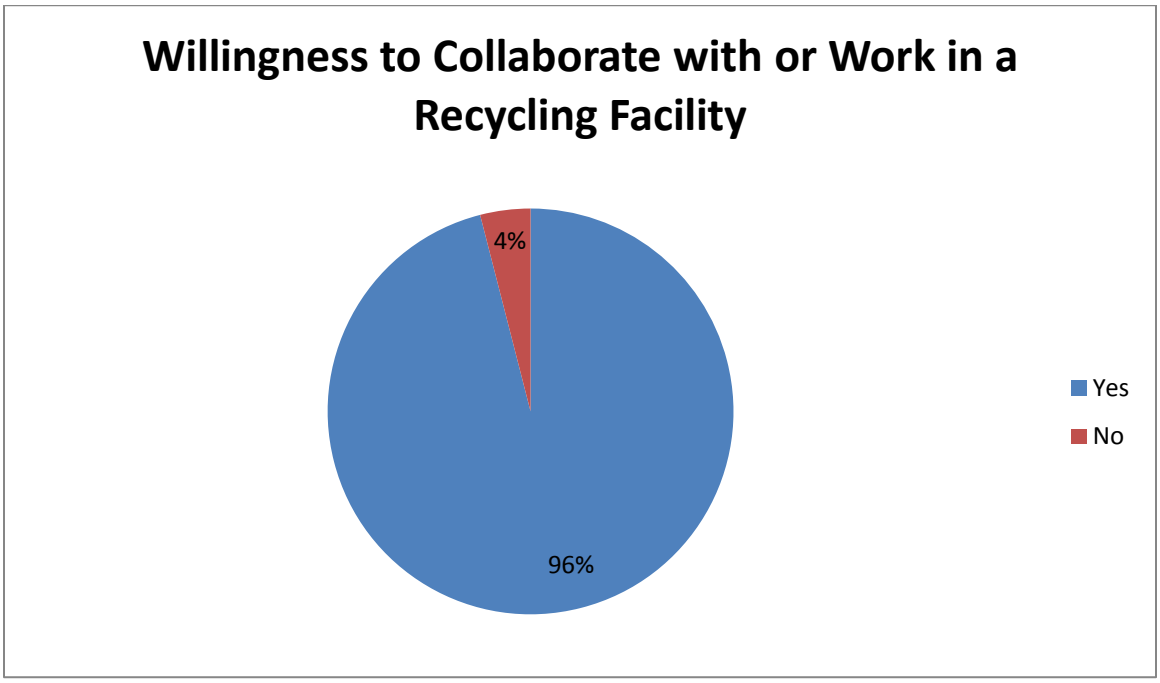

Figure 5.6: Willingness to collaborate with or Work in a Recycling Facility (*Derived from field data*)

5.4.2 Motivating Factors that will encourage them to sell to a Recycling Outlet

Even though majority (96%) of the respondents showed an eagerness to collaborate with or work in a formal recycling facility if one is established, they indicated that certain conditions have to be met before they agreed to do so. For them a negotiated fair and good price is the main motivating factor that will encourage them to sell their WEEE to an established formal recycling outlet if one is established. This is shown in figure 5.7 overleaf where of the 25 respondents interviewed, 12 (48%) of them intimated that a fair and a good price for their WEEE will be enough to motivate or convince them to sell to the formal recycling outlet. 4 (16%) of them intimated that the availability and easy access to recycling outlets will encourage them to collaborate with and sell their WEEE whilst 9 (36%) of them did not respond.

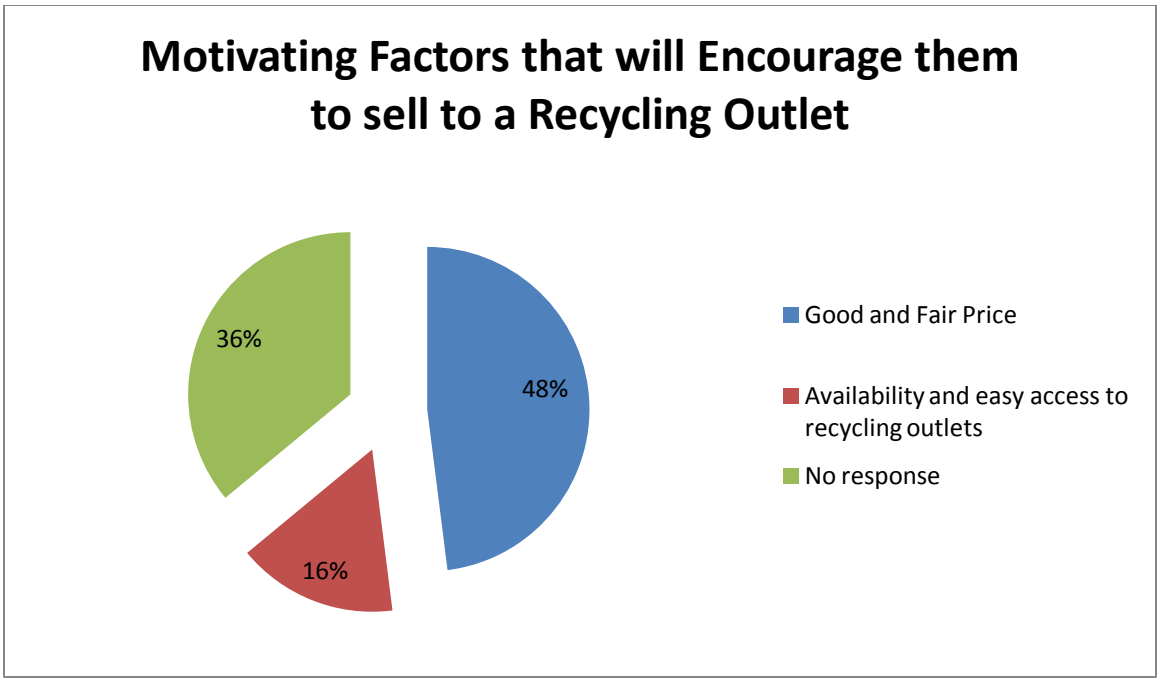

Figure 5.7: Motivating Factors that will encourage them to sell to the Recycling Outlet (*Derived from field data*)

5.4.3 Mitigating Factors that Could Make the Informal Scavengers and Recyclers Refuse to Collaborate with or Work (by selling their WEEE) with a Recycling Outlet

From the responses garnered as part of this research, the non-payment of agreed fees for the scavenged WEEE, the delay in the payment of the agreed fees, and the lack of effective communication as to how the scheme will work were the popular responses that were given by the informal scavengers and recyclers as mitigating factors that could affect their willingness to collaborate with an established formal recycling outlet. For instance, because most of them live from ''hand to mouth'', they require a constant flow of cash to sustain themselves; as such they will not welcome any delay in the payment of the agreed fees. The *non-payment* of the agreed fees as a mitigating factor had 15 picks with *delayed payment* recording 16 picks whilst the *lack of communication* had 3 picks and no response for the *other* category as indicated in figure 5.8 overleaf.

