Electronic waste trade and "sustainability" in Agbogbloshie, Accra, Ghana.

At the end of a supply chain?

 [1]

By

Hazel Beecham

Supervised by

Dr Felipe Montoya

A Major Paper submitted to the Faculty of Environmental Studies

in partial fulfillment of the requirements for the Degree of Master in Environmental Studies,

York University, Ontario, Canada

November 30, 2016

[1] Cover page photo; showing the Korle Lagoon at Agbogbloshie, Accra, Ghana. Source: Envirolist, 2015- 2016

Abstract

The rapid increase in the production and consumption of electrical and electronic equipment has resulted in high volumes of electronic waste and its associated trade from the Global North to the Global South. In the Global South, there is often little or no regulation or ineffective regulation and electronic waste is mainly managed by low skilled workers in the informal sector. Electronic waste contains hazardous components which when managed improperly can negatively impact human health and the environment. This paper reviews how the informal workers in Agbogbloshie, Ghana, manage and dispose of e-waste mainly from the Global North. Using a stakeholder's perspective, this paper explores the benefits and risks of e-waste "recycling" in Agbogbloshie; the next steps that could be taken to implement an environmentally safe process of e-waste management in Ghana, and how willing stakeholders (chosen for this research) are to be involved in stakeholder engagement. Using environmental justice as a framework, it explores the value of recycling electronic waste in Agbogbloshie. The paper concludes that it is not worth the risks associated with managing electronic waste. The paper makes recommendations based on stakeholder engagement, regulation, and the incorporation of sustainable business practices in the electronic industry's operations based on best practices and on input from the stakeholders that were interviewed in Ghana. The recommendations attempt to find ways of reducing the influx of electronic waste into Ghana and to move the current management and disposal of electronic waste towards an environmentally safer manner of managing electronic waste, in order to minimize the negative impacts.

Foreword

Generally, my plan of study speaks to the global challenge of industrial pollution and sustainability. It narrows the focus to hazardous waste pollution and its attendant health and environmental problems in marginalized communities in the Global North. These communities resisted the placement of hazardous waste and this resulted in stricter regulations, increased costs in hazardous waste disposal and led to difficulty finding disposal sites. Companies followed the "path of least resistance" by shipping these wastes to the Global South, where there were lax or no regulations and cheaper costs of hazardous waste disposal. This saw the transfer of environmental and health hazards to countries in the Global South who do not have the capability to safely dispose of these wastes.

My major paper builds on this concept by highlighting the health and environmental impacts of the new form of the hazardous waste trade; the e-waste trade from the Global North to a Global South country, Ghana's Agbogbloshie Scrapyard, where it is managed in an unsafe manner. Just as in my plan of study, my paper recommends stakeholder engagement and incorporating sustainable business practices into the electronic industry's operations to achieve some level of sustainable development and to help address this global challenge.

Acknowledgement

As the saying goes “no man is an island”. This can be said about my MES journey. I definitely could not have made it alone. This paper has been a product of not just pouring over articles and books written by unsung heroes, but also lots of support, love and guidance from family, friends and of course my FES family. I would first like to thank God, without Him I would not have been able to accomplish this feat. My MES/POS journey was a very long one, but Anna, Ellie, Felipe and Leesa you all made it bearable. Thank you!

As long as I remember, I have had a passion for the environment, which I believe was cultivated at a young age. Little did I know I would end up doing a graduate degree in environmental studies. Anna Zalik, thanks for all your unwavering support and advice, and for suggesting I use the e-waste situation I described to you for my MRP. Interestingly, my initial thought was; “e-waste? No, oil and gas it is”. However, I finally saw the seamless fit between electronic waste, sustainability and business practices. Thank you, Anna. Indeed, e-waste is a great way of illustrating how unsustainable business practices can impact human health and the environment adversely. Ellie thanks for all your support and guidance and your patience. Felipe, what can I say? Thanks I could not have done it without your help, support and direction.

Thanks to my family; my Dad, for all his support and for cultivating my interest in animals, people and the environment at a young age; my mum, for all her words of wisdom, support and encouragement throughout my life; my sisters, Jennifer, Barbara and Tessa for being there for me. THANKS.

To all my friends who have supported me throughout my academic endeavours, I could not have made it without your support and love. All my FES and CERLAC friends you know who you are, the fellowship and support have been a lifeline. THANKS.

A big thank you to the following professors; Martin Bunch, Minoo Derayah, Jose Etcheverry, Leesa Fawcett, Uwafiokun Idemudia, Len Karakowsky, Joseph Mensah and Dana Scott. You have all been pillars of support in more ways than one. I would also like to show my appreciation to Yaw Amoyaw-Osei, Bennett Nana Akuffo, Dr. Udofia, Dr. Calys-Tagoe, Dr. Lawson, Professor Martin Oteng-Ababio, Agyekum Offei, Dr. Kwasi Dartey-Baah, the informal recyclers and the Greater Accra Scrap Dealers Association. I could not have accomplished this feat without your invaluable input and support.

I also appreciate the opportunity, Joseph Da Silva (Director for E-Services, Faculty of liberal and Professional Studies, York University), gave me to do an internship at York University reviewing the current computer usage and e-waste disposal policies and writing a business proposal. Finally, I would like to show my appreciation to all the faculty and staff at FES who have supported not just me but continually giving their best to support graduate students to accomplish their academic goals.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

BAN Basel Action Network

CSR Corporate Social Responsibility

DTIE Division of Technology, Industry and Economics

EC European Commission

EEE Electrical and Electronic equipment

EPA Environmental Protection Agency

E-Scrap Electronic Scrap

E-waste Electronic waste

ENGO Environmental Nongovernmental Organisation

EU European Union

FGD Focus Group Discussion

GATT General Agreement on Trade and Tariffs

GESTA Ghana Electronic Service Technicians Association

OECD Organisation for Economic Co-operation and Development

IMF International Monetary Fund

ILO International Labour Organisation

NGO Nongovernmental Organisation

SAP Structural Adjustment Programs

STEP Solving the E-waste problem

UN United Nations

UNEP United Nations Environment Program

UNSD United Nations Statistics Division

US United States

WEEE Waste Electrical and Electronic equipment

Chapter 1

Introduction

Adidi daa ye sen adidi preko
And
Akyire mba nti kae na wu didi a gyaw bi
(Ghanaian proverbs)

The above inscriptions are Akan proverbs from Ghana, that translate as *the judicious use of one's resources is better than squandering all of one's resources in the present* **and** *one must consider the future generation's needs when utilizing one's resources* respectively**.** These proverbs both speak to "sustainability" and address the issue of considering the impact of what we do today as it affects both the current and future generations. While acknowledging the need for the current generation to utilize resources, the proverbs also caution the present generation to use resources wisely with the needs of the future generations in mind, as well as our home; planet earth.

The meaning of sustainability is embedded in the definition of sustainable development, which is the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The Brundtland Report, 1987). Some level of sustainable development can be attained through Corporate Social Responsibility (CSR). This can be achieved by businesses implementing sustainable business practices into their day to day operations. CSR can simply be defined as "the responsibility that enterprises can assume in order to contribute to sustainable development" (Khalili, 2011). Thus, there is an important intersection between industrial pollution and corporate sustainability. This intersection between industrial pollution and corporate sustainability, I believe is not only a pressing issue but a challenging one as well. It is therefore important for businesses to be responsible for the negative

impacts they have on society (including future human capital) and the environment/earth (a source of human livelihood).

1.1 Background to the Study

As part of our everyday lives, the production of waste is inevitable (Adeola, 2011). The Basel Convention defines waste as "any substance which is disposed of or intended to be disposed of, or is required to be disposed of, by the provisions of national law" (UNEP, 2011, p.10). The United States Environmental Protection Agency (US EPA, 1996) defines waste as, "any unwanted material either in solid, liquid or contained gaseous form discarded by being disposed of, buried, burned or incinerated, or recycled" (Adeola, 2011, p. 16-17). According to the United Nations Statistics Division (UNSD) waste is defined as "materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation, or consumption and of which he/she wants to dispose" (Baker, 2004, p.5).

The above definitions of waste allude to the fact that waste production is an inevitable activity associated with human activity. However, wastes can be hazardous and when managed improperly, can have an adverse effect on human health and the environment (Adeola, 2011). Nebel and Wright (2000) define hazardous waste as "anything that can cause injury, disease, or death: damage to property; or physical destruction of the biophysical environment" (Adeola, 2011, p. 17).

1.2 Problem

According to a United Nations (UN) Report, industries are the main producers of hazardous waste (Baker, 2004). The rapid generation of electronic waste (e-waste) is creating a major global problem; that is, its management after disposal (Baldé et al., 2015), especially in the Global South (Osibanjo & Nnorom, 2007). The volumes and toxicity of e-waste presents a dilemma; a business opportunity due to its valuable components and a problem as it negatively impacts human health and the environment from its hazardous content (Widmer et al., 2005) especially when dumped on poorer communities who do not have the capability to safely dispose of it (Bridgen et al., 2008; Lundgren, 2012; Pellow, 2007; Widmer et al., 2005). It is vital that e-waste be safely managed and disposed of in an environmentally safe manner for a healthier global nation and the future of our planet. Industries produce the most waste, especially hazardous waste and it is important that they bear responsibility in some manner for this production.

This paper therefore focuses on the end of the supply chain[2] as it is the migration of waste from products the electronic industry manufacture, which is harming people who had nothing to do with the production of these toxics. Thus, I use a stakeholder perspective at the end of the e-waste supply chain (a chain that originates from these industries) to answer my research questions, stated in detail below. I chose to focus on how irresponsible or "CSRless" corporate behavior can have a global impact, especially on the e-waste industry and its effect on poor and marginalized people in the Global South.

[2] This paper refers to Abgogbloshie Scrapyard as the *end of a supply chain*, because electronics are not produced in Ghana, secondhand electronics and or "dead" electronics find their way to this scrapyard mainly from the Global North. Supply Chain is metaphorically used to symbolize the journey from the Global North to Agbogbloshie Scrapyard. Moreover, it is one of many such scrapyards in the Global South. The question mark in the title raises the question, if it is really at the end of a supply chain, as electronics are "recycled" in Agbogbloshie and go back into the manufacturing process at times outside of Ghana.

Moreover, about 90 percent of hazardous waste produced worldwide, is from the Global North. Although a lot of the waste is disposed of within the countries that produce them (Margai, 2010) or traded between rich countries (Baker, 2004), an increasing percentage of the waste is being shipped to the Global South for reuse, recycling and disposal (Margai, 2010). It is noteworthy that hazardous waste that is legally traded between rich countries is done at a fair price and the receiving rich countries have the infrastructure to safely manage these wastes (Pellow, 2007). Nonetheless, the focus of this paper will be on the trade of hazardous waste, specifically e-waste from the Global North to the Global South. This is because a significant amount ends up in the Global South (Pellow, 2007) and especially because, the Global South does not have the proper infrastructure and effective regulation to safely manage and dispose of these wastes (Lundgren, 2012; Pellow, 2007; Clapp, 2001; Widmer et al., 2005).

1.3 Objectives of the study

The objective of this major paper (MP) is to find out the value of recycling e-waste in Global South local communities[3], such as Agbogbloshie. From a stakeholder perspective, it also seeks to find ways in which to improve the current methods used in the management and disposal of e-waste in a sustainable manner at Agbogbloshie[4]. Additionally, it seeks to explore the willingness of the stakeholders to find a workable solution to the challenges facing e-waste management and disposal in Agbogbloshie, to reduce the potential impact on the local communities.

The study aims to explore the increasing challenges associated with hazardous waste disposal. It is evident that industries, especially multinational corporations, have a major impact on sustainability worldwide. This is because industries often generate hazardous waste materials

[3] Local Communities are the Informal workers, people who work and live in and around Agbogbloshie.
[4] Agblogbloshie is a surburb in Accra, Ghana found in West Africa.

(Baker, 2004) which can destroy the environment and endanger human and animal life if not managed properly. Hazardous waste disposal, particularly electronic waste (e-waste) has increasingly become a global issue (Lundgren, 2012).

Specifically, this paper looks at how the increase in the production and consumption of electrical and electronic equipment (EEE) globally has given rise to high volumes of e-waste and resulted in a new form of hazardous waste trade from the Global North to the Global South. Using Agbogbloshie Scrapyard, an e-waste recycling hotspot in Accra, Ghana, as a case study, it focuses on a newer form of the hazardous waste trade; the e-waste trade, particularly between Ghana and the Global North. This paper reviews how the informal sector at Agbogbloshie in the Global South manages and disposes of e-waste; which is mainly performed by the informal sector in Ghana and is highly unregulated (Amoyaw et al., 2011). It also reviews how the management of e-waste in the Global South impacts the environment and human health. This paper explores the various perspectives of key stakeholders on the benefits and risks associated with the informal management and disposal of e-waste at the end of the supply chain on local communities.

1.4 Importance of the study

Conducting research on the e-waste trade, its disposal and "sustainability" is very important for the following reasons: the ever increasing volumes of e-waste generated; its toxicity and end-of life management and disposal and how it impacts human health and the environment; low recyclability due to complex design; high cost of recycling in an environmentally safe manner; the ineffectiveness or lack of regulation governing e-waste(Lundgren, 2012); security breaches

associated with discarded computers with confidential information which can be accessible to unauthorized persons and be used fraudulently, to mention only a few.

Additionally, this research is important because, although it seems to have a localized impact, it can potentially have a global effect. For example, the "boomerang effect" of food supply and shipping hazardous waste can affect the 'country of origin, the neighbouring countries, the countries enroute the ship's path and the receiving country" (Marbury, 1995). Moreover, the boomerang effect of e-waste dumping in the Global South can be "felt" in the Global North through the increase of cybercrime and products imported from the Global South. Used or old personal computers normally have confidential information that could be used fraudulently if hard drives are not "cleaned" before being shipped to the Global South (Lundgren, 2012). Warner (2011) notes that, the dumping of e-waste in the Global South has led to Ghana becoming a cybercrime hotspot. In addition, lead has been found in jewelry imported from China to the US, which Weidenhamer & Clement (2007) hypothesize that the jewelry was made from recycled waste originating from the US.

All these can directly or indirectly have an impact on societal and environmental issues such as poverty reduction, health and safety issues, child education, safe management of waste and environmental pollution.

1.5 Justification of study

This research is truly interdisciplinary because it brings together, corporate sustainability, industrial pollution and how it has affected the hazardous waste trade in the new form of e-waste, as well as stakeholder perspectives and environmental justice all in one paper through field research and literature review. The uniqueness about this research is that it explores what various

stakeholders would like to see in terms of moving towards a more sustainable management of e-waste. Also, it will recommend solutions that may help address the management and disposal of e-waste in Agbogbloshie, with the input of stakeholders. Some of the solutions can be used in shaping future e-waste policies in Ghana. These policies may reduce the negative impacts on the environment and human health of local communities by regulating the management of e-waste to use safer environmental standards. Thus, the solutions will be tailor made for the local context in Ghana. Solutions for Agbogbloshie Scrapyard could be a blueprint for replication across the other scrapyards in Ghana. It however, can be applied to other Global South countries. One of the practical concerns arising out of reviewing academic literature for my research is the increasing volumes of e-waste generation and its dire consequences as seen above, especially in the Global South. This research emphasizes the importance of addressing this challenge before it leaves an "indelible" mark on the human race and the earth.

1.6 Research questions

In order to explore the "sustainability" at the downstream end of the e-waste supply chain, I will use the following questions as a guide.

My First question is *What are the tradeoffs of recycling e-waste in Agbogbloshie for the local communities associated with e-waste management and disposal?* This question will explore the benefits and risks of recycling of e-waste by the informal sector in Agbogbloshie Scrapyard, Ghana, a Global South country.

My second question is *What are the next steps?* (In terms of achieving a sustainable e-waste management and disposal system). This question will try to find out what the key stakeholders

would like to see happen in order to move towards an environmentally safe management and disposal of e-waste in Agbogbloshie, Ghana (or whatever their priorities are).

My third question is simply *Are the stakeholders at the end of the e-waste supply chain (in Ghana) willing to collaborate to find a workable solution?* This question will try to explore the possibility of using stakeholder engagement as a means of resolving some of the issues stakeholders identify.

1.7 Theoretical Framework

1.7.1 Environmental Justice

This research will use the environmental justice framework in the analysis of the first research question.

Environmental justice is the principle that "all people and communities are entitled to equal protection of environmental and public health laws and regulations" (Bullard, 1996, as cited in Brulle and Pellow, 2006, p 104). According to the United States Environmental Protection Agency (EPA), environmental justice is "the fair treatment and meaningful involvement[5] of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies" (EPA, 2016).

[5] Meaningful involvement means: People have an opportunity to participate in decisions about activities that may affect their environment and/or health; The public's contribution can influence the regulatory agency's decision; Community concerns will be considered in the decision making process; Decision makers will seek out and facilitate the involvement of those potentially affected" (US EPA, 2016).

Brulle and Pellow (2006) distinguish between environmental justice and environmental inequality (or environmental injustice). They state that environmental inequality "refers to a situation in which a specific social group is disproportionately affected by environmental hazards". Moreover, they add that "a specific form of environmental inequality is the phenomenon of environmental racism[6]" (Brulle and Pellow, 2006 p. 104).

1.7.2 Types of Environmental Justice

Kuehn (2000) describes four types of environmental justice, namely: distributive justice; procedural justice, corrective justice and social justice (Rechtschaffen & Gauna, 2002).

Distributive justice is simply, the equal allocation of environmental benefits and risks for everyone especially for marginalised people. Specifically, it has to do with the results of allocation and not the procedure for getting the results. Kuehn (2000) notes that, it is not about the reallocation of environmental hazards, but rather the reduction of the hazards. He also adds that environmental justice includes the allocation of environmental programs and policies, for example, safe drinking water and parks (Rechtschaffen & Gauna, 2002).

Procedural justice is about how fair a "decision making process" is, that is, everyone should be given the same amount of respect and consideration in the allocation of environmental benefits. Advocates for environmental justice claim that people with "political power" and "resources" enjoy the environmental benefits while people of color and low income communities disproportionately bear environmental risks. Advocates also assert that involving marginalized

[6] Chavis, first defined the term environmental racism in the following manner: "Environmental racism is racial discrimination in environmental policymaking, the enforcement of regulations and laws, the deliberate targeting of communities of color for toxic waste facilities, the official sanctioning of the life-threatening presence of poisons and pollutants in our communities, and the history of excluding people of color from leadership of the ecology movements" (p. 278) (Chavis as cited in Brulle and Pellow, 2006, p 104)

groups in “decision-making” as well as the provision of “legal and technical resources” will aid in the achievement of procedural justice (Rechtschaffen & Gauna, 2002).

Corrective justice is about how fairly people or corporations are penalized for an offense and making them accountable by correcting what they did wrong. Kuehn (2000) prefers the term corrective justice over; “retributive justice, restorative justice, compensatory justice and commutative justice” because he believes it is a better representation of this aspect of environmental justice (Rechtschaffen & Gauna, 2002).

Finally, Social justice is about ensuring that everyone in society has the basics a human being needs (“enough resources and power”) and the groups who have advantages account to society in the usage of their privileges (Rechtschaffen & Gauna, 2002).

1.7.3 History

Adeola (2011) describes environmental justice as a “targeted response to patterns of environmental inequities and the corresponding injustices” (p.173). Having started in the 1980s, the environmental justice movement in comparison to the mainstream environmentalism is a newer movement (Adeola, 2011). Cole and Foster (2001) point out that associating a particular date or an event to the commencement of the environmental justice movement can be challenging, as several struggles occurred globally over many decades. Gosine & Teelucksingh (2008) add that environmental justice is not unique to the United States, however, they point out that certain concepts, frameworks and approaches came from the Southeastern United States.

Although, some refer to the birth of the environmental justice movement as having started during the protests in Love Canal, New York pollution (Adeola, 2011), numerous studies claim that the environmental justice movement began in Afton, Warren County, the poorest county in North

Carolina. Warren County's population was mainly African American (Bullard & Lewis, 1996; Adeola, 2011; Mohai et al., 2009) and it was chosen for dumping of toxic waste (30,000 gallons of PCB laced soil) in 1982 (Gosine & Teelucksingh, 2008; Geiser and Wanek, 1983 as cited in Cutter, 1995). Residents used American civil rights movement tactics to try to stop the disposal of toxic waste in their community, it was however unsuccessful (Bullard, & Lewis, 1996; Gosine & Teelucksingh, 2008). There were demonstrations, jailings and marches. These were highly publicized in the media and resulted in the Congressional Black Caucus asking the US General Accounting Office to look into the placing of toxic waste in communities with high percentages of people of colour in 1983 (Cutter, 1995; Adeola, 2011; Gosine & Teelucksingh, 2008; Mohai et al., 2009).

Although, it took over 20 years before remediation was completed in Afton, Warren County (Gosine & Teelucksingh, 2008), it had a ripple effect throughout the United States, where different marginalized groups utilized the same strategies to protest or stop various placements of toxic waste in their neighbourhood (Gosine & Teelucksingh, 2008; Adeola, 2011). Agyeman (2005) states that the environmental justice movement is now made up of civil rights groups, antitoxics groups, occupational and environmental groups, religious groups, farm workers, tenant associations, professional not-for-for profit groups, academics, labour unions, university research centers amongst others (Adeola, 2011). It also raised awareness of how the environmental regulation process discriminated against minorities and was instrumental in furthering research, policy and advocacy in other parts of North America (Gosine & Teelucksingh, 2008).

Robert Bullard, a sociologist, termed locating of toxic waste dumps in black communities and far from white middle-class communities as the "PIBBY principle" or "Place in blacks' backyards" (Gosine & Teelucksingh, 2008). Mohai et al., (2009) claim that locally unwanted land uses

(LULU) led to “NIMBY”ism (Not in my backyard), which ultimately resulted in “PIBBYism”. Chavis and Bullard have cited such occurrences as environmental racism (Bullard, & Lewis, 1996). Critics however claim that, environmental racism does not exist and the concept of “race” is divisive and takes away from “main” environmental issues (Gosine & Teelucksingh, 2008). Some people believe that income and not race is the main driving force behind injustices; this is known as the race versus class debate. Notwithstanding, there have been many studies that show that race is the main reason for environmental inequality, (Mohai et al., 2009; Cutter, 1995).

According to Mohai et al., (2009), allegations of environmental justice are controversial for the following reasons. First, since the inception of environmental justice movement, mainstream environmentalists did not include social justice and equity issues and some argue that they still do not. Secondly, although majority of studies support environmental justice claims, a few studies argue against those claims. Thus, it makes it more difficult to prove that people of color and people with low incomes experience a higher hazardous exposure, especially as it has policy implications. Thirdly, resolving an environmental injustice can be challenging, as policy could be expensive and complex and even international in nature.

There are numerous milestones associated with the environmental justice movement’s growth (Adeola, 2011). A few are highlighted below. One important outcome is the “First People of Colour Environmental Leadership Summit” which came up with 17 principles of environmental justice. See appendix A. These principles “reflect the civil rights norms and the universal human rights declarations, to serve as a guide for developing and evaluating policies and programs for environmental and social justice…”(Adeola, 2011, p 174).

Another significant outcome of the environmental justice movement was that President Clinton signed the Executive order 12898, in order to deal with the unfairness associated with federally funded government programs that disproportionately affected the environment of minorities and people with low income (Adeola, 2011; Bullard, 2000; Brulle & Pellow, 2006). The Basel Convention on the Control of Trans-Boundary Movements of Hazardous Wastes and their Disposal is another significant outcome of the environmental justice movement; it regulates the international dumping of hazardous waste (Adeola, 2011).

1.7.4 Relevance of Environmental Justice to E-waste "dumping" in the Global South

Environmental justice is currently global and it is used in the Global South context, that is, in issues related to the disproportionate allocation of environmental hazards and risks in "air and water pollution, environmental disasters, climatic changes, food insecurity, and extractive industries" (Tschakert, 2009, p.706 -7).

Evidently, the protests of people not wanting hazardous waste in their neighbourhoods in the Global North led to a shortage of locations to dump these wastes and ultimately led to the birth of the hazardous waste trade from the Global North to the Global South countries (Mohai et al., 2009). Moreover, Mohai et al. (2009) state that although the electronics industry executives and elected officials have "declared electronics an ecologically pristine and sustainable sector" (p. 420), the reality contradicts these claims. The industry is characterized by unsafe working conditions due to the industries heavy reliance on chemicals. They also produce a high volume of waste at the manufacturing stage of their products. Unquestionably, the disposal of electronic waste is also a challenge due to the toxic content of their products (Lundgren, 2012); and are shipped from the Global North to be "recycled" or trashed in Global South countries'

"backyards" (Pellow, 2007; Clapp, 2001). The e-waste trade is a newer form of the hazardous waste trade (Kone, 2014). The Global South countries invariably do not have the capacity to safely recycle or dispose of these toxic wastes, resulting in adverse impacts on human health and their environment (Lundgren, 2012). Although, there is international legislation to regulate the transboundary movement of hazardous waste, the Basel Convention, it has not been effective in stopping such global dumping of e-waste (Adeola, 2011). This is a grave environmental injustice as poorer nations have to bear the brunt of disposing hazardous waste that richer countries generate.

As Bullard and Lewis (1996) point out "the goal of an environmental justice framework is to make environmental protection more democratic. More importantly, it brings to the surface the ethical and political questions of "who gets what, why, and in what amount" Who pays for and who benefits from, technological expansion?" (p11). He also states that the "environmental justice movement attempts to uncover underlying assumptions that may influence environmental decision making" (p 10).

Moreover, in Hungary, at a 2005 environmental justice conference, environmental justice was said to "mean something different in every context". Pellow (2007) adds that it commonly has "social inequalities and environmental harm" Pellow (2007). In Agbogbloshie, Ghana, the exports of mainly "dead" electronics negatively affect, people; in terms of their health and their environment. The environmental justice framework is therefore a relevant lens through which to analyze the e-waste trade from the Global North to the Global South.

1.8 Structure of the paper

This paper is divided into six chapters. Chapter 1 begins with an introduction to the study from a sustainability perspective. It describes the background to the global e-waste industry and highlights the problems associated with the increasing growth of e-waste. Chapter 1 also outlines the objectives, importance and justification of the study as well as the research questions and the theoretical framework used for the study. Chapter 2 presents various definitions and types of e-waste, the growth and value of e-waste and issues associated with its quantification. The global disposal methods are also described, as well as the history and current form of the e-waste trade. Chapter 2 also discusses the dilemma of e-waste as it is has great value and hazardous content as well. Challenges of improper management and disposal of e-waste in the Global South are also discussed. It finally looks at the regulation of e-waste globally. Chapter 3 introduces Agbogbloshie Scrapyard, the location of the case study. The local context of the e-waste trade, growth and management and disposal of e-waste as well as the various types of e-waste informal workers and what they do are discussed. Chapter 4 describes how the research was designed, the site selection, sample and sample selection and observations that were made at the research site. It also discusses how data for the research was managed and how confidentiality for the research is being maintained. Chapter 5 presents the findings of the research on; risks and benefits of e-waste management, next steps towards a more environmentally friendly way of e-waste management and willingness for stakeholders to engage. It then discusses the findings. It also analyses the risk and benefits of e-waste management in Agbogbloshie to the local communities through an environmental justice lens. Finally in Chapter 6, recommendations are made based on best practices from the electronic industry and other industries. Some solutions use inputs from stakeholders of this research.

CHAPTER 2 Global Context of e-waste and the e-waste trade

2.1 Introduction - Hazardous/E-waste background

The mid 1900s saw an increase in capitalism and wealth, this resulted in a new era, in which the generation and disposal of hazardous and nonhazardous waste was seen as a normal part of the capitalist system. In the Global North, it was generally believed that the earth was capable of absorbing toxic waste as well as repairing itself without any adverse impact irrespective of the toxicity of the waste dumped (Adeola, 2011). In the United States for example, during an era of lax regulation, over 5 billion metric tons of very hazardous chemicals were disposed of in an environmentally unsound manner (Cunningham and Saigo 2007 as cited in Adeola, 2011).

2.2 Consequences of hazardous waste increase

Increasingly, society is becoming more dependent on electronics (Pellow, 2007). This increasing global demand for EEE is associated with a decreasing life span of EEE, which has dramatically increased the growth of e-waste (Bridgen et al., 2008). Gosine & Teelucksingh (2008) note that as hazardous waste production increased there was a simultaneous rise in environmental justice movements, which was attributed to the fact that most hazardous wastes were dumped in marginalized communities. As seen earlier, environmental justice, is simply the distribution and/or fairness of the distribution of environmental and health risks and benefits. It also looks at who bears the benefit or the cost of the risk (Gosine and Teelucksingh, 2008; Rechtschaffen and Gauna, 2002). Coupled with the dumping, there was evidence that these wastes could have an adverse effect on human health and the environment in these communities (Marbury, 1995).

Consequently, hazardous waste disposal locations were significantly reduced and difficult to find as people resisted the placement of toxic waste in their communities (Clapp, 2001; Kummar as cited in Gwam, 2001; Gosine and Teelucksingh, 2008). This resulted in what is known as "NIMBYism" or 'not in my backyard' (Clapp, 2001). An era of stricter regulation and increased costs of waste disposal in the Global North followed "NIMBYism". The challenges associated with waste disposal culminated in a new problem of disposing hazardous waste in poorer countries (Clapp, 2001; Pellow, 2007; Kummar as cited in Gwam 2001).

2.3 Significance of Illegal Trade

The value of the formal waste market is about 410 billion USD per annum (Rucevska et al., 2015). Big business! Notably, big businesses have various avenues for illegal activities to coexist within the legal business transactions (Rucevska et al., 2015). Not surprisingly, there is an illegal market for e-waste. Unfortunately, the size of the illegal waste trade worldwide is not known (Rucevska et al., 2015). Evidently, the hazardous waste is at times disposed of illegally in the Global South. A major portion of the waste consists of e-waste, which is made of electronics that are mainly at the end of their life cycle or cannot be used (Margai, 2010).

2.4 E-waste

2.4.1 Quantity of e-waste generated

Approximately, 41.8 million metric tonnes (Mt) of e-waste was produced in 2014; this figure has been predicted to grow to 50 Mt by 2018 (Balde et al., 2 015). However, as stated below, two UN studies caution to treat waste data with care (Bournay, 2006**;** Baker, 2004). For a better understanding of this UN caution, an extensive review of what e-waste is and the types of e-waste can be found below.

2.4.2 What is e-waste?

Electronic waste or e-waste is also known as Waste Electrical and Electronic equipment (WEEE), e-scrap (Balde et al., 2015). Merriam Webster's dictionary defines e-waste as "waste consisting of discarded electronic products (as computers, televisions, and cell phones). Although, this definition gives a general idea of what e-waste is, it fails to give a very comprehensive idea of what e-waste really is. This is because it does not fully portray the potential array of e-waste. There are various definitions of e-waste; a UN study (UNEP, DTIE, 2007a), Lundgren (2012), Adeola (2011) and Baker (2004) state that there is no common definition of e-waste.

Defining what electrical and electronic equipment (EEE) is essential in understanding what e-waste is. Solving the E-waste problem (STEP, 2014) provides a foundation for the definition of e-waste by stating that electrical and electronic equipment (EEE) is "any household or business item with circuitry or electrical components with power or battery supply" (STEP, 2014, p.4)

The following are various definitions of e-waste;

The Organisation for Economic Co-operation and Development (OECD) defines e-waste as "any appliance using an electric power supply that has reached its end-of-life" (UNEP, DTIE, 2007a). See table 1 below for some common definitions of e-waste.

Adeola (2011) claims that the best definition from the list of common definitions table below, is the US EPA's definition, as it covers a wide range of all kinds of "conceivable" e-waste. Nevertheless, the United Nations (UNEP, DTIE, 2007a) and the International Labour Office (ILO) (Lundgren, 2012) state that the European Commission Directive 2002/96/EC has the most recognized definition of e-waste. It defines e-waste as "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) as cited in Lundgren, 2012). See appendix B for the Directive's categories and subcategories of EEE.

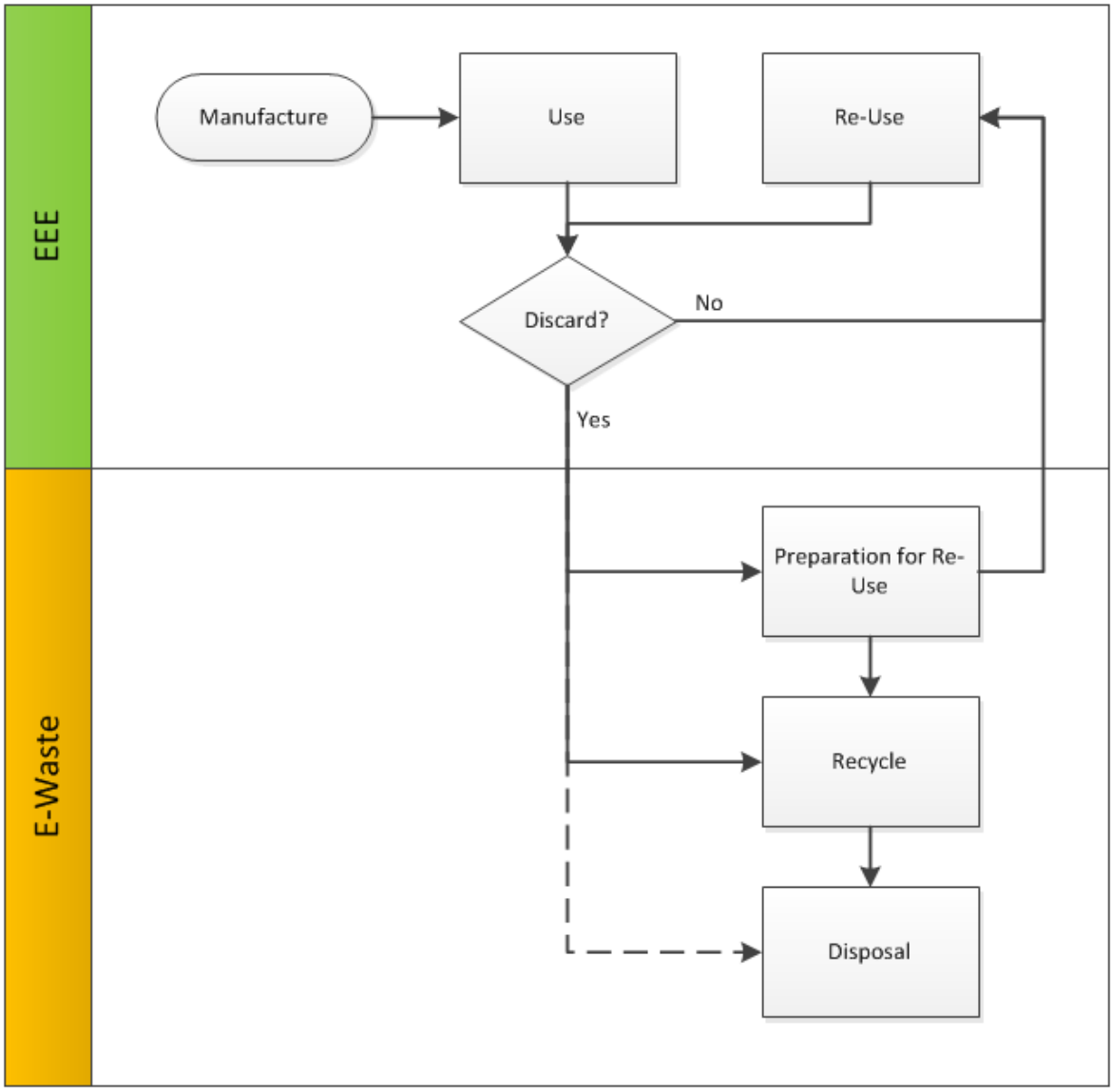
Table 1 Common definitions of E-waste

Definition	**Source**
E-waste is a term used to cover almost all types of electrical and electronic equipment that has entered or could enter the waste stream. It is also known as WEEE (i.e., waste electrical and electronic equipment).	STEP (2008)
E-waste includes computers, entertainment electronics, mobile phones and other items that have been discarded by their original owners because they were obsolete, broken, or beyond repair.	New World Encyclopedia
E-waste refers to electronic products that are "near' or at the "end of their useful life."	US EPA
WEEE/E-waste is defined as any appliance using an electronic power supply that has reached its end-of life(EOL).	OECD (2001)
E-waste encompasses a broad and growing range of electronic devices ranging from large household appliances such as refrigerators, air conditioners, cell phones, stereos, and consumer electronics to computers that have been discarded by their owners.	Basel Action Network (Puckett and Smith, 2002)
E-waste is a term used loosely to refer to obsolete, broken, irreparable or unwanted electronic equipment , or unwanted electronic equipment such as TVs, computers, and computer monitors, laptops, CPUs, printers, cell phones, copiers, fax machines, scanners, stereos, or video gaming systems, and associated wiring.	2009 CRS Luther Report for Congress

Source: Adeola, 2011

See Figure 1 for a depiction of when a product could be considered as EEE and the transition after which it is considered e-waste as well as when it becomes EEE again. The point at which EEE could become e-waste, adds a level of complexity to the definition of e-waste. This is because when EEE becomes e-waste is "subjective" as individuals determine when their EEE becomes e-waste or even if it will be reused (STEP, 2014).