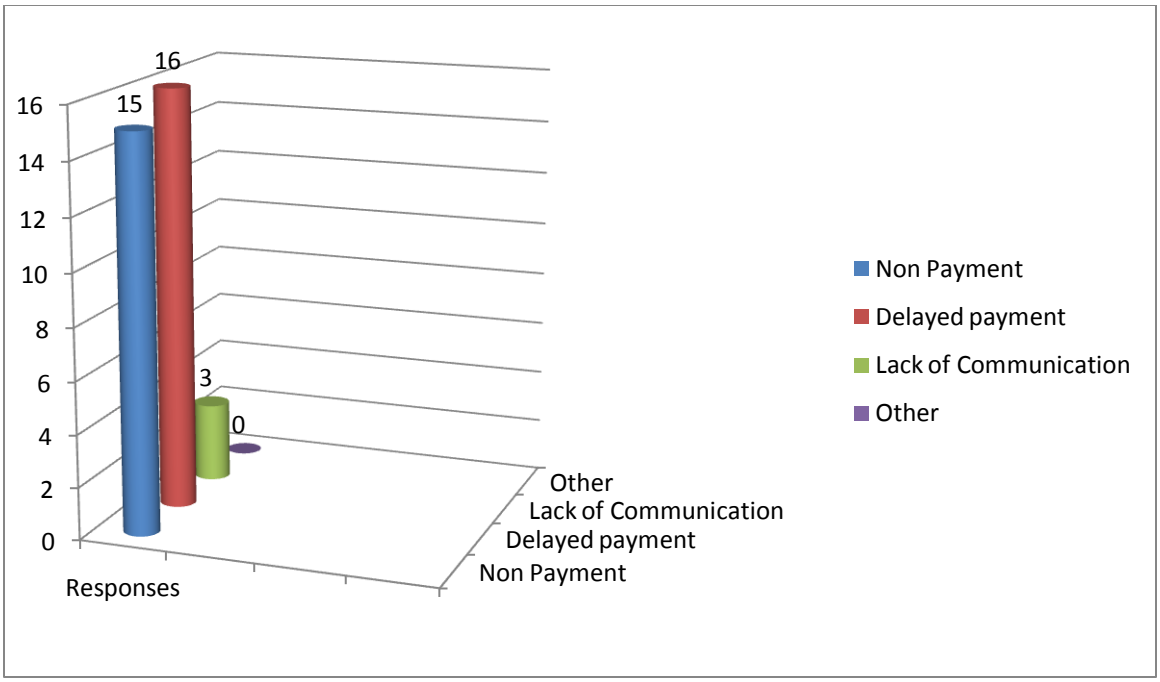

Figure 5.8: Mitigating factors that could make the Informal Scavengers and Recyclers Refuse to Collaborate with or Work (by selling their WEEE) with a Recycling Outlet (*Derived from field data*)

5.5 Duration Spent as an Informal Scavenger and Recycler

The data collected has indicated that informal scavenging and recycling is a serious business and livelihood survival strategy for most of the people engaged in it. The average time spent in engaging in this livelihood survival strategy was found to range between six (6) months to a high of fourteen (14) years, with six (6) of the respondents having spent four (4) years in the business. The full statistical representation is given overleaf in figure 5.9.

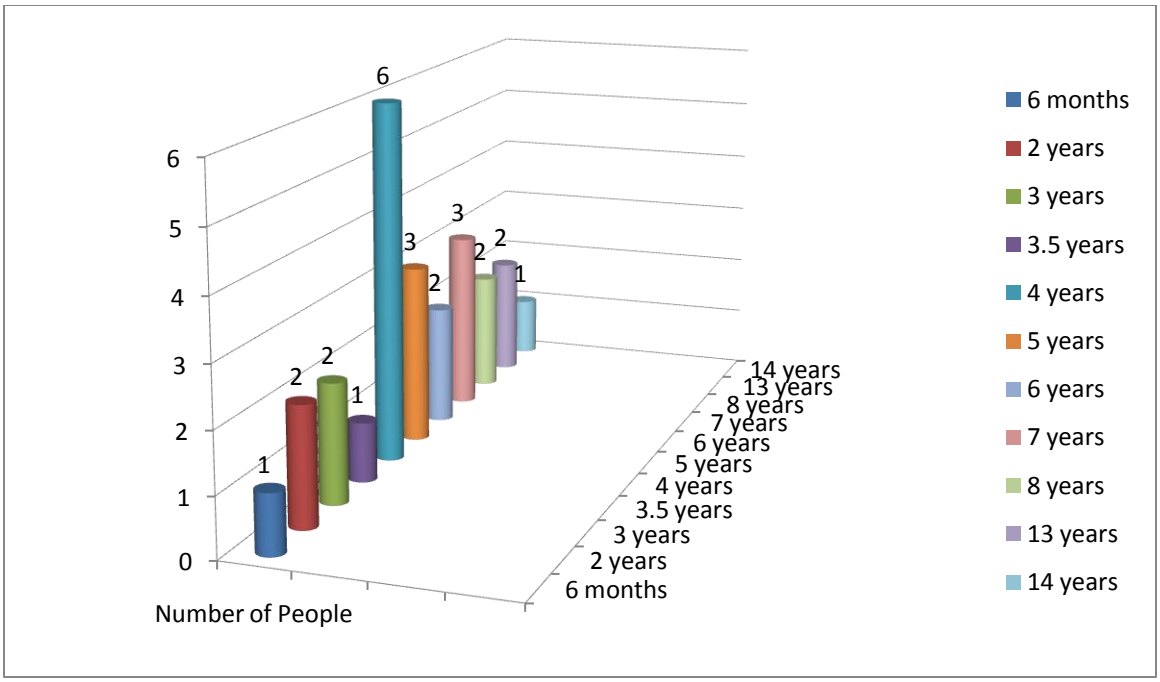

Figure 5.9: Duration spent as an Informal Scavenger and Recycler (*Derived from field data*)

Chapter Summary

This chapter presented the main findings, as well as the analysis of the findings from data that was garnered from the field survey conducted at Agbogbloshie as part of the compilation of this report.

CHAPTER 6

DISCUSSION

This section will perform a discussion based on the information garnered from interviews with the key respondents in a view to answering the research questions posed as part of this research as well as arriving at conclusions for this research.

6.1 *What are the drivers that motivated the drafting of the national WEEE strategy for Ghana?*

The influx of volumes of WEEE into Ghana as well as its attendant problems to Ghana's environment have been well documented over the years but very little has been done in terms of salvaging the situation. With dire economic circumstances and a high unemployment rate, it is no surprise that lot of migrants mainly from the three northern regions (Northern Region, Upper West and Upper East Region), have resorted to informal scavenging, dismantling and recycling as a means to survive (Oteng Ababio, 2012; Amoyaw-Osei, 2013 (Amoyaw interview transcript pp 5, 8 on CD)). Unfortunately, this livelihood survival strategy, in as much as it is providing a means of support for the people involved, leaves in its trail catastrophic environmental footprints. Apart from the fact that the environment, be it the ambient air, the land, surface water as well as ground water are all affected negatively through soil, water and air pollution especially at the Agbogbloshie site in Accra (Brigden K. et al., 2008), the health of the people involved together with that of residents living close to these facilities are equally affected. To effectively manage WEEE, various countries have proposed and implemented strategies to deal with its attendant challenges. It is in the light of this that the EPA, the umbrella body charged with protecting the environment has come up with the national WEEE strategy to effectively manage it in Ghana.

6.1.1 Motivation (s) for Development of the National e-waste Strategy

Preventing the problems posed from the recycling and disposal of WEEE in other countries from happening in Ghana is one of the main motivating factors that encouraged the EPA of Ghana to draft the national strategy on e-waste. Osei Assibey (2013 (Assibey interview transcript pp 4 on CD)), an environmental engineer at the Kumasi Metropolitan backs this assertion when he posited in an interview recorded as part of this research, that the need to have a strategy in place to manage WEEE effectively and prevent the likelihood of an environmental and health disaster as evidenced in Nigeria might have been one of the driving forces that made the EPA of Ghana draft the national WEEE strategy. Considering the fact that Ghana's inflow of second-hand EEEs, normally with a very short life span as opined by Amoyaw-Osei (2013 (Amoyaw interview transcript pp 4 on CD)) of Green Advocacy, Ghana, is on the increase, it is imperative that the EPA comes up with a means to effectively manage Ghana's current e-waste problems in order to avert a major calamity in the near future as being experienced in other countries, hence the drafting of the national e-waste strategy.

The need to come up with a framework that can check and control the importation of EEEs, especially second-hand EEEs in order to prevent the illegal trans-boundary shipment of WEEE into Ghana is

another driving or motivating factor for the drafting of the national strategy on e-waste in Ghana by the EPA (Amoyaw-Osei and Pwamang, 2011). Amoyaw-Osei (2013 (Amoyaw interview transcript pp 1 on CD)), cited that about 80% of all the second-hand EEEs sent into Ghana are junk and already could be described as e-waste. Smith, Sonnenfield & Pellow (2006) support this assertion and further state that this volume of e-waste finds their way into informal recycling sites in developing countries mostly in Africa and Asia. Having a strategy that could check the continued massive inflow of e-waste through the illegal trans-boundary movement of e-waste from Europe and North America in order to control the volume of e-waste in Ghana was another motivation for coming up with this strategy.

Andre Habets (2013 (Habets interview transcript pp 2 on CD)) of the Dutch e-waste compliance scheme and Amoyaw-Osei (2013 (Amoyaw interview transcript pp 4 on CD)) both reckon that the informal recyclers at Agbogbloshie are well aware of the repercussions that the informal recycling of e-waste could have on their health as well as the environment (as shown from results in the field survey in figure 5.5) due to the sensitization that has gone on by organizations such as Greenpeace and Green Advocacy, Ghana. However, Amoyaw-Osei (2013 (Amoyaw interview transcript pp 5 on CD)) still reckons that because a lot more people predominantly migrants from the three northern regions of Ghana are flooding the Agbogbloshie site and engaging in the informal scavenging, dismantling and recycling of e-waste, it is imperative that sensitization continues and on a regular basis to ensure that more people are kept informed about the possible dangers of informal recycling of e-waste. The need to keep sensitizing the populace and increase awareness about the possible negative effects associated with the informal recycling of e-waste could also have been a motivating factor why the EPA came out with the strategy. Apart from sensitizing the general populace about issues related to e-waste, Pwamang and Amoyaw-Osei (2011) reckon that the need to sensitize policy-makers (Parliamentary Select Committee on Environment and Science, Committee on Subsidiary Legislation, etc.), so as to promote the promulgation of legislation on control and management of WEEE and other hazardous waste was also a motivating factor for the drafting of the national WEEE strategy by the EPA.

Amoyaw-Osei (2013 (Amoyaw interview transcript pp 4, 5 on CD)) advocated the need for the major manufacturers of EEE in Europe, North America and Asia to extend their responsibilities beyond just the manufacturing, marketing and sale of their products to other issues such as the establishment and funding of schemes to collect their products that have reached their end-of-life from their customers wherever they may be. Setting up a framework that could provide the guidelines that will be needed for holding consultations with major manufacturers and local dealers of EEEs on the effective implementation of such a scheme (EPR) in Ghana was another motivating factor for the drafting of the national e-waste strategy by the EPA (Pwamang and Amoyaw-Osei, 2011). In addition, the need to provide a framework within which economic instruments like the imposition of import tariffs on new and used EEEs to be put into an e-waste management fund was also a driver for the drafting of the national e-waste strategy by the EPA of Ghana.

Scluep et al., (2011), Prakash et al., (2010) acknowledge that children are usually involved in the informal recycling business at Agbogbloshie. Amoyaw-Osei, a contributor to the writing of the document, *Socio-economic assessment and feasibility study on sustainable e-waste management in*

Ghana, confirmed this assertion in an interview conducted as part of this research stating that children between the ages of 7-16 are involved in informal recycling activities at Agbogbloshie and other informal recycling sites in Accra. The need to provide a working document that could serve as the legal framework to prohibit children from working in the scrap industry, and to punish dealers who engage the services of children was also a driver that encouraged the EPA to draft the national WEEE strategy (Amoyaw-Osei and Pwamang, 2011).

6.2 *What are the challenges/barriers that could affect the implementation of this strategy?*

"We recognized that the poor management of e-waste is a serious threat to human health and the environment in Ghana and that is why we prepared this strategy to provide a framework to tackle the problem systematically". This, according to John Pwamang, Director of Chemicals Control Department of the EPA in Ghana and co-author of the national e-waste strategy is the main motivation for the drafting of that document. As part of conducting this research, the challenges or barriers that could possibly affect the policy (national e-waste strategy) was investigated. These are presented in the paragraphs that follow. In order to arrive at the general challenges or barriers that could affect this strategy, some of the individual objectives were selected, and the potential individual barriers that could affect each of them when implemented were looked at before generalizations were made.

6.2.1 Establishing an institutional framework for collaboration in controlling the importation of used EEE

Osei Assibey (2013 (Assibey interview transcript pp 5 on CD)) posits that the preference for second-hand/used EEEs by majority of Ghanaians will be a major challenge or barrier that could affect the implementation of this objective under the national e-waste strategy. The major reason for this preference, according to Schluep (2011) stems from the fact that the second-hand/used EEEs are much more affordable than the brand-new ones. Another reason for the preference, according to Osei-Assibey (2013 (Assibey interview transcript pp 5 on CD)) stems from the perceived notion amongst most people that EEEs coming from China are generally of low quality and as compared to second-hand/used EEEs coming from Europe and North America. He reckons that this preference for used EEEs from Europe and North America has fueled the importation of these second-hand/used EEEs into the country by importers who now see this as their source of livelihood. For him, any attempt to executive this objective without due recourse to a serious sensitization of the general populace as to why this is being done will result in a major backlash from the citizenry as well as the importers of these used EEEs. The reason being that for them (consumers of second-hand EEEs) it will just be an attempt by authorities to refuse them the opportunity to own EEEs, which have become part of their everyday life at affordable prices. Another reason for the backlash according to Osei-Assibey (2013 (Assibey interview transcript pp 5 on CD)) will be the fact that for the importers, without the right kind of sensitization, there is the potential for them to also perceive this move as an attempt to strip them off their livelihood.

For Andre Habet (2013 (Habets interview transcript pp 1 on CD)) of the Dutch e-waste compliance scheme, the difficulty that confronts customs officials with respect to being able to intercept the illegal

trans-boundary shipments of e-waste especially from European and North American countries where majority of these shipments come from will be a major barrier to the success of this objective as far as the implementation of the national e-waste strategy by the EPA of Ghana is concerned. He further intimates that the difficulty in determining and classifying the status of second-hand EEEs to ascertain whether they are useable or just waste before they are shipped from the European or North American ports will equally be a major challenge as far as meeting this objective is concerned. Another possible challenge or barrier, according to Habets (2013 (Habets interview transcript pp 1 on CD)), that could affect the goal under discussion is the insufficient enforcement of the rules and regulations that should bar the shipment of e-waste from the shores of these European and North American countries. According to him, as long as this is not corrected, it will be difficult to stem the tide of the trans-boundary movement of e-waste from the developed economies to countries like Ghana. Amoyaw-Osei (2013 (Amoyaw interview transcript pp 1 on CD)) questions why this should be the case and affirms that this is a deliberate ploy adopted by most of these developed economies in the north so as to ship their e-waste to developing countries like Ghana. For him, he reckons it is just a deliberate tactic used by these countries in the global north to get rid of their e-waste and shift the high cost of recycling and burden on the health of their citizenry as well as their environment to these countries in the south especially Ghana. He further posits that this is a clear exhibition of the 'not in my backyard' (*NIMBY*) principle by these developed economies in Europe and North America. The exhibition of this *NIMB*Y phenomenon, coupled with the issue of inadequate funding to procure enough state of the art monitoring equipment as well as enough manpower with the requisite expertise and know-how to man Ghana's port of entries for these EEEs, according to Amoyaw-Osei (2013 (Amoyaw interview transcript pp 7 on CD)), will be a major challenge to the achievement of this goal as far as the implementation of the national e-waste strategy is concerned. Aside these challenges, Habets (2013 (Habets interview transcript pp 2 on CD)) still reckons that corruption, especially on the part of the officers mandated to man these port of entries could also be another challenge or barrier that could militate against the fulfillment of this goal as far as the implementation of the national e-waste strategy is concerned.

6.2.2 Establishing a hand in-take back system where old EEEs could be exchanged for new ones/cash

Andre Habets (2013 (Habets interview transcript pp 3 on CD)) of the Dutch e-waste compliance scheme reckons that the implementation of such an objective will only serve to attract even more e-waste as it could be traded in for cash without doing any recycling. For him, operating such an objective could end up "drying up" and ridding Agbogbloshie of all the informal e-waste recycling activities. What he posits will be a challenge to the execution of this objective is the funding that will be required to facilitate and operationalize this system. Amoyaw-Osei (2013 (Amoyaw interview transcript pp 7 on CD)) backs the assertion by Habets that operating such a scheme could only serve to attract more e-waste into Ghana considering the fact that Ghana already has challenges with respect to manning its port of entries as far as the illegal trans-boundary shipment of waste is concerned. For Amoyaw-Osei (2013 (Amoyaw interview transcript pp 7 on CD)), the EPA, the ministry of environment and the Ghana government should rather be focusing their attention and resources on checking the influx of e-waste into Ghana first. It is after this that the EPA and the appropriate authorities could turn their attention on schemes like this to address and deal with the internally generated e-waste.