Figure 1 EEE and its transition into e-waste



Source: STEP (2014)

2.4.3 Types of E-waste

Various types of e-waste are depicted in the table below. According to a United Nations University study report (Balde et al., 2015), each of the five types of e-waste shown in the table below varies by "original function, weight, size, material composition"; these characteristics

"determine economic values, different waste quantities and environmental and health impacts" (Balde et al., 2015, p.13).

Table 2 Types of e-waste

Five types of e-waste (Balde et al., 2015)	Three types of e-waste (Adeola, 2011)
1. "Temperature exchange equipment. Also more commonly referred to as, cooling and freezing equipment. Typical equipment is refrigerators, freezers, air conditioners, heat pumps.	1. Large household appliances also known as "white goods" – for example dishwashers, refrigerators, washing machines, microwaves.
2. Lamps. Typical equipment comprises straight fluorescent lamps, compact fluorescent lamps, fluorescent lamps, high intensity discharge lamps and LED lamps).	2. Information technology and telecommunication equipment also known as "brown goods" for example PCs laptops, printers, fax machines, scanners.
3. Large equipment. Typical equipment comprises washing machines, clothes dryers, dish washing machines, electric stoves, large printing machines, copying equipment and photovoltaic panels.	3. Consumer entertainment/information equipment also known as "gray goods", for example Tvs, VCRs, MP3 players, telephones, cell phones, stereo equipment, transistor radios.
4. Small equipment. Typical equipment comprises vacuum cleaners, microwaves, ventilation equipment, toasters, electric kettles, electric shavers, scales, calculators, radio sets, video cameras, electrical and electronic toys, small electrical and electronic tools, small medical devices, small monitoring and control instruments).	
5. Small IT and telecommunication equipment. Typical equipment comprises mobile phones, GPS, pocket calculators, routers, personal computers, printers, telephones)" (Balde et al., 2015).	

2.4.4 Waste Data warning, handle with care! (Bournay, 2006)

A UN study cautions "that all data on waste should be handled with care" as it is complex, subjective and can be controversial (Baker, 2004). In addition, it notes that there are various ways of defining, describing and counting it depending on how one views it. Some use the origin of the waste, others use the composition, toxicity or how it is handled or managed to classify waste. Due to these differences, it is problematic when generating comparable data.

As illustrated above, there are numerous definitions of e-waste. The problem with having different definitions of e-waste is that, it affects the quantification and regulation of e-waste, as well as tracking of illegal shipments (Pellow, 2007; Baker, 2004). In addition, not having a

standard classification of the types of e-waste adds a level of complexity to the e-waste regulation, definition and quantification. This paper uses the European Commission Directive 2002/96/EC definition of e-waste, which the ILO and UNEP acknowledge as the most recognized definition (Lundgren, 2012). Therefore, for the purposes of this paper e-waste is "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) as cited in Lundgren, 2012). This seems to be is the most comprehensive and more inclusive definition. Moreover, the directive has categories and subcategories of EEE, making it easier to find out what e-waste is and what e-waste is not. See appendix B.

2.5 Growth of E-waste

According to Agarwal et al., (2006) "Modernisation and technology are now considered symbiotic" (Pellow, 2007, p.185), electronics are found in every sector of society for example, in the Global North, various institutions such as the military, media, education and health care are heavily dependent on information technology for managing, processing and storing of data (Pellow, 2007). The electronic industry has become the biggest industry globally (Puckett et al., 2002). Not surprisingly, e-waste has seen an exponential growth globally over the last couple of decades. It is also experiencing the fastest growth amongst various waste streams. Currently, e-waste makes up about 8% of municipal waste, with an estimated annual growth rate of 3-5 % (Bournay, 2006).

2.5.1 Why has e-waste grown?

There has been an increase in the use of EEE (Adeola, 2011). Globally, the increase in EEE consumption is proportional to the increase in the disposal of e-waste (Widmer et al., 2005). As

noted earlier, capitalism and the increase in wealth, have contributed to the rapid growth of hazardous waste (Adeola, 2011). According to Rucevska et al., (2015), "rising global population, urbanization and consumption" are responsible for the ever growing amounts in waste. A United Nations (UN) report attributes the exponential growth of e-waste to "the increasing "market penetration" in developing countries, "replacement market" in developed countries and "high obsolescence rate" (UNEP DTIE, 2007a). Lundgren (2012) adds that the rise in internet use and lower priced EEE are partly responsible for the increase in e-waste. Macauley et al. (2001) state that the global economy depends heavily on ICT and this has resulted in an increased demand in EEE (Nnorom & Osibanjo, 2008). The increasing global demand for EEE and decreased life span of EEE has resulted in a rapid growth of WEEE (Bridgen et al., 2008).

Currently, most electronics are regarded as "disposable goods" due to a high rate of technological "improvement". The rate at which the technological industry changes is very fast for example, consumer electronics especially computers become outdated about every 18 months when a new, faster and more efficient microchip is produced; as predicted by Gordon Moore in 1965 (Pellow, 2007). Culver (2005) points out that the life span of a computer has been reduced to 2 years(2005) from 4- 6 years (1997)(Widmer et al., 2005). In addition, more consumers find it cheaper and convenient to buy new EEE instead of repairing their malfunctioning EEE (Pellow, 2007). This reinforces the aforementioned fact that the life span of electronics has become much shorter. It also implies that the reduction in the cost of EEE has increased ownership. Thus, increased consumerism has led to the "throwaway consumer culture" and has resulted in the increase in e-waste generation (Pellow, 2007).

Unfortunately, this culture is backed by government and industry for example, certain policies the government implements, supports this throwaway culture of consumers. An illustration of such a policy is when the Federal Communications Commission came up with a regulation that allows consumers to change their phone carriers and keep their numbers. However, most companies require consumers to buy new cell phones if they change carriers and this increases the rate at which cell phones become WEEE. Moreover, the industry supports regulations that increase their bottom line, even if it adversely affects the environment (Pellow 2007).

2.6 Global e-waste disposal methods

Balde et al. (2015) describe four main ways e-waste is disposed of throughout the world. The first is the *official take back systems*, in which there is legislation under which retailers, commercial pick up services and municipalities collection are methods by which e-waste is collected. The e-waste is then processed in an environmentally friendly manner in state-of-the-art recycling centres. This disposal method is found in the Global North as well as the Global South. The following are the percentages of e-waste processed by some countries or regions using this type of system. In the European Union, it is about 40%, in the US and Canada it is estimated to be about 12%, whereas in China and Japan the estimates are between 24% and 30% and in Australia it is about 1% (Balde et al., 2015).

The second type of system is what Balde et al. (2015) named the *disposal of e-waste in mixed residual waste*. In this system, the consumers throw away their EEE with their regular garbage. Very little of the e-waste is sorted in this system, most of it is either landfilled or incinerated. This method is used in both the Global South and Global North. Incineration emits toxic fumes into the environment whereas landfilling can result in the leaching of toxins. These two ways of disposing e-waste, end in loss of resources (Balde et al., 2015).

The third system, Balde et al. 2015 describe as the *collection of e-waste outside the official take-back systems in developed countries*. In this system, e-waste is sold by individual waste dealers or companies to businesses such as metal recyclers, plastic recyclers, specialised e-waste recyclers or is exported. There is no documentation of the quantities sold or exported as there is no reporting structure and a possibility of e-waste being sent to the Global South, especially as very little of the e-waste is processed in state of the art facilities (Balde et al., 2015).

The fourth system is the *informal collection and recycling in developing countries*. In this setup, there are a lot of self-employed people who collect and recycle waste. Normally, they purchase e-waste from people by going from door-to door. They sell their merchandise to recyclers and refurbishers. The recyclers mainly use environmentally "unfriendly" methods such as openly burning components of e-waste or acid leaching to retrieve metals and dumping of hazardous remains of e-waste. These countries do not have recycling facilities and legislation for managing e-waste in an environmentally sound manner. They also note that this system facilitates the e-waste trade and is a source of livelihood for the informal workers (Balde et al., 2015).

2.7 The E-waste trade from the Global North to the Global South

2.7.1 How the e-waste trade began

In the 1980s hazardous waste was initially sent to Africa and later sent to Latin America, South Asia, and Eastern Europe (Pellow, 2007). Pellow (2007) adds that these wastes are generated in the United States, Europe and Japan. Globally, China is believed to be the biggest e-waste global destination (Lundgren, 2012); this can be attributed to the fact that China has a high demand for e-waste as raw material for manufacturing and for satisfying the high demand of cheaper used EEE (Balde et al., 2015; Lundgren, 2012). Clinard and Yeager (1980) state that there is a high probability for shipments to Africa to be WEEE or low quality used products. Kone (2014) also

describes the hazardous waste "trade" as the "new toxic waste colonialism" which he claims "can take various forms. Often masked as the exportation of valuable goods, large amounts of discarded computers, mobile phones and other electronic junk, as well as old cars and refrigerators are sent to Africa all filled with hazardous substances…"(p. 1). Toxic colonialism is simply "waste dumping on the African Continent"; a term coined by a West African Head of State (Pellow, 2007). Thus the e-waste trade is a newer form of the hazardous waste trade. Moreover, the Basel Convention classifies e-waste as hazardous waste (Widmer et al., 2005).

According to the state of the World 2004 report, 12 percent of people in the world (North America and Western Europe) consume 60% of the world's natural resources whereas, Asia and sub-Saharan Africa (that is one third of the world population) consumes merely 3.2 percent (Pegg, 2004). This implies that the rich countries generate more hazardous waste.

As stated above, problems with finding dumpsites for hazardous wastes in the Global North led to illegal dumping in the Global South. Unsurprisingly, about 80% of old EEE sent for recycling in the Global North ends up being sent to the Global South countries (Lundgren, 2012) either legally or illegally and are already e-waste or close to the end of life (Osibanjo & Nnorom, 2007). See Figure 2 for a map depicting some known and suspected sources and destinations for the illegal trading of e-waste. This map corresponds with the consumption behaviour noted above.

Figure 2 known and suspected sources and destinations for the illegal trading of e-waste

Source : Dayeni and Doucette (2005) as cited in Pellow (2007).

Figure 2 shows that there is no way of tracking both legal and illegal dumping or importation of e-waste and this makes quantitative data on the actual volumes and all destinations inaccurate. Rucevska et al. (2015) point out that e-waste is disguised as other items or secondhand goods in order to mislead law enforcement authorities. Clapp (2001), notes that sometimes, the e-waste is shipped under the pretext of "working equipment" and as donations. This compounds the difficultly in accurately tracking and quantifying the amount of e-waste. Unfortunately, most Global South destinations accept these "donations" in the hope of reducing the technology gap only to find out that some of these "gifts" are not working or close to the end of life (Pellow, 2007). Invariably, the electronics close to the end of life (Gabel, 2011) becomes e-waste sooner

than later and adds to the volumes of hazardous waste (Robinson, 2009). Lundgren (2012) notes that e-waste is sent to Global South hotspots such as China, India and Pakistan in Asia and now to countries such as Nigeria and Ghana. According to Rucevska et al. (2015), normally when a country implements strict regulations it results in changes in illegal routes.

2.7.2 What led to the hazardous trade (from The Global North to The Global South)?

As mentioned earlier, in the Global North, "NIMBYism" or "Not in my backyard" was borne out of people protesting the placement of hazardous waste in their communities which led to the problem with finding adequate locations for hazardous waste disposal and this led to the dumping of hazardous waste in poorer countries (Clapp, 2001).

In addition to "NIMBYism" and the increase in the generation of hazardous waste production, the following are other factors that have contributed to the rise in the transfer of these hazardous wastes to the Global South.

There are stiff waste handling and disposal regulations in the Global North, whereas the Global South regulations regarding waste handling and disposal are not rigid. Also it is comparatively cheaper for Global North companies or individuals to dump waste in the Global South (Clapp, 2001; Pellow, 2007). Additionally, globalization (Lundgren, 2012; Pellow 2007; Gwam 2001) and trade liberalization policies increased access to global markets (Pellow, 2007; Clapp, 2001) and these have also facilitated this trade.

Moreover, the Global South needs foreign currency as it helps them to reduce their indebtedness. This indebtedness resulted from a "long history of colonialism and contemporary loan and debt arrangements between southern and northern nations" (Porterfield & Weir, 1987). For example,

the International Monetary Fund (IMF) and the World Bank's Structural Adjustment Programs (SAPs) adopted by the Global South; required the Global South to liberalize their trade and investment policies. In order to reduce their indebtedness, some Global South governments agree for waste to be shipped to their countries (Porterfield & Weir, 1987). In addition to SAPs, institutional weakness in the Global South countries makes them economically susceptible to toxic traders' offers (Clapp, 2001).

Lundgren (2012) claims that, the main driver for the illegal waste trade is profit. Widmer et al. (2005) echo Lundgren's (2012) claim by stating that the profitability of resources recovered from e-waste has culminated in the global waste trade. According to Widmer et al. (2005), in emerging countries, e-waste importation is not only a business opportunity, but also a means of meeting the high demand for cheap used EEE. Balde et al. (2015) emphasise Widmer et al.'s (2005) statement above by noting that, the main reason facilitating the e-waste trade is the demand for cheap second hand EEE and cheap raw materials.

Pellow (2007) identifies a "racist and classist culture and ideology in the Global North that believe "dumping on poor communities as perfectly acceptable" as another reason this trade exists (p. 9). This viewpoint can be seen in an infamous memo written by Lawrence Summers (1991) the Chief Economist and Vice President of the World Bank at the time. See appendix C for the memo. The "toxic technology transfers schemes around the planet" funded by the World Bank is an example of how this ideological position is seen in some World Bank policies and practices (Pellow, 2007, p. 9). In my opinion, such ideologies have encouraged inconsiderate and cruel acts of inhumanity which have contributed to higher mortality rates in the Global South.

2.8 E-waste Dilemma

E-waste is complex, Widmer et al. (2005) state that "e-waste is an emerging problem as well as a business opportunity of increasing significance" (p.1). Balde et al. (2015) describe e-waste as a potential "urban mine". See table 3 for the values and quantities of the urban mine. As noted earlier, in 2014, e-waste was valued at 48 billion Euros worldwide. This urban mine can be used to remanufacture, refurbish and in recycling if the amount of e-waste collected and level of recovery are high (Balde et al., 2015). EEE has plastics, valuable materials such as iron, copper, aluminium, and precious metals like gold, silver, platinum and palladium.

Although these valuables can mostly be recycled, it is currently not always profitable (Balde et al., 2015) especially with the high cost and stricter regulations associated with the proper management of e-waste in the Global North (Lundgren, 2012). Widmer et al. (2005) however, claim that metal recovery from e-waste is very profitable and has led to the e-waste trade. As noted previously, the cost of disposal is lower in the Global South. In addition, Zandi and Singh (2010) claim that e-waste reduces poverty levels (Oteng-Ababio & Amankwaa, 2014), as it provides hundreds of thousands of jobs to people (Lundgren, 2012) and exhibits entrepreneurship and creativity amongst the informal recyclers (Oteng-Ababio et al., 2015).

Table 3 Urban Mine

Materials	Kilotons	Million Euros
Metal		
Iron, Steel (Fe)	16500	9000
Copper (CU)	1900	10600
Aluminium(Al)	220	3200
Precious Metals		
Gold (Au)	0.3	10400
Silver (Ag)	1.0	580
Palladium (Pd)	0.1	1800
Plastics		
PP, ABS, PC, PS	8600	12300

Source: Balde et al., 2015

As stated above e-waste is an emerging problem. Although, e-waste is an urban mine that can be recycled and reused (Balde et al., 2015), it also has toxic contents like mercury, lead and cadmium (Balde et al., 2015; Widmer et al., 2005) or a "toxic mine" as described by Balde et al. (2015) which is shown in Table 4 below.

Table 4 Toxic Mine

Metals	**Chemicals**
Mercury, Cadmium	Poly-/Brominated Flame Retardants in Plastics
Chromium	Phosphors
Lead Lead glass – 2200 kilotons	PCBs/A Polychlorinated biphenyl (old capacitors)
	Hexavalent chromium (PVV)
Components Batteries – 300 Kilotons	Ozone depleting substances (CFCs, HCFC, HFC, HCs) -4.4 Kilotons

Source: Balde et al., 2015

2.9 E-waste "mismanagement" and potential impacts

As mentioned above, when e-waste is not properly managed and disposed of, it can affect the environment and human health in a negative manner (Adeola, 2011). Balde et al. (2015) note that, the best practice that currently exists for e-waste management and disposal is to process e-waste in an environmentally friendly manner in state-of-the-art recycling centres. Thus, e-waste presents a challenge as it needs to be handled and recycled in a safe manner to prevent environmental depredation and harm to human health. Unfortunately, solid waste management in the Global South is a challenge (Oteng-Ababio, 2010) and not surprisingly, the e-waste destinations in the Global South countries do not have the infrastructure or legislation in place to safely handle and dispose of these hazards (Lundgren, 2012).