6.2.3 Establishing a formal and efficient WEEE recycling Industry/Facility

The huge investments that will be needed to establish a formal and efficient WEEE recycling industry/facility is a major challenge that could face such a scheme as far as the execution of the national e-waste strategy is concerned according to Andre Habets (2013 (Habets interview transcript pp 3 on CD)). It is a view that is shared by both Amoyaw-Osei and Osei-Assibey (2013 (Assibey interview transcript pp 6 on CD)). Apart from the availability of the needed investment being a challenge, Andre Habets (2013 (Habets interview transcript pp 3 on CD)) also reckons that such an industry will need continuous support from both the government of Ghana and very crucially from high end industries in Europe and North America in order to make it a success. Amoyaw-Osei (2013 (Amoyaw interview transcript pp 2 on CD)) however, is not entirely sure that a formal recycling industry in Ghana could attract such support in terms of adequate investment from high end recycling industries from Europe and North America. According to Amoyaw-Osei (2013 (Amoyaw interview transcript pp 2 on CD)), this is because Ghana's total e-waste volumes especially the internally generated ones may not be significant enough cost-benefit wise to attract such a high level of investment from recycling outlets abroad. He reckons that the benefits in terms of profits that may accrue to these companies may not be enough to justify their high investments hence the difficulty in attracting such support from these high end recycling industries form Europe and North America.

6.2.4 Developing an enforcement mechanism to check the informal recycling of e-waste

Even though there are a number of laws and regulations that have some relevance to the general control and management of hazardous waste, the same cannot be said for the existence of any specific legislation or regulations to check the informal recycling of e-waste in Ghana (Schluep M., 2011). The lack of a specific legal framework to check the informal recycling of e-waste in Ghana, according to Osei-Assibey (2013 (Assibey interview transcript pp 6 on CD)) is the biggest challenge that could hamper the execution of any enforcement mechanisms to check the informal recycling of WEEE. Amoyaw-Osei (2013 (Amoyaw interview transcript pp 7, 8 on CD)) agrees with this assertion and provides another dimension to this challenge. He posits that even in the scenario where the enforcement becomes successful, the informal recyclers could vacate their sites and instead pitch their informal recycling activities within residential vicinities in a bid to escape from the authorities. According to him, he has received various reports of such activities going on behind homes, and sending dangerous fumes directly into the rooms of people at different locations in Accra and across Ghana. This he reckons, will be a major challenge to any enforcement mechanism to check the informal recycling of e-waste at Agbogbloshie and the other informal recycling sites in Ghana.

6.2.5 Strengthening the capacity of the WEEE-Scrap Dealers and the training of the membership in safe and efficient handling and good business practices

Both Amoyaw-Osei and Osei-Assibey agree that this is a good objective and should be pursued. Amoyaw-Osei (2013 (Amoyaw interview transcript pp 8 on CD)) goes on to state that he does not really for see any major challenge or barrier that could hamper the execution of this objective as part of the

implementation of the national e-waste strategy. Osei-Assibey (2013 (Assibey interview transcript pp 6 on CD)) however, has a dissenting opinion on this and reckons that even though the informal recyclers are all over the place at Agbogbloshie, mobilizing them could still be a bit difficult especially without the right kind of approach and communication as there is the risk of the whole process being perceived as an attempt by the EPA and the government to push them out of their job. Another challenge that Osei-Assibey (2013 (Assibey interview transcript pp 6 on CD)) reckons could militate against this objective, especially with respect to the training of the scrap dealers on the business aspect is the 'get it now and spend it' attitude of these recyclers as with most of them it is all about surviving in the interim and not really about the long term. Such a mentality, he posits, is one of the challenges that could confront the EPA as far as the execution of this objective is concerned. Nevertheless, he reckons that with the right approach in terms of involving them and taking their views on the way forward, and a lot more sensitization, the EPA should be able to pull this off.

6.3 *How can these challenges/barriers be addressed or handled to ensure that the implementation of this strategy becomes successful?*

To ensure the successful implementation of the national e-waste strategy by the EPA of Ghana, the barriers discussed should be addressed. Osei-Assibey (2013 (Assibey interview transcript pp 7 on CD)) of the environmental department of the KMA, for instance reckons that the government of Ghana has to exercise a lot of political will by backing such a policy to ensure that it is executed very well. According to him, budgetary allocations earmarked for the EPA for instance to fulfill some of the objectives (like the establishment of a dismantling and recycling outlet) stated in the national e-waste strategy should be duly disbursed to enable the EPA carry out those projects successfully when they are finally rolled out. John Pwamang (2013 (Pwamang email interview pp 1 on CD)) of the EPA also acknowledges that it crucial to get political backing from the government and policy makers especially in the formulation, promulgation and enforcement of the relevant laws needed to back the implementation of such a strategy. He goes on to posit that in other to achieve this, it is crucial that policy makers in government are adequately sensitized to buy into the strategy. Equally important, according to Amoyaw-Osei (2013 (Amoyaw interview transcript pp 8 on CD)) is the sensitization of the general populace including the informal recyclers about the benefits that the implementation of this national e-waste strategy will bring to them and the environment as a whole. If this is done very well, he reckons that it will be easy for the strategy to be implemented. This is a view that is also supported by Osei-Assibey (2013 (Assibey interview transcript pp 7 on CD)) of the KMA because for him, it is vital that the general populace understand the rationale behind the adoption of this strategy by the EPA. When that is done, and they are convinced that it is in their best interest and that of the environment, they will contribute their quota to ensure the success of the strategy when it is implemented. With respect to the setting up of an efficient recycling industry, Osei-Assibey (2013 (Assibey interview transcript pp 7 on CD)) states that it is imperative that the government encourages the idea of public-private partnerships so as to attract and encourage relevant local or international firms who may be interested to invest in such an industry.

This section performed a discussion that was based on the information garnered from interviews with the key respondents in a view to answering the research questions posed as part of this research as well as arriving at conclusions for this research.

CHAPTER 7

CONCLUSIONS, THEORETICAL IMPLICATIONS AND FINAL REMARKS (PERSPECTIVES)

This chapter deals with the conclusion(s) reached after the analysis of the survey results, as well as the discussions based on the interviews with the key respondents. In addition, the theoretical implications of the findings will be looked at. The chapter will be concluded with some recommendations about what could be done as far as managing Ghana's WEEE challenge for the better is concerned.

7.1 Conclusions

This thesis throws a spotlight on Ghana's attempt at managing its e-waste issues with the drafting of the national e-waste strategy. It assesses the objectives of the draft national e-waste strategy and investigates the drivers that encouraged the EPA to come out with it, the challenges that are likely to be faced when it is implemented and what could be done to address these challenges or barriers so as to ensure its success when it is implemented.

As part of this research, I adopted a case study design strategy using a semi qualitative ethnographic technique; using both data sourced through Skype interviews and emails from key respondents as well as a survey at the study site to collect a section of my data with the help of a research assistant back in Ghana. The data sourced from the field as well as from the key respondents were combined with various documentary reviews and analyzed in a bid to answer the research questions posed to guide this dissertation. The following are the answers to the formulated research questions developed for this thesis;

7.1.1 Research Question 1: ***What are the drivers that motivated the drafting and adoption of the national WEEE strategy in Ghana by the EPA?***

The drafting of the national WEEE strategy by the EPA shows a clear sign of the willingness of the organization to tackle the problems associated with e-waste in Ghana. The outcome of this investigation shows that the main driver that motivated the EPA to come out with this draft (National WEEE Strategy) was to provide a framework to tackle and effectively deal with the issue of the poor management (informal dismantling and recycling) of WEEE so as to protect human health as well as Ghana's natural environment. It is however clear from the investigation that apart from this, there are other reasons why the EPA came out with the national WEEE strategy. These are;

- The need to have a working framework to guide the importation of brand new EEEs, second-hand EEEs, and to check and stop the trans-boundary shipment of WEEE into Ghana.
- The need to sensitize policy-makers (Parliamentary Select Committee on Environment and Science, Committee on Subsidiary Legislation, etc.), so as to promote the promulgation of

legislation on control and management of e-waste and other hazardous waste. In addition to this, it is clear that the need to sensitize the general populace including the informal scavengers, dismantlers and recyclers of WEEE so that they understand, support and contribute to making sure that the strategy works was also a reason why the strategy was drafted.

- The need to set up a framework that could provide the guidelines needed for holding consultations with major manufacturers and local dealers of EEEs on the effective implementation of their Extended Producer Responsibility in Ghana.

- The need to provide a working document that could serve as the legal framework to prohibit children from working in the informal WEEE industry in Ghana, and to punish those who engage the services of children in such activities.

7.1.2 Research Question 2: ***What are the challenges/barriers that could affect the successful implementation of this strategy?***

Based on the analysis done using the data derived from the various interviews with the key respondents, the following emerged as the challenges or barriers that could affect the successful implementation of the national e-waste strategy. The following are listed below;

- Poverty and the high unemployment rate in Ghana driven by the dire economic situation in the country has forced a section of the populace to indulge in livelihood survival strategies of which the informal scavenging, dismantling and recycling of e-waste is one of them (Oteng-Ababio, 2012). As a result of this, any attempt to force these informal recyclers from engaging in this livelihood survival strategy without providing a credible alternative in terms of livelihood support will lead to opposition from the informal recyclers as it will be interpreted by them as a move to strip them of their livelihood. Similarly, it has been made clear that the high demand for second-hand EEEs which has fueled their importation into Ghana, can be attributed to the fact that it is relatively cheaper and much more affordable; hence any attempt to check their importation into the country without the needed sensitization could result in problems as it will be interpreted as an attempt by the EPA and government to strip the importers of their livelihood.

- The insufficient enforcement of WEEE regulations (to enjoinder producers of EEE in the countries in the global north) to ensure that EEEs manufactured and sold by the producers, and which have reached their end of cycle are collected and recycled appropriately is one of the challenges that will militate against the successful implementation of the national WEEE strategy in Ghana. This coupled with Ghana's own problem of not having the funds and the logistical support to properly police its borders and check the influx of WEEE through the illegal trans-boundary movement will be a major challenge that could undermine the successful implementation of the national WEEE strategy. Aside these challenges, corruption, especially on the part of the officers mandated to man these ports of entries has also been identified through

this investigation as another challenge or barrier that can militate against the execution of the national WEEE strategy as far as checking the inflow of WEEE into Ghana is concerned.

- It has also been revealed that the issue of funding is also a possible challenge or barrier to the successful implementation of the national WEEE strategy. A number of the objectives, for instance the hand-in take-back system and the establishment of formal recycling outlets, that were cited for consideration as part of the execution of the strategy will need a substantial injection of capital into them to ensure their effectiveness and long term sustainability. Without this injection of funds, it will be difficult to start and sustain such capital intensive schemes.

- The lack of a specific regulatory legal framework to guide the proper management of WEEE in Ghana, as cited by Schluep (2011) is one of the barriers that will militate against the successful implementation of the national WEEE strategy.

- The difficulty in making a clear distinction between what is WEEE and usable second-hand EEEs is also a possible barrier that could affect the implementation of the national WEEE strategy as far as controlling the importation of WEEE into Ghana is concerned.

7.1.3 Research Question 3: ***How can these challenges/barriers be addressed or handled to ensure that the implementation of this policy becomes successful?***

From the investigations done as part of conducting this research work in a bid to answering the third research question posed, it can be concluded that for the successful implementation of the national WEEE strategy, there is the need for the government of Ghana to show ample commitment or backing for the strategy by offering its unflinching political support in a bid to make it successful. Some of the suggested forms and nature of this political support and commitment as discussed are;

- Budgetary support or allocations to enable the EPA to carry out some of the proposed schemes as stated in the objectives of the strategy.
- Promulgation and the impartial enforcement of relevant laws needed to support the implementation of the strategy by government machinery such as the legislative and the judicial arms of government respectively.
- Creating of a conducive environment that will encourage private-public partnerships in a bid to attract relevant local or international firms who may be interested to invest in such an industry (formal WEEE recycling industries).
- On the part of industrialized nations in the global north, there has to be the tightening of the rules and regulations regarding the management of WEEE in their respective countries so as to prevent the trans-boundary shipments of WEEE from their shores to developing countries like Ghana. This they could do for instance by putting more pressure on the manufacturers of EEEs within their respective countries by putting in measures that will push their EEE manufacturing companies to do more as far as the Extended Producer Responsibility initiative is concerned.

This will help ensure that a lot more WEEE are available for formal recycling and not shipped illegally to developing countries like Ghana.

7.2 Theoretical Implications

The informal scavenging, dismantling and the recycling of WEEE especially at Agbogbloshie and other urban informal recycling sites across Ghana is a livelihood survival strategy adopted by a section of the Ghanaian populace, especially the migrants from the three northern regions of Ghana, as a reaction to surviving the present economic hardships as well as the rising unemployment rate amongst Ghanaians especially in the urban space (Oteng-Ababio, 2012). The present day unemployment, and by implication poverty situation in Ghana, according to World Bank (2001) and UN-Habitat (2003), can be linked to the adoption of the SAP in the 1980s as a remedy for the economic crises of the 1980s.

Sporadic protracted tribal conflicts and intensified climate variability have rendered farming not only a tremendously risky venture but has also given impetus for households to migrate southwards in search of better livelihood opportunities (Awumbila and Ardayfio-Schandorf 2008). Due to the high unemployment rate within the formal sector in Ghana especially within the urban space, most of these migrants in a bid to survive, engage in all sorts of livelihood survival strategies of which the informal scavenging, dismantling and recycling of WEEE is one of them as backed by figures 5.2 and 5.4 in chapter 5. Based on this, it can be inferred that there is a link between the politico-economic decisions (adoption of SAP in the 1980s) that were taken by the government of Ghana, the migration of people from the three northern regions (Upper West, Upper East and Northern) in Ghana and the boom associated with the informal recycling of WEEE at Agbogbloshie and other informal recycling sites across Ghana. This link between the politico-economic decisions adopted (as part of the adoption of the SAP in the 1980s) in Ghana, resulting in the chronic unemployment problems that have stayed even up till now and the current boom in informal recycling that has resulted in massive environmental and health problems reflects the premise upon which ***political ecology***, as a theory denotes. This is because the basic premise, upon which political ecology, as Bryant (1998) will put it, is that politics and environmental issues as indicated by the figure below are thoroughly interconnected. Hence the adoption of ***political ecology*** as one of the theoretical frameworks for this dissertation.

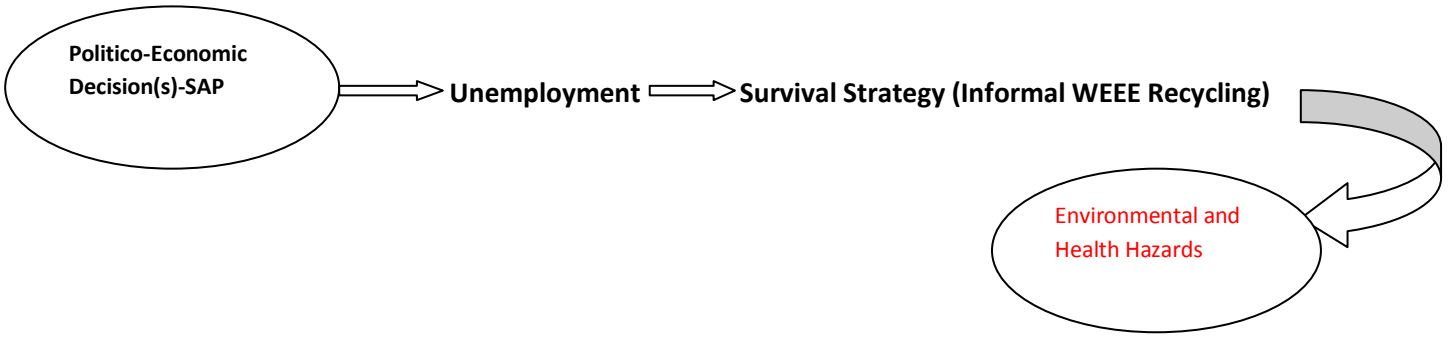

Figure 7.1: Model of flow showing the link between the effects of politico-economic decisions and environmental problems (Author's own construct with inspiration from Blaikie's chain of explanation in land degradation).