Moreover, the informal sector mainly manages the e-waste in these e-waste hubs (Lundgren, 2012). The informal workers utilise rudimentary and unsafe methods to recycle e-waste and dispose of e-waste; they openly burn cables to recover copper and to reduce remains from e-waste (Adeola, 2011; Puckett et al., 2002) in order to make ends meet (The Lancet, 2013). These methods can expose the environment to pollutants that can seep into the atmosphere, groundwater, soil and waterways (Krueger, 2011). These workers "recycle" without any protective equipment thus exposing themselves and local communities to harm (Adeola, 2011; Lundgren, 2012; Krueger, 2011). Guiyu in China and Agbogbloshie in Ghana, are examples of environmental catastrophes, resulting from the e-waste trade as well as the improper management and recycling of e-waste (Balde et al., 2015). In Agblgbloshie and Guiyu, toxic metals have been found. For example, lead has been found in large quantities in Guiyu (Wong et

Table 5 Toxic heavy metals with established health effects

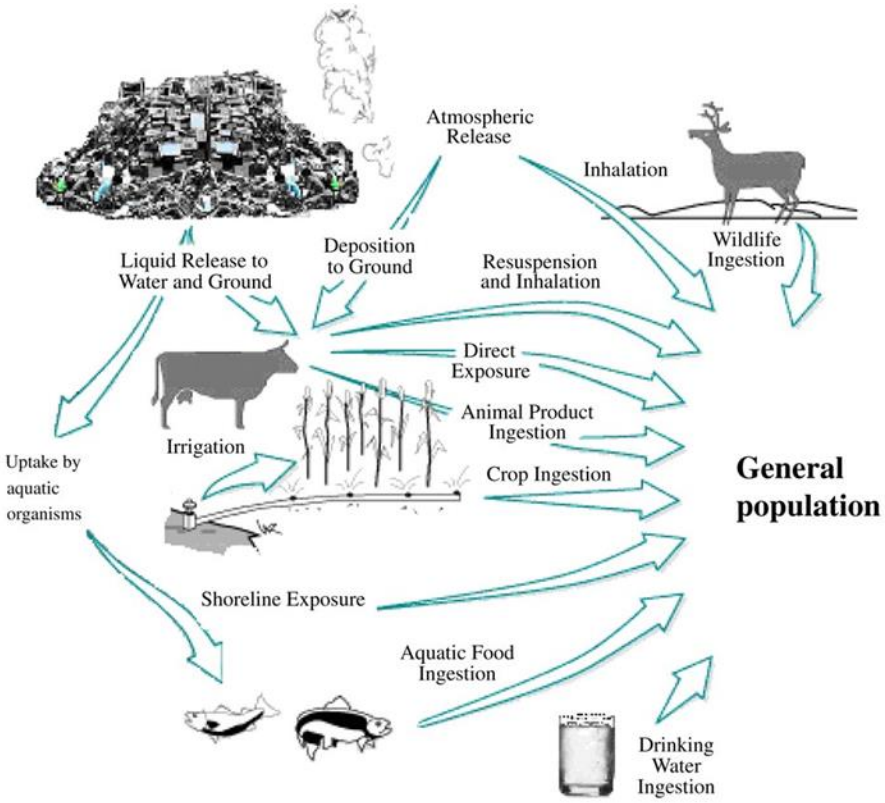
Heavy Metal	Sources of Environ mental exposure	Minimum Risk level	Chronic exposure toxicity effects
Lead	**Industrial, vehicular emissions, paints and burning of plastics, papers, etc.**	**Blood lead levels below 10 µg/dl of blood***	**Impairment of neurological development, suppression of the haematological system and kidney failure**
Mercury	**Electronics, plastic waste, pesticides, pharmaceutical and dental waste**	**Below 10 µg/dl of blood* Oral exposure of 4mg/kg/day****	**Gastro-intestinal disorders, respiratory tract irritation, renal failure and neurotoxicity**
Cadmium	**Electronics, plastics, batteries and contaminated water**	**Below 1 µg/dl of blood***	**Irritation of the lungs and gastrointestinal tract, kidney damage, abnormalities of the skeletal system and cancer of the lungs and cancer**

µg/dl*: micrograms per decilitre of blood
mg/kg**: milligrams per kilogram

Source: Kimani, 2007

al., 2007; Robinson 2009) and Agbogbloshie (Bridgen et al., 2008). Additionally, Chan et al. (2007) states that dioxin levels were found to be high in human hair, placentas and milk in Guiyu. This indicates that people in Guiyu are exposed to these toxins; which are a threat to their health (as cited by Robinson, 2009). Table 5 shows some heavy metals' source of exposure and health effects.

Figure 3 Exposure's routes and fate and behaviour of e-waste related mixtures of toxicants in the environment, including contamination of food chains



SOURCE: Frazzoli, C., Orisakwe, O. E., Dragone, R., & Mantovani, A. (2010).

Furthermore, e-waste is mainly non-biodegradable, and has toxic components (Adeola, 2011). Figure 3 shows that humans can be exposed to the toxic contaminants through their environments via the food chain, air inhalation and drinking water. The toxic metals can cause "neurological damage, kidney and liver dysfunction, skeletal problem, mental retardation and

developmental and reproductive disorders amongst other serious adverse health effects" (Adeola, 2011, p. 70). Evidently, e-waste is an environmental health hazard. Margai (2010) describes environmental health hazards as the "complete realm of disease causing agents, pathogens, events and processes in the external environment that threaten the health and well-being of people in their homes, neighbourhoods, communities and other surroundings" (Margai, 2010, p.4).

Unfortunately, there is little information on how environmental health has been affected by e-waste "especially their impact on terrestrial and aquatic ecosystem". Most researchers have tried to find "the nature of toxic substances associated with e-wastes and the presence of these in the environment with a limited number of studies focusing on human health" (Kiddee et al., 2013, p. 1240). Furthermore, there is a need for health risk assessments that examine the impacts of e-waste management and disposal in the Global South (Osibanjo & Nnorom 2007). According to McCarron et al. (2000), some results from epidemiological studies' differ from community's health perceptions (Agyei-Mensah & Oteng-Ababio, 2012). This differing results, creates uncertainty and can result in substandard environmental measures and "health and safety practices" (Moffatt and Pless-Mulloli 2003 as cited in Agyei-Mensah & Oteng-Ababio, 2012). Nonetheless, Adeola (2011) notes that the precautionary principle is being promoted worldwide. "This principle suggests that whenever there is scientific uncertainty about safety or potentially serious harm from chemicals or technologies, manufacturers or decision makers shall do everything possible to prevent harm to humans and the environment" (Adeola, 2011, p. 98).

2.10 Regulations governing e-waste management, disposal and trade

The adverse health effects led to a number of multilateral environmental agreements (MEAs) such as the Basel Convention and Bamako Convention (Margai, 2010). The Basel Convention is the "most comprehensive attempt at regulating hazardous wastes internationally" (Adeola, 2011, p.154). "The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted on 22 March 1989 by the Conference of Plenipotentiaries in Basel, Switzerland, in response to a public outcry following the discovery, in the 1980s, in Africa and other parts of the developing world of deposits of toxic wastes imported from abroad" (Basel convention, 1989).

Developed countries such as the United States resisted the formulation of this convention and this led to an amendment of the convention. The amendment however has a loophole that enables people to ship hazardous waste and renders the convention ineffective. Hazardous wastes are either shipped to the Global South under the guise of "recycling" or mislabeled, which mostly end up in the waste piles (Clapp, 2001). Although, the Basel Convention has been in existence for over 20 years, the trade in hazardous waste is still a major problem. This is evident in the current "underground" nature of the trade (Adeola, 2011). The data on volumes of toxic waste is unreliable, inconsistent and incomparable and there is no system of stringent monitoring and enforcement; these are some reasons why the Basel Convention is ineffective (Adeola, 2011).

The Bamako convention was another treaty formed by the members of the Organisation of African Union (OAU), which sought to totally ban the hazardous waste trade. Unfortunately, some countries in the Global North such as the US and the EU strongly resisted this convention that sought to totally ban hazardous waste, stating that it would "violate the General Agreement on Trade and Tariffs (GATT) rules" (Adeola, 2011). Although, the Bamako Convention has a

"broader scope" than the Basel convention (Marbury, 1995), its governing mechanism is weak because it lacks enforcement capabilities (Kaminsky, 1992).

Unfortunately, Both the Bamako and the Basel treaties have not been very effective in stopping the e-waste (Margai, 2010). There is still illegal dumping of e-waste in countries (Nnorom & Osibanjo, 2008) such as China (Lundgren, 2012) and other Asian countries, even though they have introduced legislation to deal with the e-waste challenges (Widmer et al., 2005). Besides, Zoeteman et al. (2010) add that, if a race to the bottom occurs" there will be an increase in the e-waste trade problem in West Africa and Eastern European destinations (Lundgren, 2012); dramatically increasing the e-waste burden especially for Global South countries such as Ghana which did not have any regulation to address the e-waste problem (Amoyaw et al., 2011), until a few months ago (Cudjoe, 2016).

Despite the fact that e-waste "recycling" may have some benefits such as providing lots of jobs (Lundgren, 2012), Jim Puckett from the Basel Action Network(BAN), other environmentalists, nongovernmental organisations and authors disagree with these said benefits. They contend that the e-waste trade is an environmentally unjust practice, especially for marginalised and impoverished communities in the Global South (Pellow, 2007; Adeola, 2011, Bridgen et al., 2008; Puckett et al., 2002). Moreover, NGOs such as Green Peace and BAN, have given voice to social issues such as, dumping of or WEEE in the Global South from the Global North, the use of child labour in e-waste recycling hubs such as Agbogbloshie; the occupational health and safety hazards of informal recycling, the resultant pollution from informal e-waste activities and its potential impact on human health and the environment (Bridgen et al., 2008; Puckett et al., 2002). They advocate for producers to do what is right by being responsible for the "end of life management and disposal" of their EEE products, and the need to formulate and implement

effective and enforceable regulation to combat the e-waste challenge (Bridgen et al., 2008; Puckett et al., 2002).

Conclusion

The e-waste dilemma has a high probability of becoming an uncontrollable nightmare in the long term, if interventions are not implemented soon. As seen in chapter 1, the impacts of e-waste dumping seem to be localized in the Global South countries; it could however impact Global North countries as well. The challenges associated with the generation and management and disposal of e-waste, especially the illegal "dumping of e-waste in the Global South can be addressed through environmental justice strategies in order to promote principles that are in line with sustainability.

Chapter 3 Local Context

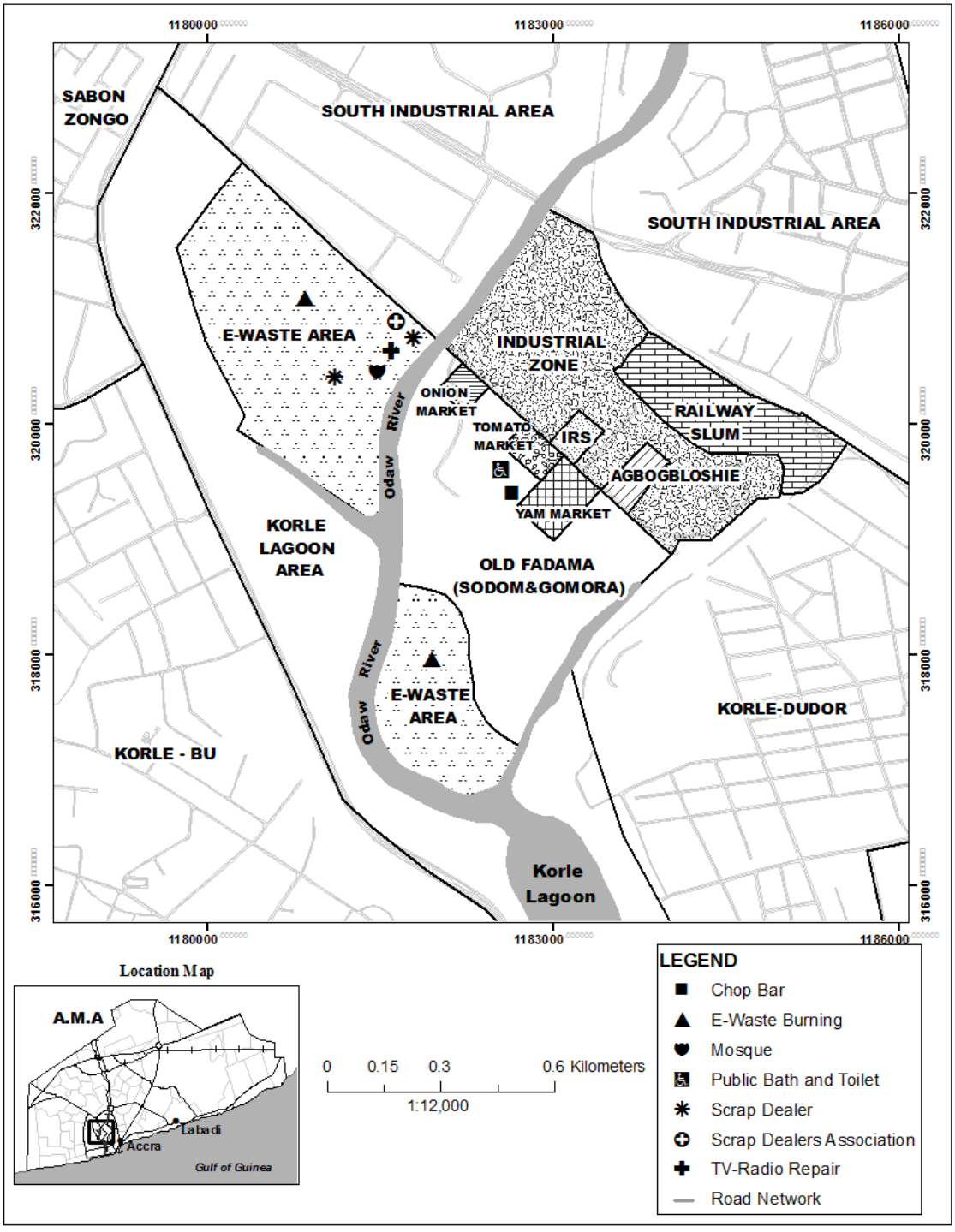
3.1 Introduction - Agblogbloshie/Old Fadama (History and Background)

Agbogbloshie is found in Ghana, West Africa (see figure 4). Ghana is bordered by the Gulf of Guinea and is situated between Togo and Cote D'Ivoire. Ghana covers a total area of 238,533 square kilometres, with a population of 25.7 million (CIA world fact book, 2015). Agblogbloshie is located in the capital city of Accra, which is found in the Greater Accra Region (see figure 4); one of ten regions of Ghana (Amoyaw-Osei et al., 2011). It covers an area of 146.21 hectares (Grant 2006; Agyei-Mensah & Oteng-Ababio, 2012). It is a triangular area bordered by Abossey Okai Road, the Odaw river ("in the upper reaches of the Korle Lagoon") and the Agbogbloshie drain (Grant, 2006; Agyei-Mensah & Oteng-Ababio, 2012), (see figure 5). It is also known as Agbogbloshie/Old Fadama, or Old Fadama (Grant 2006).

Figure 4 Map of Ghana showing the location of Agbogbloshie, in Accra.

Source: http://cctvafrica.cctv-news.net/wp-content/uploads/2014/01/Agbogbloshie-Market-in-Accra-Ghana-2.jpg

Figure 5 Location of the Agbogbloshie Scrapyard.



Source: Agyei-Mensah, S., & Oteng-Ababio, M. (2012)

Agbogbloshie is densely populated, with poor sanitation and residences made of wooden shacks and kiosks. It is made up of two settlements. The first settlement is Agbogbloshie, a formal

settlement with informal settlements around it. The poorer residents are located close to the boundaries of the settlement; near a railway line. It is also a trading hub with food markets, numerous stores and industries, a commercial bus depot, a tax office and some municipal offices. Although, the land is now public, a good number of the residents own their land. Next to Agbogbloshie is an informal settlement also known as Old Fadama. The residents here, do not own the land. This settlement has specialty food markets such as a yam market and an onion market. Old Fadama also has hawker markets and offers a number of services and business enterprises (Grant, 2006).

The Agbogbloshie Scrapyard was started at the beginning of the 1980s (Oteng-Ababbio, 2012), and the population of Agbogbloshie has grown steadily over the years to 79,684 (People's Dialogue, 2010 as cited in Grant, 2006).

Amoyaw-Osei et al. (2011) outline the following as reasons for growth in Agbogbloshie:

- "Spill-over population associated with the size and growth of the adjacent market;
- Migration from the north of Ghana, as an outcome of tribal conflict;
- Social downward movement by those forced out of more expensive areas in Accra, partly attributable to the impact of the Structural Adjustment Programme initiated in the early 1980s; and
- Cheaper settlement area free from bureaucratic constraints and high rentals in recognized formal areas in Accra" (p.3)

Agbogbloshie has had a long standing conflict over the land that spans over the following three time periods (Grant, 2006);

- "A period when traditional claims to the land clashed with colonial plans
- A period where the government of Ghana acquired the land over traditional claims and
- The contemporary period which has pitted the government of Ghana against the settlers" (p.8)(n.d.).

The current conflict is mainly over the boundaries of the settlements and the lagoon and who legally owns the land. Some of the legal issues involve the legality of the settlements, for instance; are the residents legally occupying the land, does their occupation of this land conflict with "the government's environmental and urban planning objectives" (Grant, 2006, p.8). These land conflicts have resulted in investors and residents not willing to put up permanent buildings (Grant & Oteng-Ababio, 2012).

As seen in figure 5, the Korle Lagoon borders the electronic waste (e-waste) area. The Korle Lagoon plays a significant role in the drainage system in the city of Accra. The drains in Accra are channeled through the Korle Lagoon as an outlet into the sea. The Lagoon however, has a lot of silt and waste dumped into it and this has built up over time, reducing the lagoon's ability to drain efficiently. This has made Agblogbloshie prone to flooding (Boadi & Kuitunen, 2002). The Korle lagoon, which once had fish and shellfish and provided the local community with a source of income (Boadi and Kuitunen, 2002); is now one of the most contaminated water bodies in the world (Lundgren, 2012). See figure 6 for an image of the Korle Lagoon at Agbogbloshie, Accra Ghana.

Figure 6 Korle Lagoon at Agbogbloshie

Source: Rucevska et al., 2015

In addition, the Government of Ghana obtained a loan to embark on a project (Grant, 2006) to "restore the lagoon to its natural ecology", desilt the lagoon in order to improve its drainage capability and to transform it into a major tourist attraction (Boadi and Kuitunen, 2002, p.308). The residents continually resist the implementation of this project as it involves them relocating (Grant 2006). On the other hand, the government is faced with pressure from the project's funders (Prakash et al., 2010). This pressure faced by the government thus compounds the ongoing conflict over the land. Amidst all these controversies over the land, some people who support the government's position on demolishing Agbogbloshie, have nicknamed

Agbogbloshie, *Sodom and Gomorrah* after a biblical settlement that was destroyed by fire and brimstone (Grant 2006).

Furthermore, there was little oversight of the land by the municipal authority and e-waste processing thus began to flourish (Grant & Oteng-Ababio, 2012). The Scrap dealers leased the land in 1994 (Amoyaw et al., 2011). Agbogbloshie is a metal scrapyard and the centre for processing or recycling numerous "recyclables" such as old lead-acid batteries and cars in Ghana. Agbogbloshie, has thus developed into a slum for scrap dealers and a place to dispose of e-waste and household waste (Prakash et al., 2010). Although, there are numerous recycling centres springing up in the country, Agbogbloshie has evolved into a major hub for informal recycling of e-waste in Ghana (Amoyaw et al., 2011). Even though e-waste scavenging only started about nine to ten years ago (Oteng-Ababio, 2012), Agbogbloshie scrapyard has grown rapidly to become the second largest in West Africa and has been named as one of the top toxic cities in the world (Blacksmith Institute and Green Cross report, 2013), "where hundreds of tons of e-waste" are dumped on a monthly basis (Amoyaw et al., 2011).

3.2 What has led to the increase in e-waste in Ghana?

As noted before, the proliferation of electronics has led to an increase in the production of electrical and electronic equipment (EEE) and waste generated from electronics (Adeola, 2011; Baker, 2004; Brigden et al., 2008; Pellow, 2007; Lundgren, 2012). Moreover, e-waste is becoming a major challenge not only because of its increasing volume, but also due to its toxic content, management and disposal (Lundgren, 2012), especially in the Global South (Osibanjo & Nnorom, 2007). Globalisation of e-waste, planned obsolescence (Lundgren, 2012; Pellow, 2007)

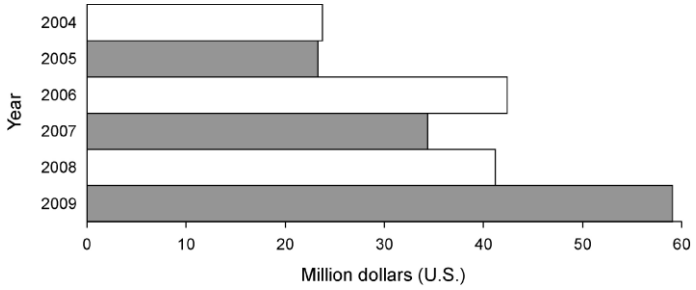
increasing global demand for EEE (Bridgen et al., 2008) and NIMBYism (Clapp, 2001) amongst other global factors are driving the increase in e-waste generation and the e-waste trade.

3.2.1 Local drivers for the e-waste increase in Ghana.

Amoyaw et al. (2011) emphasise the important role of the computer in a nation's development and internet usage and this is evident in some policies in Ghana. Grant and Oteng-Ababio (2012) note that, the most important Information Technology and development policy in Ghana is the Information and Communication Technologies (ICT) for Accelerated Development Policy which aims to "transform Ghana into an information-rich, knowledge-based and technology driven high income economy and society" through initiatives such as "one laptop per child initiative"(Kotey, 2010 as cited in Grant and Oteng-Ababio, 2012) and "laptop per household project" (Ghanaian Times, 2009 as cited in Oteng-Ababio, 2012). Thus, the consumption rate of electronic products especially computers and computer accessories have been on the increase; as they have become more common in various institutions such as offices and schools and as "e-literacy" grows (Amoyaw et al., 2011).

In addition, some policies implemented by the Government of Ghana, created an enabling environment for the increase and use of electrical and electronic equipment (EEE) in Ghana. For example, the import duty on computers and computer accessories was eliminated in 2004 to encourage importers to bring more EEE into the country as a means of "bridging the digital divide". The result of this policy change has seen a huge growth in used computer importation; for instance in 2004, US $23.7 million worth of secondhand computers were imported, this figure rose by over 200% to US $59.4 million in 2009 (Grant and Oteng-Ababio, 2012). See figure 7 for the comparison of values of used computers imported into Ghana from 2004 to 2009.

Figure 7 Used computer imports into Ghana 2004-2009



Source: Ghana Customs Excise and Prevention Service (2010) as depicted in Grant and Oteng-Ababio (2012)

Coupled with above, the poverty level in Ghana is relatively high (44.8% in 2008 lived on less than a dollar a day) and most people cannot afford to buy a brand new EEE. This has resulted in an increase in demand for secondhand and refurbished EEE. For example, a secondhand personal computer (PC) is about 30% of the cost of a new one (Oteng-Ababio, 2010). Secondhand PCs translates into more Ghanaians being able to afford a computer. Not surprisingly, about 70% of the computers imported into Ghana are secondhand computers. The secondhand computers have a shorter life span and ends up as e-waste sooner than later. Moreover, a portion of the secondhand computers that are shipped to Ghana are already e-waste, adding to the volumes of e-waste generated locally (Amoyaw et al., 2011). Additionally, the people who import used computers do not check for functionality, and this increases the likelihood of e-waste shipments into Ghana by about 80%. There is therefore an increase in Ghana's dependence on the use of computers, which has resulted in the generation of more e-waste (Oteng-Ababio, 2010).

To make matters worse, in Ghana, there has been no regulation or import restriction for secondhand EEE (until a few months ago; Cudjoe, 2016). This has made it difficult to quantify

the current amount of e-waste imports into Ghana. As noted above, there is no formal way of safely managing and disposing of EEE; this has fostered an environment where informal scrapyards have sprung up all over Ghana and causing health and environmental hazards. The ICT policy for example, does not take into consideration the effect of the secondhand PCs on human health and the environment. Moreover, although Ghana is a signatory to the Basel Convention on trans-boundary movement of hazardous wastes and their disposal it has not incorporated the Basel framework into local legislation (Amoyaw et al., 2011, Oteng-Ababio, 2012). At the time of the research there was no e-waste regulation, however, the government of Ghana recently passed a regulation (Cudjoe, 2016). It remains to be seen how effective the new e-waste regulation will be.

3.3 E-waste In Ghana

E-waste is imported into Ghana, brought in illegally or collected locally from e-waste generated in Ghana. Prakash et al. (2010) assert that most of the secondhand EEE that come into Ghana almost qualify as e-waste or become e-waste shortly after arrival; they however, state that a portion of these can be refurbished. Moreover, Balde et al. (2015) state that illegal waste trade is a main e-waste "generator" for Ghana and Nigeria. Grant and Oteng-Ababio (2012), quantify the amount of secondhand EEE coming into Ghana that are e-waste or will become e-waste shortly after arrival as 80%. This implies that most of the secondhand EEE that are shipped to the Global South are at the end of their useful lives or "useless" and end up being dumped in places like Agbogbloshie. This high volume is consistent with Lundgren's (2012) assertion that about 80% of e-waste collected for recycling in the Global North ends up being processed by informal recyclers in the Global South countries. However, there are inconsistencies in the portion of secondhand EEE that is shipped to Ghana as e-waste, for example, Amoyaw et al. (2011) state

that, 60 - 70% of secondhand EEE imported to Ghana are functional, 20-30 % can be refurbished or repaired and 10 - 20% are nonfunctional.

3.3.1 Quantity of e-waste shipped to Ghana

Moreover, Grant and Oteng-Ababio(2012) cite Frontline's and Afrol News' estimates of e-waste that come through the Tema harbor into Ghana every month as being between "300 to 600 40-foot-long containers (each with 2390 cubic feet of storage space)" (p. 2). Nonetheless, they caution that the actual data of e-waste shipped into Ghana is difficult to quantify as Ghana has porous borders. In addition, Prakash et al. (2010), claim that roughly 10,000 to 13,000 metric tons of e-waste is processed every year in Ghana. Although, the quantification of data is difficult, it is generally agreed that the volumes of data of e-waste shipped into Ghana is a cause for concern (Brigden et al., 2008, Lundgren, 2012).

Grant and Oteng-Ababio (2012), also state that about 40 to 60% of e-waste in Ghana is processed at Agblogbloshie. The bulk of the e-waste processed at Agbogbloshie is made up of computers, monitors and television sets (Brigden et al., 2008; Agyei-Mensah & Oteng-Ababio, 2012).

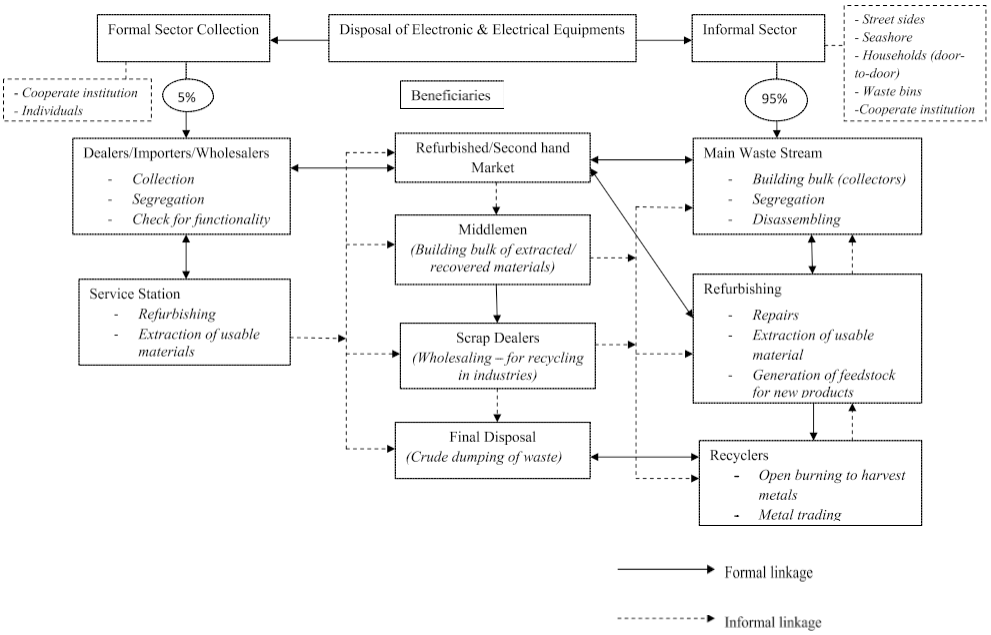
3.3.2 Handling of E-waste in Ghana

Amoyaw et al. (2011) identify the following as five main ways broken or old EEE are handled by owners in Ghana. It also shows how e-waste or EEE flows into the informal sector.

- "It is taken for repair, but if unsuccessful (i.e. not repairable) then it goes into the informal recycling.
- It can be brought for refurbishment, where parts are replaced or are updated and the lifespan is pro-longed, while non-usable parts go into the informal recycling.

- It is mixed with communal waste, where it may be collected at a landfill, with parts separated and informally treated on-site or brought to the informal recycling.
- It is collected by scavengers and enters the informal recycling sector.
- It is brought to the formal recycling sector" (p. 62).

Figure 8 Current recycling and disposal practices at Agbogbloshie



Source: Oteng-Ababio, 2012

3.4 At the end of an e-waste supply chain

Figure 8 shows that the e-waste importers/dealers/wholesalers initially distribute the "secondhand EEE" or e-waste in both the formal and informal sectors. According to Amoyaw et al. (2011) used EEE importers are either formal or informal small scale businesses. These importers normally provide repair and refurbishment services as well. The formal business

importers/distributors typically import new EEE from manufacturers and used EEE from places like auctions, the USA army, federal institutions and private companies (Amoyaw et al., 2011).

The e-waste industry in Ghana provides jobs to about 14,500–21,000 people in Accra and about 20,300–33,600 people in Ghana (see table 6). In addition, about 87,000–126,000 people in Accra and 121,800–201,600 in Ghana are "dependent on the e-waste recycling and refurbishing activities" (Prakash et al., 2010). Although the e-waste workers work long hours, for example, WEEE recyclers work between 106 to168 hours of overtime per month, they are still very poor (Amoyaw et al., 2011).

From figure 8 above, one can see that a substantial amount (95%) of e-waste in Ghana is processed by the informal sector (Oteng-Ababio, 2012). An informal sector is "part of the economy that is characterized by private, usually small-scale, labour-intensive, largely unregulated, and unregistered manufacturing or provision of services" (Diaz et al., 2005).

3.4.1 E-waste Workers

The e-waste industry mainly employs young men: who often work between 10 and 12 hours a day (Prakash et al., 2010). These workers are between 14 and 40 years. Despite the fact that the average age of the informal recyclers and collectors are early twenties (Prakash et al., 2010), Bridgen et al. (2008) claim that children as young as 5 years (mainly boys) were seen working in e-waste sites in Ghana such as Agbogbloshie. The children mainly work as dismantlers and burners, and make less than $20 a month and are generally self-employed. Girls aged between 9 and 12 years, have also been seen selling water sachets at Agbogbloshie, a few of these girls were also seen working as collectors (Prakash et al., 2010). Table 7 below shows the amount of money the informal e-waste workers make per day.

Table 6 Number of people employed and dependent on refurbishing and e-waste recycling in Ghana

	Refurbishers	Collectors Recyclers	Total
Employed in Accra	10,000–15,000	4,500–6,000	14,500–21,000
Employed in Ghana	14,000–24,000	6,300–9,600	20,300–33,600
Dependent on re-furbishing and e-waste recycling in Accra	60,000–90,000	27,000– 36,000	87,000–126,000
Dependent on re-furbishing and e-waste recycling in Ghana	84,000–144,000	37,800–57,600	121,800–201,600

Source: Prakash et al., (2010).

Table 7 Remuneration (in US$) for the people engaged in refurbishing and e-waste recycling business in Ghana

	Refurbishers	Collectors	Recyclers
Renumeration per day	(3.3) 6.3–8.3	(2.0) 2.3–4.6	(2.0) 5.8–9.5
Renumeration per month	(100) 190–250	(60) 70–140	(60) 175–285

Source: Prakash et al., 2010 (Figures in brackets are from Anane, an environmental journalist)

The e-waste industry experiences a high turnover rate; the average worker works between 3 to 7 years due to poor working conditions, deteriorating health, low wages, and, unstable employment. Although some informal worker associations exist, there is no social security provided for the workers as the sector is mainly informally organized (Prakash et al., 2010).

Though the recycling sector is not formal it is highly organized. It is organized into the following; collection, refurbishment/reuse, recycling and disposal (Oteng-Ababio, 2012).

3.4.1.1 Collectors

Collectors are individuals and companies who collect waste electrical and electronic equipment (WEEE) from consumers to be recycled or discarded at a dumpsite. Collection is done mainly by informal workers or scavengers (Amoyaw et al., 2011; Oteng-Ababio, 2012). They collect WEEE to sell to middlemen before and after it has been processed (Grant and Oteng Ababio 2012). Collectors make up majority of e-waste workers. They are mainly young men (Amoyaw et al., 2011; Grant and Oteng-Ababio 2012) and they go door to door in residential areas, dumpsites/transfer stations and businesses to either collect discarded WEEE or to purchase WEEE for a very small fee, for example, they pay between 1- 2.5 USD for a computer (Oteng-Ababio, 2012). Oteng-Ababio (2012) note that competition changed the nature of acquisition that is, the collectors used to acquire the e-waste for free, but now have to pay for it. Prakash et al. (2010) however, claim that the collectors normally do not pay for e-waste as people dump them by the roadside, whereas Grant and Oteng-Ababio (2012) point out that, some collectors buy directly from importers. The collectors at times dismantle the e-waste themselves (Lundgren, 2012). See table 7 for collectors pay.

3.4.1.2 Repairers/refurbishers

Agbogbloshie is the main refurbishing centre in Ghana (Oteng-Ababio 2012). Most of the used EEE are not checked for functionality before being imported into Ghana. This results in a high proportion of non-functioning computers (Grant and Oteng-Ababio 2012). The refurbishers or repairers thus, repair broken /old computers by reusing parts from non-functioning EEEs that cannot be refurbished (Oteng-Ababio 2012; Amoyaw et al., 2011). They clean their wares to

make them more attractive and sell them at low prices (Oteng-Ababio 2012). They also resell parts of the obsolete computers.

In addition, the repairers serve a very important role as they increase the life span of an otherwise discarded computer. The repairers thus contribute to the increase in accessibility to computer usage. Refurbishing reduces the amount of energy, raw materials used and pollution generated when new computers are produced (Oteng-Ababio 2012; Amoyaw et al., 2011). The rate of repair is about 70% and the lifespan of secondhand EEE is extended by a year or two (Amoyaw et al., 2011). See table 7 for refurbishers' pay.

Also, the refurbishers have an association named the Ghana Electronic Service Technicians Association (GESTA), with 1200 members throughout Ghana. There are 500 GESTA members in Accra, 900 members in the Greater Accra Region. About two thirds of the GESTA members nationwide are general repairers and one third are specialists in Computer repairs (Amoyaw et al., 2011).

3.4.1.3 Recyclers or dismantlers

Informal recyclers are mainly children (Oteng-Ababio, 2012) who use manual tools such as hammers, screw drivers and knives (see figure 9) to dismantle EEE such as computers, monitors and televisions to recover some valuable metals such as copper and aluminum. They also openly burn some EEE components to recover copper (Oteng-Ababio et al., 2015). Unfortunately, they do not wear protective equipment (Bridgen et al., 2008). The rudimentary methods used expose workers, the local communities and the environment to negative impacts (Bridgen et al., 2008; Lundgren, 2012; Agyei-Mensah and Oteng-Ababio, 2012).

Although, they recover some materials, the methods used is not the most efficient and leads to some recovery loss. This method, although not environmentally friendly, reduces the amount of

e-waste that would have been dumped in the landfills (Oteng-Ababio, 2012). In figure 9, a young boy is dismantling EEE to retrieve copper and in figures 10 and 11, recyclers are seen burning wires to retrieve copper. The recyclers sell the recovered metals for the following average prices, steel/iron US$ 0.46 per kg, aluminium US$ 1.07 per kg and copper US$ 4.6 per kg. They usually sell the recovered metals to middlemen; nonetheless, they occasionally sell their wares directly to refineries or remelters (Prakash et al., 2010). See table 7 for recyclers pay.