In conclusion, informal scavenging, dismantling and recycling of WEEE is a livelihood support strategy especially among the urban poor that has been boosted over the years by the present precarious unemployment situation in Ghana, and migration down south especially from the three northern regions as indicated in my results from chapter 5 of this report. As such any attempt to tackle it and its attendant problems (environmental pollution and health problems among the operators and the general populace) should take into consideration this fact (that is a livelihood survival strategy) and provide credible employment alternatives preferably within the same recycling sector but in a more formalized manner. Any intervention strategy or policy short of incorporating this into its planning and implementation is bound to encounter a lot of problems and challenges, especially in the implementation stage as it will be resisted by the people involved as a ploy to strip them off their livelihood. If 80% of the people interviewed (as shown in figure 5.5) are aware of the hazardous potential of informal recycling but still decide to engage in it, then it is clear that they could do anything including but not just limited to sabotaging such an environmental intervention strategy to resist being stripped off that source of livelihood.

7.3 Final Remark (Perspectives) and recommendation for further research

Central to political ecology research is the notion that politics should be `put first' in the attempt to get an insight into how the human-environment interaction may be linked to the causes of perceived environmental problems (Bryant, 1998). It is no coincidence, however, that most of the key respondents indicated and advocated for a larger involvement of the government of Ghana, through the show of adequate political will and support for the national WEEE strategy to ensure its success when it is implemented. It is in the nature of that show of political will/support that I share a different opinion.

Personally, I believe that in as much as the government providing the political backing in terms of budgetary support, promulgation and enforcement of the relevant laws to back the strategy, etc, I recommend the following;

To solve Ghana's environmental and health problems brought about by the activities of informal recycling, it is imperative for the current Ghanaian government and subsequent ones to focus as much attention to ensuring that the decisions they take help improve upon the economic situation in the country especially in the area of job creation. This is because, when there are alternatives in terms of jobs to fall on, it will be easier to convince people engaging in informal recycling to quit as they will have a better alternative. Other than that all attempts at sensitizing them about the need for them to quit the business of informal WEEE recycling because of environmental and health hazards alone will not be enough. This is because, for the economically vulnerable, the will to survive even if it may be injurious to him or the environment, as has been revealed in this research and corroborated by Amoyaw-Osei, and key data from the field (figures 5.4; 5.5), will always be at the top of his priority list. All other things, including but not limited to environmental issues will come second.

Ideally, curbing the trans-boundary movement of WEEE from the developed economies to developing countries like Ghana will be a step in the right direction as far as the management of WEEE in Ghana is concerned. This however will come with a couple of challenges especially on the part of Ghana, as has

been revealed in this research. For instance, it has been revealed that Ghana presently lacks enough logistical capacity to properly police its borders effectively in order to prevent the influx of WEEE into the country. Apart from this, corruption, especially on the part of the officers mandated to man these ports of entries has also been identified as another challenge that could affect any attempts to try to curb the influx of WEEE into Ghana. Judging from these challenges, and taking into consideration the fact that the informal scavenging, dismantling and recycling of WEEE still provides jobs for a section of Ghana's populace, Ghana should in the interim focus on trying to get the best out of this situation by turning this negative situation (WEEE influx) into a positive one. How? One way could be to set up a dismantling centre in the interim where the informal scavengers could exchange their scavenged wares (WEEE) for a mutually agreed and fair fee. With such an arrangement, the probability of getting the scavengers and recyclers to collaborate with the dismantling centre will be enhanced thereby ensuring that they stop the informal recycling of the WEEE themselves. Such an arrangement whilst safeguarding the protection of the environment will still continue to ensure that the informal scavengers and recyclers keep their jobs. Consequently, the dismantled recyclable parts could be sold directly to interested recycling outlets in Europe, North America and Asia, and the proceeds used to run the dismantling centre.

On a broader scale, the success of such a scheme will not only impact Ghana by protecting the environment and safeguarding the livelihood of the informal scavengers and recyclers; Europe, North America and Asia and the world in general stands to benefit too.

Ghana

By still managing to keep the informal recyclers in business and sustaining their livelihoods, the urban unemployment situation in Ghana is at least kept in check. On top of this, the success of such a scheme could be the genesis or the foundation for establishing a recycling industry in Ghana. This is because, the more recyclable WEEE parts Ghana generates and exports to recycling outlets abroad, the easier Ghana can convince and attract investment locally and internationally for the establishment of its own recycling outlet. The establishment of a recycling out in Ghana will not only provide added jobs for the populace but could provide increased revenue from the sale of recycled precious metals of added value, and not just the raw recyclable WEEE parts.

Europe, North America and Asia

This provides an opportunity for recycling outlets/manufacturers of EEEs in these developed economies to get a constant supply of raw materials at affordable prices for the manufacture of new EEEs.

Informal Recyclers

Aside safeguarding the livelihood of the informal scavengers and recyclers, their health is also protected as they will not need to engage in the open burning of WEEE in order to make a living for themselves.

Environment

With the cessation of the open burning of WEEE, the environment is safeguarded from the negative effects of informal WEEE recycling (land pollution, surface and ground water pollution as well as air pollution). The increment of the flow of recyclable WEEE parts from Ghana to recycling outlets in Europe, North America and Asia could contribute to reducing the over dependence on primary production (mining) of precious minerals for the production of new EEEs. This way, the negative impacts of primary mining (landscape destruction, deforestation, surface water and ground water contamination, destruction and disturbance of natural habits for flora and fauna, etc) can be reduced.

The possibility of Ghana using the economic potential of WEEE as an alternative to solving youth unemployment especially amongst the poor and economically vulnerable whilst protecting the environment is something that interests me as far as future research in this field is concerned. The research will seek to consider the WEEE situation in Ghana, analyze the cost-benefit aspects of it in terms of the potential to offer employment, and environmental protection to Ghana and the world in general.

Chapter Summary

This chapter dealt with the conclusion(s) reached after the analysis of the survey results, as well as the discussions based on the interviews with the key respondents. In addition, the theoretical implications of the findings were looked at. The chapter concluded with some recommendations about what could be done as far as managing Ghana's WEEE challenge for the better is concerned.

REFERENCES

ADI (2013). African Development Indicators, Open Data by Country.
http://data.worldbank.org/data-catalog/africa-development-indicators
Assessed on the 25th of August, 2013 at 2:27 am.

Afrol News. 2010. "Ghana Boom in Dangerous E-waste Imports."
Available: http://www.afrol.com/articles/36355.
Assessed on 25th, October, 2013

Alloway, B.J. (1990) Heavy metals in soils. John Wiley and Sons, Inc. New York, ISBN 0470215984

Awumbila, M., and E. Ardayfio-Schandorf. 2008. "Gendered Poverty, Migration and Livelihood Strategies of Female Porters in Accra, Ghana." *Norwegian Journal of Geography* 62.3: 171–79.

Bains, N., Goosey, M., Holloway, L., Shayler, M., 2006. An Integrated Approach to Electronic Waste (WEEE) Recycling: Socio-economic Analysis Report. Rohm and Haas Electronic Materials Ltd., UK.

Bibler A. et al, 2005 United States: European Union Directives on Electronic Equipment Reflect Trend Toward Global Product Regulation, 07 September 2005
Available:http://www.mondaq.com/unitedstates/x/34662/Chemicals/European+Union+Directives+on+Electronic+Equipment+Reflect+Trend+Toward+Global+Product+Regulation
Assessed on 26th July, 2013 at 10:57 pm

Bohr, P., 2007. The Economics of Electronics Recycling: New Approaches to Extended Producer Responsibility. PhD thesis, Technischen Universität, Berlin, Germany.