Figure 9 A boy dismantling or "recycling" WEEE at Agbogbloshie

Source Sangani (2011) http://eandt.theiet.org/news/2011/dec/weee-directive.cfm

Figure 10 Recyclers at work in Agbogbloshie

Source: Agyeman, 2015 http://www.aintiawomancollective.com/visual-the-gaze-on-agbogbloshie/

Figure 11 A recycler at work in Agbogbloshie

Source: Souppouris, V. (2016)

3.5 Disposal of e-waste

E-waste was formerly disposed of in landfills. Currently, the dynamics of e-waste disposal has changed due to the fact that the informal e-waste sector manages 95% of the e-waste (Oteng-Ababio, 2012). Moreover, Ghana does not have the proper infrastructure to safely dispose of hazardous waste (Bridgen et al., 2008). At Agbogbloshie the workers get rid of both hazardous waste and nonhazardous waste at a dumpsite, which periodically gets burnt to reduce the volume of the waste (Amoyaw et al., 2011). Bridgen et al (2008), note that, insulation foam from discarded refrigerators is used in the burning of e-waste; which is a chemical hazard and a long term pollution issue. It also contributes to ozone-depleting substances. The waste comprises of the casings and leftover ashes from recycling activities which have hazardous chemicals and can contaminate the soil and groundwater (Oteng-Ababio, 2012).

3.6 The "Recycled" metals

The metals such as aluminium and steel are sold to local refineries whereas copper is exported. Printed wiring boards are sold through middlemen to buyers from China and Nigeria (Amoyaw et al., 2011).

3.7 Impacts on Human health and the Environment

As noted above the improper management and disposal of e-waste is a health and environmental hazard especially due to the toxicity of the e-waste especially, computers. Also, the improper methods used by e-waste workers pollute the environment and endanger human health (Adeola, 2011; Bridgen et al., 2008, Caravanos et al., 2013). The recyclers are the most affected workers due to the metal recovery processes they use in e-waste recycling; open burning and manual dismantling of e-waste for example, crashing screens with stones can expose them to toxic dust and fumes. Nevertheless, commonly used e-waste recycling practices in Asia such as chemical

leaching (Bridgen et el, 2008), solder recovery and plastic shredding (Agyei-Mensah and Oteng Ababio, 2011) are not used in Agbogbloshie.

The collectors are exposed to less risk from e-waste process if they do not double up as dismantlers. Despite the lower level of risk, the collectors load hand drawn carts around the city, collecting and transporting e-waste and for 10 to 12 hours per day and this can injure their back and spine. Also, the refurbishers are not exposed to as much risk as the recyclers or dismantlers. However, they are exposed to toxic fumes from soldering activities (Prakash et al., 2010).

A few studies (Bridgen et al., 2008 and Caravanos et al., 2011) show a link between the toxicity of metals from e-waste and the impact on the environment in Ghana (Agyei-Mensah and Oteng Ababio, 2011). Bridgen et al. (2008) discovered a high level of contamination from the soil at Agbogbloshie and from the lagoon as well, for example, they found toxic residue from numerous metals such as lead, Agbogbloshie had over 100 times the normal levels. They also reported that the level of contamination found at Agbobloshie was similar to the contamination levels in recycling areas in China, India and Russia. The toxic chemicals reported are either found in e-waste or are created when e-waste is incinerated (Bridgen et al., 2008). Besides toxic metals, they discovered that Agbobloshie also has persistent environmental contaminants as well as chemicals that can bioaccumulate in the food chain (Bridgen et al., 2008). See appendix D for a summary of key chemicals found at e-waste recycling sites in Ghana, including Agbogbloshie from Greenpeace. Caravanos et al. 2013 recommends that a comprehensive evaluation of biomarkers and environmental exposure is needed to define the level of health risk posed to the e-waste recyclers.

Unfortunately, the activities from the "mismanagement" of e-waste especially, the burning of the unwanted parts, affects the local communities near the Agbogbloshie Scrapyard. Such communities include Accra Central, Korle-Bu, Kaneshie, the industrial area and the adjoining market. The pollution not only affects the workers but also the secondary workers in the businesses borne out of e-waste such as food vendors (Amoyaw et al., 2011). Finally as noted earlier, Agbogbloshie now has one of the most polluted water bodies on earth (Lundgren, 2012), a lagoon that once supported a livelihood to the local community with incomes from fishing (Boadi and Kuitunen, 2002).

Conclusion

Although the informal recycling may have some benefits, for example, it provides employment to lots of people in the Global South (Lundgren, 2012); in the long term it can wreck enormous havoc in Global South communities such as Agbogbloshie. As illustrated above, the e-waste trade and its associated mismanagement and improper disposal of e-waste are not in line with sustainable development.

Chapter 4 Methodology

4.1 Research Design

In my research, I examined the various views of the key stakeholders of what I describe as an "unsustainable"[7] end of an e-waste supply chain, Agbogbloshie, Ghana in West Africa. In examining these views, I utilized a qualitative research design that included interviews, field visits, observation and literature reviews. To accomplish my research goals described earlier, I initially conducted a preliminary literature review to gain an overall background on the global and local contexts of the e-waste trade and the "potential" impacts of the e-waste trade and the informal recycling sector on human health and the environment.

4.2 Research Site

A field research was conducted at the Agblogbloshie Scrapyard in April to May of 2016. Agbogbloshie Scrapyard a suburb in Accra, Ghana, West Africa was chosen as the case study location. A case study is a "detailed analysis and intensive analysis of a single case" (Bryman et al., 2012, p. 39). There are numerous e-waste destinations in the Global South, but I focus on a single destination for this research. Abgogbloshie Scrapyard was chosen because it is the biggest scrapyard in Ghana (Amoyaw et al., 2011) and the second largest in West Africa (Blacksmith Institute and Green Cross report, 2013). Moreover, at Agbogbloshie, a whole range of "scrap" including electronic waste is recycled (Prakash et al., 2010). Agbogbloshie Scrapyard has been described as one of the top ten most polluted places on earth (Aulakh, 2013). It is also a good illustration of the end of an electronic waste supply chain, for two reasons; one, a lot of junk ends up being shipped to Ghana from the Global North, as Brigden et al. (2008) and Lundgren (2012) point out, the volumes from e-waste shipments data into Ghana is a cause for concern. Secondly,

[7] Unsustainable, mainly because the manner in which e-waste is managed and disposed of

a lot of electronics imported into Ghana are secondhand goods and as such have a shorter life span. Invariably, most of these secondhand electronics end up in Agbogbloshie, thus, adding to volumes of "recyclable" junk there (Amoyaw et al., 2011). Finally, I chose the Agbogbloshie Scrapyard in Ghana, West Africa because according to Zoeteman et al. (2010), in the probability that a 'race to the bottom' occurs, West Africa and Eastern Europe may be the destination of choice for e-waste disposal around the world (Lundgren, 2012). Lundgren (2012) adds that Ghana and Nigeria are the main e-waste destination hubs in Africa. Moreover, Balde et al. (2015) state that illegal waste trade is a main e-waste "generator" for Ghana and Nigeria.

4.3 Sample and Sample Selection

Examining the views of stakeholders enabled me to obtain information from people who are "affected by or affect" the management and disposal of e-waste at the Agbogbloshie Scrapyard. Stakeholders are "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman 1984: 46, as cited in Friedman and mills, 2006). The stakeholder identification was based on literature I reviewed such as, the United Nations Environmental Programme (UNEP), (2007a) and Amoyaw et al.'s (2011) studies. The major stakeholders of an e-waste supply chain according to UNEP (2007a) are; producers/manufacturers, retailers (businesses, governments, others), consumers (individual households, businesses, governments and others), traders, retailers, scrap dealers, dissemblers/dismantlers, smelters and recyclers.

Given that this paper would be examining the perspectives of stakeholders at the end of an e-waste supply chain, it identifies the stakeholders who were affected by or affected events/activities at the end of the e-waste supply chain in Agbogbloshie, Ghana based on

academic literature. Amoyaw et al. (2011) identify local stakeholders in Ghana as those who import, distribute, consume and handle e-waste. They also state that the local stakeholders at the end of the supply chain (Ghana) are as follows; Assemblers (there are no manufacturers just assemblers who "import parts of EEE and assemble them") and Retailers and/or Importers(new and secondhand) and Consumers (private, corporate and institutional), Collectors (formal, informal and domestic waste collectors), Refurbishers/Repairers, Recyclers (formal and informal) and downstream Processors of WEEE (purchasing industries that use recycled fractions of WEEE in their manufacturing processes), those who dispose of WEEE (formal and informal), most affected communities, policy makers and implementers and other civil society organizations and the media.

The key stakeholders included in this research are; a local academic expert on e-waste (a faculty member from the University of Ghana), informal recyclers from the Agbogbloshie Scrapyard (workers as well as key informants[8] from the Greater Accra Scrap Dealers' Association), a representative of Green Advocacy Ghana (GreenAD), a local environmental non-governmental organization (ENGO) which collaborates with local and international stakeholders to work on e-waste related issues in Ghana, a medical doctor who works at the department of Community Health in a neighbouring hospital (Korle Bu Teaching Hospital). The medical doctor has done research on hazardous waste.

Engaging stakeholders will enable me to better explore the e-waste problem and devise possible recommendations with the input of the stakeholders. However, involving everyone "affected by

[8] "Key informants play a role in introducing and sponsoring the fieldworker. And in other settings, but especially in community studies, the go-along with key informants provides insight into the meanings a setting has for individuals within it." (Warren and Karner, 2016, p. 71)

or affecting" a decision or process or project at the end of this e-waste supply chain is not feasible for my project for a couple of reasons; inadequate time and resources. And as such, I limited the stakeholders to the above key stakeholders. See appendix E for detailed information about the stakeholders.

I used purposive sampling technique for all stakeholders as I needed people who will give me information that answer my research question. I was introduced to the ENGO through an old York University student and a York University faculty member introduced me to the academic e-waste expert. A mutual friend introduced me to the medical expert. However, I used the snowballing technique in the recruitment of the informal recyclers. GreenAD Ghana (ENGO) facilitated my research in gaining access to gatekeepers[9] at the Agbogbloshie Scrapyard. Through my contact at the ENGO I interviewed, I met with the Greater Accra Scrap Dealership Association's Chairman, Secretary and Assistant Secretary. The ENGO representative also introduced me to the guide who took me on an extensive tour of the scrapyard to get a sense of how the place runs and what is done there. The tour guide also facilitated the recruiting of the informal recyclers for interviews I conducted.

I interviewed four key informants; two of whom have key positions with the Greater Accra Scrap Dealership Association. The other key informants are informal workers, who employ other informal workers. In addition, I conducted two focus group discussions (FGDs) consisting of six participants each. The FGDs took place at the Agbogbloshie Scrapyard on two separate days and lasted about thirty minutes each. See appendix E. The FGDs were done early in the morning,

[9] "individuals at the site who provide access to the site and allow or permit the research to be done" Creswell p 188 or are those individuals who grant or deny initial access to a setting …" (Warren and Karner, 2016, p. 69)

when most of the participants were on break in a shed; where they hang out to relax, chat and watch television. I used pseudonyms for all my interviewees with the exception of the Academic and the ENGO representative. The ENGO representative assisted me by translating some of my questions, to the informal recyclers, into "pidgin English[10]" or Twi[11].

I used semi-structured interviews for all the stakeholders using an interview guide. Using my three major questions s as a guide, I created an interview guide in order to conduct in-depth and face-to-face interviews. The semi structured interview, mainly comprised of open ended questions. See appendix F. Open ended questions offered unusual insight for the research as participants offer information that as a researcher I would not have thought of (Bryman, 2009). I used some existing photographs of Agbogbloshie for this research to "illustrate points" and to "liven my dry findings" (Bryman, 2009).

4.4 Observations

I made some observations during my site visits at the Agbogbloshie Scrapyard. Their working conditions were poor. I noticed that none of the informal workers wore protective clothing while working. However, some of the workers had boot-like footwear or running shoes, whereas, others wore slippers. Moreover, their working environment was very noisy and there is a chance of walking on sharp objects and getting injured, as the place was littered with pieces of crashed electronics.

There were also other hazards such as, flying objects. Due to the methods used there is a potential for the flying objects from hammering of e-waste to injure workers. There was also some debris in the air, especially when the wind blew heavily. In addition, they grow vegetables

[10] Broken english
[11] A Ghanaian language - An Akan dialect

and rear animals at the scrapyard. Some of the cattle and sheep I saw were eating from a garbage damp close to some informal workers who were burning wires, etc. Moreover, the nearby waters seemed heavily polluted. Finally, I observed some girls and women who were selling food and drinks to the workers.

4.5 Data Management/ethics

I used written and verbal consent forms to make participants aware of the following; I identified myself and the University I am studying at (sponsoring institution); the purpose of this research; the potential benefits of participating; what would be required in terms of participating; the potential risks for participating; and that they could withdraw voluntarily at any time during the research. Finally, I provided them with contacts of my supervisor and the representative at York University's Office of Research Ethics if the need arose for questions or if they needed any clarifications (Creswell, 2014). I used a guide for a verbal consent for some of the informal recyclers who cannot read.

As Creswell (2014) points out, a researcher should be cautious when interviewing people on site in order to minimize the level of interruption, thus I tried as much as possible during my data collection not to overly interfere with the informal recyclers activities by interviewing them while they were working and having the focus group discussion early in the morning when they take a break at a communal shed. I also kept the focus group discussions short in order not to disrupt their work routine.

Creswell (2014) also notes that, the researcher must pay back the participants in order not to unduly take advantage of them. In line with this concept of paying back, I bought the workers

who participated in the focus group discussions a cold drink as a small token of my appreciation for their participation.

4.6 Confidentiality

I coded the names of participants who took part in the interviews and kept them separately on a "passworded" tablet that is locked away when not in use by me. I also informed them of my intention to record the interviews and proceeded only when they agreed. One of the stakeholders preferred that I take notes instead, to which I obliged. All the data I collected from participants are confidential and used only by me. I also used pseudonyms in my research in order to reduce the possibility of revealing the identities of the participants who were unwilling to have their names used in my research. Also, I made them aware they could refuse to answer any questions they were not comfortable with and I did not use any information that any participant told me in confidence. Finally, I will keep the raw data for two years, after which all data collected will be destroyed; this is in keeping with York University's Office of research Ethics' guidelines.

4.7 Data Analysis

All interviews were recorded with the exception of one. I transcribed the recorded interviews under three themes; risks and benefits of e-waste management, next steps towards a more environmentally friendly process of e-waste management and willingness for stakeholders to engage. Transcribing the recordings was very challenging for the FGDs I conducted with the informal workers due to the level of background noise. As a backup for recorder malfunction, I had a journal and a pen to take detailed notes to capture their responses to the best of my ability. To increase objectivity and accuracy in my note taking and transcription I made a conscious effort to replicate the answers of the participants verbatim.

Chapter 5 Results and Discussion

This chapter presents the results of the research under the following themes; risks and benefits of e-waste management at Agbogbloshie; next steps towards a more environmentally friendly process of e-waste management; and willingness for stakeholders to engage.

5.1 Risks and benefits of e-waste management at Agbogbloshie

My First question is, *What are the tradeoffs of recycling e-waste in Agbogbloshie for the local communities associated with e-waste management and disposal?* This question will explore the benefits and risks of recycling of e-waste by the informal sector in Agbogbloshie Scrapyard, Ghana, a Global South country.

5.1.1 Research Results (Benefits)

All the stakeholders said that the importation of e-waste drove a huge economic market. The ENGO representative and the Academic both mentioned that it increases access to EEE due to the importation of cheaper secondhand EEE. The ENGO representative pointed out that informal recycling of e-waste at Agbogbloshie provides an essential service in Ghana, as e-waste is mainly managed by the informal sector in Ghana (Oteng-Ababio, 2012).

Additionally, all the stakeholders were of the opinion that the informal recycling of e-waste is a source of livelihood for the recyclers, who are mainly uneducated or school dropouts with little or no employable skills. The recyclers added that they earn money to provide for their families. This is illustrated in the following response from one of the FGDs participants.

It benefits us a lot, because some of us are school dropouts so we just come down here to start this business, to support our family and our children in school. We also have our people that we need to support financially and we need to do our businesses (informal recycler).

In fact, the ENGO representative revealed that according to a study conducted last year, Agbogbloshie Scrapyard employs about 4000 people. Besides the economic benefits, the Academic believes that it has enabled some of the recyclers to develop technological skills, for example, some of them can repair and/or build computers from scratch and send them to the North.

5.1.2 Risks

All stakeholders acknowledged that in spite of above said benefits there were numerous risks. The informal workers especially highlighted the following risks; exposure to hazardous materials and pollution from burning of e-waste; bodily injuries such as cuts and burns that workers sustain from working with no protective equipment and using simple tools or methods when retrieving precious metals such as copper; high noise level, the danger posed by flying objects, sharp objects from scrap leftover abandoned around the scrapyard, and not wearing gloves and other protective clothing due to the expense. An informal recycler response on some of the risks during the onsite interviews is seen in the following;

… Also using the chisel and hammer, a piece of the electronic can break and hit your eye or hit your elsewhere and injure you. You can also step on a broken piece and if you don't take care you can injure yourself. Also the fumes coming from the copper when you breathe it, it can cause headache and also coughing and even sometimes we have like some of us having Apollo[12] because of the dry weather and because of the smoke (informal recycler).

Most of the stakeholders mentioned that the health of the workers, residents and the other local community members are negatively affected due to the burning and the way e-waste is handled and processed. One participant stated that at times, their wives and family members who come on site to help are also negatively impacted. The medical doctor, some of the recyclers and a key

[12] Red watery eye

informant from the association revealed that the workers hardly seek proper medical attention because they find it expensive. Thus, they buy cheap drugs or concoctions from drug peddlers or chemists. In addition, some participants made references to studies on heavy metal poisoning such as lead and how it impacts human health. According to a key informant quoted below, despite the negative impacts on human health, to his knowledge there had been no association between the recycling operations and the effects it has on the recyclers' health.

The e-waste operations maybe associated with long term effects, however, they have never associated any one illness to e-waste, even though people around here cough...(key informant, Agbogbloshie).

However, the Academic commented that the recyclers' perception of risk is being influenced by their need to survive. He also mentioned that the streams, lagoon and market have been polluted and that vegetables grown as well as animals were bred for sale at Agbobgloshie which increases the risk of exposure to community members.

The ENGO representative mentioned that besides the local e-waste generated, a portion of EEE imported is e-waste and the secondhand EEE has a short life span adding to the volumes of e-waste and ends up in Agbogbloshie and other recycling sites. He believes that these dead EEE should not be imported in Ghana.

One key informant mentioned that the boys steal a lot and get into trouble with law enforcers and others, for example, the informal workers have stolen cars, stripped and recycled them and at times the recyclers steal other recyclers' e-waste which leads to fights. This is shown below in an interview excerpt.

The boys get into trouble a lot with the police or other people because there is a big problem with theft. At times, people come here to repossess their stuff. The leaders then have to help get them out of trouble. They can even steal cars and strip them and be caught at times. At times they steal each other's goods right here and cause a lot of fights (key informant, Agbogbloshie).

Not surprisingly, the Academic said that there has been a sharp increase in the competition for the collectors and dismantlers of e-waste.

5.1.3 Discussion

The discussion of the risks and benefits of e-waste management at Agbogbloshie uses an environmental justice lens.

The e-waste trade and its attendant e-waste management and disposal in Agbogbloshie, Ghana are very beneficial. "An entire new economic sector is evolving around trading, repairing and recovering materials from redundant electronic devices" (Widmer et al., 2005). All the stakeholders claimed e-waste drives a huge economic market. Not surprisingly, most researchers also claim that EEE drives a huge market (Lundgren, 2012; Widmer et al. 2005; Prakash et al. (2010). Moreover, Widmer et al. (2005) state that the valuable content in e-waste is about 60%. In Ghana, e-waste recycling and refurbishing alone is valued between US$ 105 and 268 million on a yearly basis (Prakash et al., 2010).

As seen earlier, the e-waste industry employs thousands of informal workers (Lundgren,2012) majority of whom have little or no education (Amoyaw et al., Prakash et al., 2010). The ENGO representative confirmed this by stating that according to a study conducted last year, the Agbogbloshie Scrapyard employs about 4000 people. This was reflected in most stakeholders' responses, including the informal workers, who mentioned that it provides them with a source of livelihood and enables them to look after their families. This also confirms what previous studies have stated (Lundgren, 2012; Amoyaw et al., 2011; Oteng-Ababio, 2012; Prakash et al., 2010). Besides offering business opportunities, the e-waste industry, also satisfies the demand for cheap

secondhand EEE (Oteng-Ababio, 2010), this was highlighted in the responses of some of the respondents. As mentioned earlier, most of the EEE imported into Ghana is secondhand, thus, it is "bridging the digital divide" by increasing access to EEE for some people who would otherwise not have been able to afford a new one. Nonetheless, a portion of the cheaper secondhand EEE, is already e-waste or almost at the end of its life (Amoyaw et al., 2011). As the ENGO representative commented, it adds to the mounds of "carcass or third grade EEE coming into Ghana" and ending up at Agbogbloshie. These need to be stopped from entering Ghana.

All stakeholders acknowledged that despite the benefits the e-waste industry offers, there were numerous risks. Likewise, many researchers such as Akormedi et al. (2013), Adeola (2011) and Lundgren (2012) have stated that although it is a source of income for the informal workers, it is associated with negative risks for human health and the local environment (Akormedi et al., 2013) due to the unsafe methods used (Agyei-Mensah & Oteng-Ababio, 2012). These methods release persistent and bioaccumulative chemicals into the environment (Bridgen et al., 2008) and lead for example, has been found in alarming quantities in Agbogbloshie (Prakash, 2010, Bridgen et al., 2008). Also the methods can expose the environment to pollutants that can seep into the atmosphere, groundwater, soil and waterways (Krueger, 2011). The environment as one participant stated "is, whew, highly polluted" (Bennett Nana Akuffo, ENGO representative). Agbogbloshie being a trading hub, thus exposes the environment of the workers, numerous traders, including the food markets to these pollutants. Figure 3, shows how humans can be exposed to the toxic contaminants through their environments via the food chain, air inhalation and drinking water.

From the cover page picture to the pictures throughout this paper one can see the destruction of the environment at Agbogbloshie. The lagoon that was once teemed with fish and was a source

of livelihood for some area residents has been heavily polluted and can no longer support life (Prakash et al., 2010). Sadly, some livestock at Agbogbloshie were observed eating off the polluted land, thus, moving toxins up the food chain. Moreover, the aesthetic beauty of the Agbogbloshie landscape and its environs landscape has been destroyed. According to the Rio Declaration "A healthy environment is a basic right of all the Earth's inhabitants (UN, 1992 as cited in Cutter, 1995). All of the above are environmental injustices as it is a transfer of environmental burdens from the Global North to Agbogbloshie, because Agbogbloshie and its environs are being continuously polluted mainly from e-waste shipped into Ghana from the Global North (Balde et al., 2015).

Moreover, workers confirmed what several researchers (Adeola, 2011; Bridgen et al., 2008; Lundgren, 2012) have described as using rudimentary methods and tools in their e-waste recycling operations. In the Global North, recycling e-waste is challenging. Puckett (2002) states that even with hazardous waste recycling in Global North countries' state-of-the-art facilities, workers are still exposed to toxic materials. Agbogbloshie does not have the proper infrastructure and capability or resources to manage e-waste in an environmentally friendly manner, yet e-waste is sent to Ghana to be recycled by low skilled workers (Prakash et al., 2010). Moreover, a report from Greenpeace in 2008 points out how e-waste operations at Agbogbloshie negatively impact the human health and the environment (Bridgen et al., 2008) see appendix D. Furthermore, as seen previously the informal workers are exposed to many occupational health and safety hazards. All the informal workers described hazardous exposures such as, bodily injuries, exposure to toxic fumes from open burning, noise pollution, flying and sharp objects.

Clearly this is an illustration of distributive justice, as it is an unequal allocation of environmental benefits and risks for everyone. The poor young men who have migrated from the Northern part of Ghana in search of a better livelihood (Prakash et al., 2010) are suffering an unfair share of health and safety risks. Meanwhile, the people in the Global North countries who enjoyed the utility of the electronics (benefits), transfer hazards to these marginalised Agbogbloshie workers, in the name of reusing, recycling and disposing these hazardous wastes (Clapp, 2001) and this is a disproportionate distribution of benefits and risks.

Although, Oteng-Ababio et al. (2015) and Oteng-Ababio (2014) acknowledge that e-waste trade and its associated poor management in the Global South is hazardous, they argue that the creation of numerous jobs for these poor workers is beneficial for them. However, the Agbogbloshie informal workers stated that they do not wear protective clothing as they cannot afford them. If the creation of the jobs is that beneficial, one may ask why they cannot afford to buy protective clothing, as it is essential to protect oneself in such a hazardous work environment. This adds to their unfair share of exposure to harmful and potentially fatal toxic chemicals and heavy metals on a daily basis.

In addition, the above is an occupational health and safety hazard. Everyone, including the Agbogbloshie informal workers, should be able to work, not only for a decent wage but also in a safer environment. These young workers are made to bear the unfair burden of health problems associated with these crude and unsafe recycling methods, while the companies or individuals save money by means of capitalizing on the cheap labour of these vulnerable and needy low income youth and people. Additionally, a key informant mentioned that the boys often got into trouble with law enforcers for deviant social behaviours such as thefts of vehicles, which they

strip for scrap metal. Unfortunately, they make very little money (Prakash et al., 2010) and some of these deviant social behaviours maybe as the result of insufficient means of survival.

Furthermore, the Academic pointed out that there were technological benefits. He is of the opinion that the e-waste industry has offered some of the informal recyclers at Agbogbloshie the opportunity to develop technological skills. He stated that most of them are young uneducated men or school dropouts and yet are still able to develop these skills and are also entrepreneurial. They send for example, televisions to their brothers in the Northern part of Ghana, who show movies for a fee, as a source of entertainment. This is a positive outcome as most of them are not educated but are able to develop themselves technologically and become entrepreneurial. However, exposing oneself to such hazards while gaining technological skills and being enterprising may not be worth the risk of hazardous health exposure.

Again, this is an unfair allocation of risks for people who barely or do not enjoy the benefits of the electronics shipped from the Global North countries. Thus, it is a greater environmental injustice to these workers, who are uneducated or school dropouts. They should be in school or learning alternative trades instead of being exploited, as these workers are mainly young men (Amoyaw et al., 2011) or children (Bridgen et al., 2008). This unfair burden may affect their future health and productivity and ultimately affect their country's economy. This is an illustration of distributive injustice. Distributive justice is a form of environmental justice, which, Kuehn (2000) defines as "the right to equal treatment, that is, to the same distribution of goods and opportunities as anyone else has or is given" (Rechtschaffen and Gauna, 2002 p. 8). I believe, these illegal waste traders would not expose workers to the same unsafe working conditions in the Global North and as such are treating the Global South recyclers unfairly as they are treating them differently in terms of risk exposure.

Furthermore, one may argue that they can work elsewhere if their working conditions are that poor and the work is unsafe and unhealthy. However, the youth are facing high unemployment (Oteng-Ababio, 2012) according to a recent World Bank report; the youth in Ghana are facing an unemployment rate of 48% (Allotey and Opoku Mensah, 2016). Thus, seeking other job opportunities would mean they basically have to choose between their survival versus 'poison'. Puckett et al. (2002) describes this as, "A free trade in hazardous wastes leaves the poorer peoples of the world with an untenable choice between poverty and poison – a choice that nobody should have to make" (Puckett et al., 2002, p.11). Moreover, this is an unfair choice for the following reasons: by choosing their jobs they are burdened with developing respiratory and other diseases; by not working at these jobs, it means that they would not have a source of livelihood.

The above is a clear illustration of environmental injustice. Under the broader concept of environmental justice known as the Principles of Environmental Justice, the eighth principle speaks to the right to work and in a "safe and healthy" place without having to choose between an "unsafe livelihood" and not being employed (Gosine and Teelucksingh, 2008 p. 10). See Appendix A.

Moreover, it is an instance of environmental injustice as it demonstrates that there is an unequal power relationship between the big players in the industry with all the money and power to make all the decisions about who should do their "dirty work" under potentially deadly working conditions, while the workers depend on these jobs as they need them. This creates a social inequality, which is a social determinant of health (Raphael, 2004). Furthermore, this marginalizes the low income workers as they have to make a very costly choice of exchanging their "good" health for a source of income, even though they will be burdened with diseases.

Especially, as some of the interviewees stated that the Agbogbloshie workers seldomly seek proper medical care and resort to purchasing drugs and/or concoctions from peddlers and chemists when they fall sick or are injured from work related activities, potentially making their illnesses worse.

Again, one can contend that they chose their jobs over their health. However, they may not get sick immediately and that may influence some of the workers; who make this choice in light of a more pressing and immediate need: money to survive however small the wage. Moreover, the Academic believes that the recyclers' perception of risk exposure is influenced by their need to survive.

A key informant from Agbogbloshie remarked that there is no known association between e-waste recycling and its impact on human health. As discussed earlier, there is a need for more research on the impacts of e-waste on management and disposal in the Global South (Osibanjo and Nnorom 2007), as most researchers have tried to find "the nature of toxic substances associated with e-wastes and the presence of these in the environment with a limited number of studies focusing on human health" (Kiddee et al., 2013, p. 1240). However, there is scientific proof that for example, lead can cause various illnesses (Bullard, 2000; Adeola, 2011), lead is found in e-waste (Adeola, 2011).

Furthermore, in reference to environmental scientists, Bullard (2000) states that they "have not refined their research methodologies to assess the cumulative and synergistic effects of all of society's poisons on the human body" and concludes that, "some health problems cannot wait for the tools to catch up with common sense" (Bullard, 2000 p.19).

Additionally, the people living and working in the neighbouring communities of the Agbogbloshie Scrapyard, do not directly work with these toxic chemicals or metals, but are nonetheless exposed to very hazardous chemicals via "*dermal contact, inhalation and ingestion by drinking contaminated water and agricultural produce from e-waste polluted areas"* (Adeola 2011, p. 72). Besides, the wind can also carry these toxins throughout the neighbourhoods and residents will be breathing in all the "harm". This can expose the area residents to these toxins by virtue of being a resident in a nearby town or city. Amoyaw et al., (2011) claim the nearby communities are exposed to pollution from the Agbogbloshie Scrapyard. This is unfair to these communities residing or working nearby, as it will increase their body burdens. Body burdens are the toxic contaminants found in living beings as a result of industrial pollution (MacKendrick, 2010). The people enjoying the benefits of the electronics in its useful life should be responsible for the safe disposal and not these innocent and poor people who may have to bear the burden of disease. The residents bear the burden of exposure to deadly toxins while the people who created the waste and those who are responsible for its disposal safely find a cheaper way of disposing of it.

Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generations. (Principle 1 Declaration of the United Nations Conference on the Human Environment, 1972)

From Principle 1of the *Declaration of the United Nations Conference on the Human Environment*, we can infer that, it is also a violation of their basic human right because everyone deserves to have a safe and healthy neighbourhood to live in as well as their unborn children. This Principle is in agreement with The Principles of Environmental Justice (see appendix A).

Furthermore, the above also demonstrates social injustice. Social justice is about ensuring that everyone in society has the basics a human being needs ("enough resources and power") and the groups who have advantages account to society in the usage of their privileges. The Agbogbloshie community does not have the basic human needs and as such are forced to trade their good health for an unsafe job in order to survive.

Moreover, some people in very powerful positions have made some very discriminatory statements in their justification of why rich countries should send their hazardous waste to poor countries. Pellow (2007) believes that another reason for the global waste trade is that the culture and ideology in the Global North and institutions is classist and racist. He illustrates this with the internal 1991 World Bank memo form Lawrence Summers (Chief economist and vice president of the World Bank) (See Appendix C).

This is a clear instance of environmental racism. Environmental racism is defined as "any policy, practice or directive that differently affects or disadvantages (whether intended or unintended) individuals, groups or communities based on race or colour" (Bullard, R.D, 1996, p. 497). Summers' memo implies that the lives of people in the Global South countries are not valuable, so it is not an issue even if hazardous wastes are exported to them. It is unjust, discriminatory and an affront to human dignity that someone in such a powerful position as Summers, would make such a statement.

In my opinion, the memo implies that the practice of dumping toxic waste such as e-waste, does not matter to a community of sub humans as their lives are inconsequential and as the Global South has "higher mortality rates" and people there, will die of other causes anyway. I believe it is a baseless statement, as such acts of dumping toxic waste on poorer countries, that do not have

the infrastructure or the capital to safely dispose of toxic material cannot be justified and is inhuman. In my opinion, such ideologies have encouraged inconsiderate and cruel acts of inhumanity which have contributed to higher mortality rates in the Global South.

Moreover, Summers' memo which tried to justify that it makes economic sense to practice this deadly trade of hazardous waste to the Global South cannot be justified. I argue that, such a practice is morally wrong, because it slowly and needlessly kills poor people. It is also very disadvantageous to communities in the Global South. It is unfair for people in high positions who have the power to influence trade policies and economic decisions on an international scale to make such a discriminatory statement. It was not being disposed of in the Global North, where they have the infrastructure and tighter regulation to ensure safe disposal, yet it is being dumped in the Global South to be "reused or recycled", where poor people have to bear the burden of disease while the industry makes profit.

Furthermore, the issue of recycling is debatable; for the following reasons, the workers in Agbogbloshie are low skilled workers and they use rudimentary methods to recover some valuable metals, however the methods used leads to some recovery loss (Oteng-Ababio, 2012) and thus rendering their recycling efforts inefficient, which a UN report describes as counterproductive as it pollutes and generate another form of waste (Baker 2004).

Moreover, Greenpeace (2008) reported remnants of WEEE parts could be traced to multinational companies like Philips, Sony, Microsoft, Nokia, Dell, Canon and Siemens at Agbogbloshie Scrapyard. They also discovered some of the equipment from companies such as the Danish Royal Guard, and the US Environmental Protection Agency (Bridgen et al., 2008). The electronic industry and organizations in the Global North are not being responsible for the end of

life of their products, and instead Agbogbloshie and other Global South communities are saddled with the burden of "recycling" WEEE, even though they do not have the capabilities to safely do so (Lundgren, 2012).

From the discussion above, one can see the illustration of corrective justice which is about how fairly people or corporations are penalized for an offense and making them accountable by correcting what they did wrong. The electronic industry, waste brokers, recycling companies and entrepreneurs who are involved directly and indirectly in the shipping of WEEE in the Global North are burdening communities such as Agbogbloshie, meanwhile they go unpunished. They are maximizing their profits on the back of these marginalized workers, who exchange their cheap labour for working in a hazardous environment and adverse impacts on their health and environment at a fraction of the real cost of recycling and yet there is no chance of them cleaning up the scarpyard.

Although, the companies are practicing corporate irresponsibility, some argue that industry and governments would follow the path of least resistance as they would want to minimize controversy. Others use an economic explanation, that is, companies want to maximize profits by reducing costs of production and using cheaper labour. And this they argue has nothing to do with deliberately treating marginalised[13] people differently (Mohai et al., 2009). This however, needlessly exposes these people to health and environmental hazards.

All above environmental injustices are also resulting from procedural justice, which is about how fair a "decision making process" is, that is, everyone should be given the same amount of respect and consideration in the allocation of environmental benefits. Advocates for environmental

[13] Racial, poor and ethnic minorities

justice claim that people with "political power" and "resources" enjoy the environmental benefits while people of color and low income communities disproportionately bear environmental risks. The companies, waste brokers and people, who hold high offices such as Larry Summers, unfairly determine who gets what benefit or risk. The above illustrates an unequal distribution of environmental benefits and goods, without the participation of the marginalized communities in the decision making process in determining what they get. Larry Summers' memo also demonstrates a lack of respect for such communities.

However, the ENGO representative highlighted a very significant benefit; the informal sector provides a service that is very much needed in Ghana, as there is inadequate formal collection, management and disposal of e-waste. Although, there are a few formal e-waste management services, people in Ghana do not want to pay for their e-waste to be recycled and as such use this alternate informal service where the informal collectors pay to pick up people's e-waste (Amoyaw et al., 2011). Thus, it is a much needed service in Ghana however; as seen previously the current informal sector's management and disposal of e-waste is done in a manner that is environmentally unsafe and bad for human health.

Nonetheless, NGOs and other activists such as Jim Puckett from the Basel Action Network have criticised the e-waste trade as it is environmentally unjust for Global South communities such as Agbogbloshie (Pellow, 2007; Adeola, 2011, Bridgen et al. 2008; Puckett et al., 2002). In addition, they, maintain that producers should be responsible for the "end of life management and disposal" of EEE. In line with this, they support the use of the precautionary principle (Bridgen et al., 2008). The precautionary principle is in line with environmental justice principles (Mohai et al., 2009). Moreover, as a native proverb goes "when the last tree is cut, the river poisoned and the last fish dead, we can't eat money" (Knowles, 2009**,** p.130). This proverb

stresses a very important point about the relentless pursuit of money without the consideration of resources and the environment, as human beings cannot survive on money alone.