Brigden, K., Labunska, I., Santillo, D. & Allsopp, M. (2005) Recycling of electronic wastes in China and India: workplace and environmental contamination. Greenpeace Research Laboratories Technical Note 09/2005, Publ. Greenpeace International, August 2005: 56 pp. (+ 47 pp. appendices)

Brigden et al. 2008 Brigden, K.; Labunska, I.; Santillo, D.; Johnston, P.: Chemical contamination at e waste recycling and disposal sites in Accra and Korforidua, Ghana. Greenpeace International, Amsterdam 2008.

Briggs, J., and I.E.A. Yeboah. 2001. "Structural Adjustment and the Contemporary Sub-Saharan African City." *Area* 33.1: 18–26.

Briggs, J., and I.E.A. Yeboah. 2001. "Structural Adjustment and the Contemporary Sub-Saharan African City." *Area* 33.1: 18–26.

Britten N. Qualitative interviews in healthcare. *In* Pope C, Mays N (eds) *Qualitative research in healthcare* 2nd ed. pp 11-19. London: BMJ Books, 1999

Bryant, 1998). Power, knowledge and political ecology in the third world: a review
Available: http://www.williamtsuma.com/sites/default/files/political-ecology-third-world-review-bryant-1998.pdf
Assessed on 24th October, 2013 at 12:00 am
Bryman, A. 2008. Social Research Methods. Oxford University Press.

Capron, A.M. (1989). Human experimentation. In R.M. Veatch (Ed.), Medical ethics (125-172). Boston: Jones & Bartlett.

COHRE, 2004. A Precarious Future. The Informal Settlement of Agbogbloshie Accra, Ghana
Available: http://www.mypsup.org/content/libraryfiles/60.pdf
Assessed on 3rd October, 2013 at 10:38 am

Creswell, J. W. (2009). Designing and conducting mixed methods research (2nd ed.). Thousand Oaks, CA: Sage.

Cui, J., Forssberg, E., 2003. Mechanical recycling of waste electric and electronic equipment: a review. Journal of Hazardous Materials 99 (3), 243–263.

Danish Environmental Protection Agency, 1999. Waste in Denmark. Ministry of Environment and Energy Danish Environmental Protection Agency.

DFID (1999a) Sustainable Livelihoods Guidance Sheets, Numbers 1–8, London: Department for International Development
Available on www.livelihoods.org
Assessed on 15th October, 2013 at 4:00 pm

DFID (2007). The DFID approach to sustainable livelihood in a nutshell
Available: http://www.poverty-wellbeing.net/media/sla/docs/2-1.htm
Assessed on 16th October, 2013 at 8:15 pm

DHHS 2005 U.S. Department of Health and Human Services (DHHS), Public Health Service, National Toxicology Program: Report on Carcinogens, Eleventh Edition

Division of Technology, Industry and Economics (DTIE), International Environmental Technology Centre. 2007a. *E-waste: Volume 1: Inventory assessment manual* (Osaka/Shiga).
Available: http://www.unep.or.jp/ietc/Publications/spc/EWasteManual_Vol1.Pdf.
Assessed on 25th July, 2013 at 12.45 am

Education Development Center, 2004. "Data Collection Methods: Getting Down to Basics."Available:
http://www.oasas.ny.gov/prevention/needs/documents/KeyInformantInterviews.pdf Assessed on 24th September, 2013 at 2:38 pm

Ellis F (2000): Rural Livelihoods and Diversity in Developing Countries Oxford University Press

EU commission, 2012.The roots of democracy and sustainable development: Europe's engagement with Civil Society in external relations
Available: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0492:FIN:EN:PDF
Assessed on 23rd September, 2013 at 6:44 am

(Eurostat, 2012)
http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/key_waste_streams/waste_electrical_electronic_equipment_weee
Assessed on 3rd September, 2013 at 7:58 pm.

Field, P.A., & Morse, J.M. (1992). Nursing research. The application of qualitative approaches. London: Chapman & Hall.

Flyvbjerg, B. 2001. Making Social Science Matter. Cambridge University Press.

Frontline. 2009. "Ghana: Digital Dumping Ground."
Available: http://www.pbs.org/frontlineworld/stories/ghana804/slideshow/slideshow.html
Assessed on 1st December, 2013

Haefliger, P.; Mathieu-Nolf, M.; Lociciro, S.; Ndiaye, C.; Coly, M.; Diouf, A.; Faye, A.L.; Sow, A.; Tempowski, J.; Pronczuk, J.; Filipe Junior, A.P.; Bertollini, R.; and Neira, M. 2009: Mass lead intoxication from informal used lead-acid battery recycling in Dakar, Senegal. Environmental Health Perspective, Vol. 117(10), 2009, p. 1535-1540

Hapke H. and Ayyankeril D., 2004. "Gender, the Work-life Course, and Livelihood Strategies in a South Indian Fish Market." *Gender Place and Culture* 11.2: 229–56.

Hellstrom, L.; Elinder, C.G.; Dahlberg, B.; Lundberg, M.; Jarup, L.; Persson, B.; Axelson, O. 2001: Cadmium Exposure and End-Stage Renal Disease. American Journal of Kidney Diseases, 38(5), p. 1001-1008

Kuriyama et al. 2005 Kuriyama, S.N.; Talsness, C.E.; Grote, K.; and Chahoud, I.: Developmental exposure to low-dose PBDE-99: effects on male fertility and neuro behavior in rat offspring. Environmental Health Perspective, Vol. 113, p. 149-154

Kvale, Steinar (1996) Interviews: An Introduction to Qualitative Research Interviewing. London ..: SAGE, Chapter 7: The Interview situation, pp. 124-135; Chapter 8: The quality of the Interview, pp. 144-159
Available: http://www.inside-installations.org/OCMT/mydocs/Microsoft%20Word%20%20Booksummary_Interviews_SMAK_2.pdf
Assessed on 24th September, 2013 at 2:50 pm (stages of interview preparation)

Labunska, I., Brigden, K., Santillo, D. & Kiselev, A. (2008) PBDEs and other contaminants arising from production, recycling and disposal of electrical and electronic equipment in St-Petersburg area, Russia. Greenpeace Research Laboratories Technical Note 07/2008, Publ. Greenpeace International

Legler & Brouwer. 2003.: Are brominated flame retardants endocrine disruptors? Environmental International 29(6), 2003, p. 879-885

Lepawsky, J.; McNabb, C. 2010. "Mapping international flows of electronic waste", in *Canadian Geographer*, Vol. 54, No. 2, pp. 177–195.

Liu, Q. et al. 2009. "Chromosomal aberrations and DNA damage in human populations exposed to the processing of electronics waste", in *Li, Guang --- Fan, Fei Yue --- Zhao, Yong Cheng Environmental Science and Pollution Research*, Vol. 16, No. 3, pp. 329–338.

Lourenço-Lindell, I. 2004. "Trade and the Politics of Informalization in Bissau, Guinea-Bissau." In K. T. Hansen and M. Vaa (eds.) *Reconsidering Informality: Perspectives from Urban Africa*. Uppsala: Nordiska Afrikaininstitutet.

Lundgren, Karin, 2012. *The global impact of e-waste: addressing the challenge* / Karin Lundgren; International Labour Office, Programme on Safety and Health at Work and the Environment (SafeWork), Sectoral Activities Department (SECTOR). – Geneva: ILO, 2012

Market Line, 2010, http://www.reportlinker.com/ci02311/Electronic-Manufacturing.html
Assessed on 25th July, 2013 at 9.22 pm

Marshall, MN. 1996. Sampling for qualitative research. Family Practice 1996; 13: 522-525.
Available: http://spa.hust.edu.cn/2008/uploadfile/2009-9/20090916221539453.pdf
Assessed on 22nd September, 2013 at 7:17 am

Munhall, P. (1988). Ethical considerations in qualitative research. Western Journal of Nursing Research, 10(2), 150-162.

Mvo Platform; GoodElectronics. 2009. *Reset: Corporate social responsibility in the global electronics supply chain*.
Available at http://goodelectronics.org/publications-en/Publication_3248/at_download/fullfile
Assessed on 11th September, 2013 at 12:32 am

Nimpuno, M.; Scruggs, C. 2011. *Information on chemicals in electronic products: A study in needs, gaps, obstacles and solutions to provide and access information on chemicals in electronic products* (TemaNord).
Available: http://www.chemsec.org/get-informed/globalinitiatives/unep-cip-study-on-electronics
Assessed on 11th September, 2013 at 1:03 am

Orb A., Eisenhauer L., and Wynaden D., 2001. Ethics in Qualitative Research. JOURNAL OF NURSING SCHOLARSHIP, 2000; 33:1, 93-96. ©2001 SIGMA THETA TAU INTERNATIONAL.
Available: http://www.columbia.edu/~mvp19/RMC/M5/QualEthics.pdf
Assessed on 25th September, 2013 at 8:12 pm

Oteng-Ababio M., 2012. When Necessity Begets Ingenuity: E-Waste Scavenging as a Livelihood Strategy in Accra, Ghana. *African Studies Quarterly* | Volume 13, Issues 1 & 2, spring 2012
Available: http://www.africa.ufl.edu/asq/v13/v13i1-2a1.pdf
Assessed on 3rd October 2013 at 8:06 am

Oteng-Ababio M, 2012.Electronic Waste Management in Ghana– Issues and Practices

Owusu, F.Y., 2007. "Conceptualizing Livelihood Strategies in African Cities: Planning and Development Implications of Multiple Livelihood Strategies." *Journal of Planning Education and Research* 26: 450–65.

Prakash, S.; Manhart, A. 2010. *Socio-economic assessment and feasibility study on sustainable e-waste management in Ghana* (Published by Öko-Institut of Applied Ecology, Freiburg,).

Pwamang J.A. et al 2011 Ghana e-Waste Project National Strategy

Qu et al. 2007 Qu, W.; Bi, X.; Sheng, G.; Lu, S.; Fu, J.; Yuan, J.; Li, L.: Exposure to polybrominated diphenyl ethers among workers at an electronic waste dismantling region in Guangdong, China. Environment International, 33(8), p. 1021-1028

Raghupathy, L.; Krüger, C.; Chaturvedi, A.; Arora, R.; Henzler, M.P. 2010. *E-waste recycling in India: Bridging the gap between the informal and formal sector*.
Available at http://tutzingwaste.org/pub/Tutzing/WebHome/Krueger_e-waste_recycling_in_india.pdf
Assessed 11th September, 2013 at 11:23 am

Ramos, M.C. (1989). Some ethical implications of qualitative research. Research in Nursing & Health, 12, 57-63.

Remenyi D., 2012 Field Methods for Academic Research- Interviews, Focus Groups and Questionnaires in Business and Management Studies, 2nd Edition, Academic Publishing

Salomons, W. & Forstner, U. (1984) Metals in the hydrocycle. Springer-Verlag, Berlin, Heidelberg, New York, Tokyo, ISBN 3540127550

Sepúlveda, A. et al. 2010. "A review of the environmental fate and effects of hazardous substances released from electrical and electronic equipments during recycling: Examples from China and India", in *Environmental Impact Assessment Review*, Vol. 30, No. 1, pp. 28–41.

Schluep, M., Hagelueken, C., Kuehr, R., Magalini, F., Maurer C., Meskers C., Mueller E and Wang, F. (2009). *Recycling: From e-waste to resources*, Sustainable Innovation and Technology Transfer Industrial Sector Studies (Nairobi and Bonn, UNEP and STeP).
Available: http://www.unep.org/PDF/PressReleases/E-Waste_publication_screen_FINALVERSION sml.pdf.
Assessed on 25th July, 2013 at 1.09 am

Schluep, M., Amoyaw-Osei, Y., Agyekum, O., Pwamang, J., Mueller, E. and Fasko, R., 2011. Ghana e-waste country assessment, SBC e waste Africa report, 2011.

Smith, T.; Sonnenfeld, D.A.; Naguib Pellow, D. 2006. Challenging the chip: Labor rights and environmental justice in the global electronics industry (Philadelphia, PA, Temple University Press).

Strategic Approach to International Chemicals Management (SAICM) 2009. Background information in relation to the emerging policy issue of electronic waste, paper presented at the International Conference on Chemicals Management, Geneva, 11–15 May (SAICM/ICCM.2/INF36).

Sjödin et al. 2001 Sjödin, A.; Carlsson, H.; Thuresson, K.; Sjolin, S.; Bergman, Å.; Ostman, C.: Flame retardants in indoor air at an electronics recycling plant and at other work environments. Environmental Science and Technology 35(3), p. 448-454

Sjödin et al. 2003 Sjödin, A.; Patterson, D.G.; Bergman, A.: A review on human exposure to brominated flame retardants – particularly polybrominated diphenyl ethers. Environment International, 29, 2003, p. 829-839

UN-Habitat. 2003. *Slums of the World: The Face of Urban Poverty in the New Millennium? Monitoring the Millennium Development Goal, Target 11—World-wide Slum Dweller Estimation Working Paper.* Nairobi, Kenya: United Nations Human Settlements Programme.

University of Wisconsin Writing Centre, 2012. http://twp.duke.edu/uploads/assets/lit_review.pdf
Assessed on 21st September, 2013 at 3:55 pm.

World Bank. 2001. *World Development Report 2000/2001. Attacking Poverty*. New York: Oxford University Press.

WDI (2013). The World Bank, Development Indicators, Open Data by Country.
Available: http://data.worldbank.org/indicator
Assessed on the 24th of August, 2013 at 6:46 pm.

WHO (2004) Chlorobenzenes other than hexachlorobenzene: environmental aspects. Concise international chemical assessment document: 60. ISBN 92 4 153060 X, ISSN 1020-6167, Geneva 2004

Wong, M.H., Wu, S.C., Deng, W.J., Yu, X.Z., Luo, Q., Leung, A.O.W., Wong, C.S.C., Luksemburg, W.J. &

Wong, A.S. (2007) Export of toxic chemicals – A review of the case of uncontrolled electronic-waste recycling. Environmental Pollution 149(2): 131-140

Wood, G., and S. Salaway. 2000. "Policy Arena Introduction: Securing Livelihoods in Dhaka Slums." *Journal of International Development* 12: 669–88.

World Bank (2007) Ghana Country Environmental Analysis. Report No. 36985 – GH Nov. 2, 2007.

Yin, 1994.Case Study Research. Design and Methods (1994, Second edition. Thousand Oaks: Sage)

Yu, J.; Welford, R.; Hills, P. 2006. "Industry responses to EU WEEE and ROHS Directives: Perspectives from China", in *Corporate Social Responsibility and Environmental Management*, Vol. 13, No. 5, pp. 286–299.

Internet Sources:

http://www.electronicstakeback.com/promote-good-laws/state-legislation/ assessed on 27th of July, 2013.

http://www.google.co.uk/search?q=political+map+of+ghana&source=lnms&tbm=isch&sa=X&ei=XmUNUvLSGILm7AbD-YC4Ag&sqi=2&ved=0CAcQ_AUoAQ&biw=1024&bih=499#facrc=_&imgdii=_&imgrc=ylwbPwN_ne5O8M%3A%3BSLsFq4CSV8SbRM%3Bhttp%253A%252F%252Fupload.wikimedia.org%252Fwikipedia%252Fcommons%252Fthumb%252F2%252F2a%252FGhana-karte-politisch.png%252F251px-Ghana-karte-politisch.png%3Bhttp%253A%252F%252Fcommons.wikimedia.org%252Fwiki%252FAtlas_of_Ghana%3B251%3B291 (Political map of Ghana)

http://www.epa.gov.gh/index.php?option=com_content&view=article&id=46&Itemid=109 (EPA)

http://www.out-law.com/page-10692 assessed on 6th December, 2013 at 2: 31 am.

APPENDICES

Appendix A (Compact Disc)

Recorded Audio Interview with Amoyaw-Osei (Audio WS650039)

Recorded Audio Interview with Osei-Assibey (Audio WS650034 and WS650042)

Email interview with Andre Habets

Email interview with John Pwamang

Transcript of Amoyaw-Osei interview

Transcript of Osei-Assibey interview

Breakdown of Results from Field Study at Agbogbloshie, Ghana

Sample Questionnaire for Scavengers

Sample Questions for Key Respondent Interviews

Names and addresses of Key Respondents for the Skype and Email Interviews

NB: Interview WS650042 is a continuation of Interview WS650034.