Finally, while some NGO and activists have successfully pushed for changes in this industry, through regulation, corporate environmental policies, this trade seems to be going strong. (Mohai et al., 2009). It is important to continue utilizing environmental justice strategies amongst others to push for changes in the electronic industry and its associated postconsumer electronics management and disposal. Thus environmental justice strategies can also be used to correct some of the environmental injustices outlined above.

5.2 Next steps towards a more environmentally friendly way of e-waste management

My second question, *What are the next steps?* (In terms of achieving a sustainable e-waste management and disposal system) This question will try to find out what the key stakeholders would like to happen in order to move towards an environmentally safe management and disposal of e-waste (or whatever their priorities are).

5.2.1 Research Results

The Medical Expert envisions a formally organized collection and management of hazardous waste, with a transition facility to resell waste that can be reused as input for some manufacturers. In addition, the Medical Expert proposes a formal structure that has a safe working environment for workers. Also, the Medical Expert believes that if the imported EEE are strictly monitored and the functionality of e-waste are certified at the ports, it would reduce the problem significantly. The ENGO representative echoed a similar sentiment by stating that

the importation of "carcass" and third grade electronics such as old refrigerators, microwaves and air conditioners should be stopped.

The ENGO representative gave the following three prong solution that he believes the Government of Ghana could do:

1. Regulate the management of e-waste and hazardous waste

2. Clean up Agbogbloshie Scrapyard and other recycling sites

3. Organize the informal recycling of e-waste in an environmentally friendly manner

Moreover, the ENGO representative suggested that the government should introduce a bill mandating electronic retailers to have a rebate system with a take back program for all electronics. He pointed out the following challenges the government faces;

1. The informality of the e-waste trade.

2. Customs not being able to check importation of EEE mainly, as borders are porous (Bennett Nana Akuffo, ENGO representative).

In addition, he recounted that a joint task force between the government and Interpol had resulted in some arrests but not stopped or reduced the e-waste coming into the country. He concluded by stating that a joint collaboration between the government of Ghana and the countries where e-waste originates from, can help stop e-waste from being shipped to Ghana.

The Academic views the following as a prerequisite for the next steps to commence and increase the likelihood of successfully implementing a change in e-waste management in Ghana; *the need for stakeholders to understand that the root of the problem is survival* (Professor Martin Oteng-Ababio, Academic). He also believes that the government should provide assistance to the informal workers who are mainly uneducated, by upgrading their employable skills and/or try to

formalise the informal operations by, for example, creating an environmentally friendly workplace for their recycling operations. He however, does not believe that the processing of e-waste can be completely eliminated for the following reasons. First, he states that the initial government's policy of bridging the digital divide in Ghana was a good one, but has however been abused. Referring to the Basel Convention, he mentions that both the importing and exporting countries have a responsibility to certify that electronics are functional.

Another level of complexity the Academic pointed out is that there is no policy to regulate the e-waste management problem (at the time of the research). He adds that the Government of Ghana does not see e-waste as a problem and will need evidence that e-waste is toxic. Moreover, he added that the government uses a top down approach in planning instead of bottom up.

He summed it up by suggesting that the government should collaborate with the workers to find a workable solution. Meanwhile he believes that the government can continue implementing social interventions in the Northern part of Ghana to reduce the influx of the young men and boys to the Southern part of Ghana in search of a better livelihood.

One informal worker shared a caution that one has to work with care and not work hurriedly in order to reduce injuries. In addition, he said that they should be wearing boots and gloves for protection although, he admitted that he and some of the workers do not wear gloves as they got in the way while working. Another informal worker recommended cleaning up around the working environment to reduce the likelihood of slips, falls and injuries from left over scrap at the scrapyard. One respondent claimed the informal workers need more assistance and training on how to process and manage e-waste safely, as well as assistance in obtaining protective equipment and clothing.

A key informant emphasized the role of the government in moving towards an environmentally friendly processing of e-waste. He also states that the recyclers also have a role to play. The following statement was his response to the next steps in moving towards an environmentally friendly processing of e-waste;

The success of the management and disposal of e-waste about 80 -90 % of it lies with the government, everything that we put on paper, its achievement will rely physically on government interaction. One we are talking about how these materials come onto the country, they come through our borders where we have customs that handles these materials, customs is government. We are talking about legislation, it is the government, we are talking about many things it is the government, but the actual implementation and you know how you deal with the actual thing independently, lies with the people dealing with the scrap business. But I can assure you that 80 -90% of its success will honestly rely on government's interaction. One we need education and training to handle this material and also we need funding to buy these materials to handle it in an environmentally sound manner and we need law enforcement... these are the three key areas…The 20% depends on us…(Key informant , Agbogbloshie).

One of the key informants believes the government can assist the Association and the Association in turn would help the people to manage e-waste in an environmentally safer manner. Another key informant pointed out that there are certain things one can do to protect themselves from injury, yet there are other kinds of injuries that he believes and hopes God will protect them from. Finally, one key informant mentioned that at times they act as good citizens and clean up their environment, to prevent floods by filling the land with sand etc.

5.2.2 Discussion

Most of the stakeholders came up with well thought out and very practical suggestions to move towards a more environmentally friendly e-waste management and disposal process in Ghana. Some of these suggestions if implemented effectively could change the e-waste industry in Ghana and reduce the negative impacts on human health and the environment.

The medical expert for instance, proposed a formal e-waste management system, with good working conditions and proper health and safety standards. She added that this formal structure could have a transition facility that sells reusable parts of e-waste. The ENGO representative also mentioned moving towards a formal and environmentally safe facility and cleaning up the scrapyard.

The Academic made a very pertinent comment regarding the root of the problem, which he believes is survival and the need for other stakeholders especially, the government to acknowledge the root of the problem. Nonetheless, others such as Pellow (2007), Adeola (2011), and Lundgren (2012), have mentioned that survival is one reason why the e-waste trade exists. As discussed previously there are other factors.

In addition, all the stakeholders believe that the government could play a significant role in transforming the e-waste industry into a more sustainable industry. Outlined below are the roles the respondents believe the government could play in this endeavor; regulation of the e-waste industry, enforcement of regulation, banning the importation of "dead" EEE, cleaning up existing contaminated sites including Agbogbloshie, introduction of a retailer rebate system and take back program for all EEE, certifying the functionality of imported secondhand EEE, strict ports monitoring, retraining of informal recyclers for other industries, train workers to protect themselves and subsidize their efforts in purchasing protective clothing, collaborate and negotiate with informal workers towards safe e-waste management, continue developing social interventions to curb the influx of young men from the Northern part of Ghana to the promise of employment at the Agbogbloshie Scrapyard.

A few informal workers while pointing out the need for governmental assistance acknowledged that the informal workers also bear a responsibility in workplace injuries by reducing the pace of their work and by wearing protective clothing. They also show initiative by cleaning up the scrapyard from time to time.

5.3 Willingness for stakeholders to engage

My third question is simply *Are the stakeholders at the end of the e-waste supply chain (in Ghana) willing to collaborate to find a workable solution?* This question will try to explore the possibility of using stakeholder engagement as a means of resolving some of the issues stakeholders identify.

The purpose of this question was to find out if respondents had been involved in stakeholder engagements in the past and their willingness to be involved in future stakeholder engagements as a way of resolving issues associated with the e-waste industry in Ghana.

5.3.1 Research Results

All the interviewees have been involved in stakeholder engagements at various times with the exception of the Medical Expert. Mainly, the informal recyclers have been involved in information and training sessions on how to work safely to reduce the negative impacts on their health and the environment. In addition, they have been given protective equipment such as gloves and goggles. However, they claimed that when people come to Agbogbloshie for various stakeholder meetings, they make promises which they do not fulfill. Another added that, this has resulted in the workers being reluctant to participate in interviews and stakeholder engagement. Also, an informal worker echoed similar sentiments by stating that the stakeholder meetings were numerous and highly ineffective because nothing was done after the meetings; however, he

remained hopeful that something will be done in the future. The response of one informal worker sums it all up; w*hen they come they don't come back so people do not like answering questions* (informal recycler).

Normally, the leaders of the informal workers meet with other stakeholders, after which, they hold meetings to inform the workers. At times, they involve key informal recyclers[14] or seek their advice before holding general meetings. However, one participant mentioned that sometimes the leaders do not inform them of important issues. According to this participant, for example, the leaders have not held a meeting to inform everyone of a relatively new machine installed at Agbologbloshie, which strips copper from cables and has the potential to eliminate the burning of cables at the scrapyard.

The ENGO's representative mentioned that they had been involved in several stakeholder engagement meetings with various governmental bodies. The ENGO has collaborated with other stakeholders as well. For example, through a joint venture with BlackSmith Institute, GreenAD has installed copper stripping machines at the scrapyard for the informal recyclers to strip the wires from cables retrieved from e-waste in order to prevent the burning of wires to harvest copper.

According to the ENGO representative, stripped copper can be sold for more money than burnt copper, nevertheless, an informal worker claimed that most of the workers prefer to burn cables to retrieve copper. The Academic pointed out that the installation of the copper stripping machine is not practical because the informal recyclers have to pay a fee to use these machines. He added that the boys are unwilling to do so, as they would rather save their meager earnings to buy food and support their families.

[14] Key informal workers refers to informal workers who either employ people or highly viewed by fellow informal workers.

The ENGO also added that GreenAD had visited various electronic EEE manufacturers outside of Ghana to gain an insight into their operations and how the manufacturers plan to incorporate sustainable business practices into their manufacturing processes to ensure their products are environmentally friendly.

The Academic expressed his belief that the various stakeholders do not have a clear understanding of what the issue at hand is. He is of the opinion that the stakeholders' actions are driven by their various agendas. He claims that,

The truth of the matter is people do not appreciate the problem as they should. When you talk to the NGOs they get too emotional; the city authorities have an economic objective; the government are a bit too skeptical for political reasons; academics pursue it from an objective perspective; the traditional rulers want to sell the land; and the "victims" also want to secure the right to the city because they are Ghanaians (Professor Martin Oteng-Ababio, Academic).

These conflicting positions held by the various stakeholders add a level of complexity to the issues associated with the management and disposal of e-waste, and in his opinion the e-waste challenges in Ghana cannot be resolved until the various stakeholders become cognizant of the fact that the issue at stake is simply the informal recyclers having to choose between poverty and poison as they do not have other alternatives.

Additionally, he critiques NGOs for responding emotionally to the e-waste challenge in Ghana, as he argues that their stance of wanting to ban e-waste imports or stopping the informal recyclers from recycling at Agbogbloshie, will not end the e-waste challenges in Ghana but rather result in the informal workers finding a different location to recycle e-waste. He believes that NGOS can help reduce the challenges by retraining the workers for other industries.

Finally, all the stakeholders indicated that they are willing to continue using stakeholder engagement as a means of resolving the e-waste management and disposal related issues in

Ghana. The Academic sums this point up, by stating that he is interested in solving this issue as well as numerous other environmental issues as it affects everyone.

5.3.2 Discussion

The examination of the various perspectives that stakeholders hold enabled me to obtain information from some people who are "affected by or affect" the management and disposal of e-waste at the Agbogbloshie Scrapyard.

All stakeholders are willing to engage with other stakeholders. The willingness of all stakeholders to utilize stakeholder engagement in finding a better way of addressing the e-waste challenge facing Ghana is very positive. As the popular saying goes "two heads are better than one". Stakeholders are important in today's society, as firms, institutions and governments or individuals who want to increase the likelihood of a decision, policy, change and project success involve stakeholders in the process (Arora, 2014).

Mostly, the stakeholder meetings they have had so far, have been beneficial on some levels. For example, there have been training sessions on health and safety for the informal workers. Unfortunately, unmet needs and promises have made some of the informal workers cautious about stakeholder engagement, as they may find it a waste of time and unfruitful. Not surprisingly, some of the informal workers seemed suspicious or just did not want to be interviewed especially during the recruitment of FGD participants for this research.

Also, the stakeholders made insightful comments and good suggestions. As pointed out by the Academic, banning the importation of e-waste or stopping the informal workers from recycling at Agbogbloshie will be futile. This is because they may go underground and find a new location to operate. It is thus very important to engage stakeholders. In this specific situation, it is

essential to involve the informal workers in the next steps to better manage e-waste in Ghana. As pointed out by a key informant, the informal workers bear a shared responsibility alongside the government in the successful implementation of any changes in the e-waste industry. Again involving stakeholders in decision making increases the likelihood of its success (Arora, 2014). The Academic makes a good point, however the impacts of the e-waste trade and its management in Agbogbloshie as seen above are of great concern, thus any solutions to this problem should not preclude the banning of shipping e-waste into Ghana.

As illustrated by the diverse positions of the stakeholders pointed out by the Academic, regarding the root of the problem, stakeholder engagement can generate conflicting ideas or views (Unerman & Bennett, 2004). Indeed, the stakeholders may all have valid concerns and solutions; however, they need to deal with the main issue, which in turn may help address some of their concerns. Despite this challenge, Orr (2014) argues that, stakeholder engagement is essential in the creation of an efficient and "coherent public policy".

According to the Carroll & Buchholtz (2012), the following are what can be achieved through stakeholder engagement:

- It enables the identification of potential future problems and gives an opportunity for better prioritization of identified issues.
- To better understand each other's interest and challenges and increase approval for government policies.
- To gain ideas for what the government could do in the e-waste industry and allows for collaborations between stakeholders.

- A means for the government to improve relationships with stakeholders and an opportunity for stakeholders to trust each other better and make resolution of issues easier.
- To reduce the potential of stakeholder conflicts or issues from becoming publicized. (These suggestions were adopted for the government of Ghana and its stakeholders instead of a business and its stakeholders from Carroll & Buchholtz (2012, p. 214).

One important issue that surfaced was in spite of the potentially grave health risks posed especially to the informal workers, the workers are blinded by their drive to survive (interview with the Academic, May, 2016). As rightly pointed out by the Academic, the informal workers do not have alternative choices besides choosing between poison or poverty, perhaps they can make better choices if they have other options to choose from. Unfortunately, they are choosing poison over poverty. On a positive note, they also seemed willing to continue using stakeholder engagement as a means of trying to find a workable solution to reduce or eliminate the risks associated with informal recycling and the e-waste trade.

Stakeholder engagement can be usefully applied to the e-waste industry in Ghana, Jeffery (2009) states that it is "relevant to any type of organization: business, public or civil society" (p.3). Stakeholder engagement could result in shared knowledge, resources and capabilities (Silanpaa, 2010). Moreover, "stakeholders bring unique information, resources, agendas, power, interests, interrelationships, experience, capabilities, support, credibility and access to target groups"(Olden 2003 p 44 as cited in Orr, 2014, p. 6). The e-waste industry with its numerous challenges in Ghana could thus benefit from its use if is done effectively.

Conclusion the above results and discussion evidently show that there are multiple issues associated with the management and disposal of e-waste in Ghana. Solutions to these challenges are wide and varied, however a few are discussed in the next chapter.

Chapter 6 Recommendations and Conclusion

6.1 Recommendations

Evidently, the rapid generation of e-waste, its toxic content and management and disposal and some challenging issues associated with e-waste raised above must be addressed urgently, especially in Global South communities such as Agbogbloshie, where they do not have the capability to safely manage and dispose of e-waste. Certain measures could be taken to reduce its potential impact on human health and the environment. This paper suggests a few recommendations based on the findings of the research as well as some best practices from the electronic industry and other industries. There is not a single solution to this problem that can be considered as a universal remedy, as each remedy may have its pitfalls. Thus, this paper suggests a number of solutions which when implemented alongside each other can reduce or eliminate the e-waste trade and the negative impacts of e-waste mismanagement.

First, it is essential for the international community including NGOs, the electronic industry and governments both locally and globally to jointly create a standardized definition for e-waste that would be used worldwide. This could make quantification, regulation and tracking of e-waste much easier; which can ultimately enable the reduction of the burden created by e-waste.

One of the main focuses of environmental justice is regulation (Cutter, 1995) and as such the regulation of illegal dumping of these hazards on poorer and ill-equipped communities, is essential in promoting sustainability. New international regulation that builds on the Basel Convention and addresses the Basel Convention's loopholes should be formulated. It should be effective and enforceable to reduce the illegal and 'legal' trading of e-waste to Global South countries that are ill-equipped to manage and dispose of e-waste in an environmentally friendly

manner. The regulation should mandate the proper management, including recycling and disposal of e-waste, to be done in state of the art recycling facilities especially in the Global North, where the use of EEE and the generation of e-waste has been historically been higher than the Global South (Pellow, 2007). The regulation should have severe penalties for offenders to increase the level of compliance.

The Government of Ghana, the regulator of hazardous waste in Ghana, must shape policies to reduce the quantity of hazardous waste. The government, the regulator of e-waste in Ghana must also endeavour to regulate and monitor the importation of WEEE. Although the government of Ghana recently (July 7, 2016) formulated an e-waste regulation (Cudjoe, 2016), it is only with time that the effectiveness of this new regulation will be tested. In addition, the international community could also set up an e-waste governing body that evaluates the effectiveness or lack of regulation especially in Global South Countries. This organization can work with Global South countries to formulate and/or tighten existing regulations.

As seen at the beginning of this paper, some level of sustainable development can be attained through Corporate Social Responsibility (CSR). The electronic industry can implement sustainable business practices into their day to day operations in order to reduce some of the negative impacts they have on society and the environment/earth.

The electronic companies could incorporate sustainable business practices throughout their operations and their products life cycle, by adopting a model named after the Reduce, Reuse and Recycle concept.

Reduce - This could be accomplished through regulation and the use of the concept of the precautionary principle, by substituting hazardous content with nonhazardous content to reduce

the toxicity of e-waste. E-waste has more than 1000 chemicals some of which are hazardous (Lundgren, 2012; Widmer et al., 2005). Some electronic companies have taken this initiative. According to Iles (2004), original equipment manufacturers in Japan for example, have been eliminating the use of hazardous contents such as lead from their products and increasing recyclable content. For example, NEC reengineered a personal computer (PC) called PowerMate Eco for the US market. It manufactured the PC with 100% recyclable plastic and eliminated the use of 36 potentially toxic chemicals. The PC is safer to recycle, and does not for example, contain flame retardants. In addition, the electronic companies can be regulated to set goals for achieving the elimination of the toxic content by continuously reducing them in their products every few years. Therefore by redesigning their products to contain safer components, the electronic companies would be reducing the negative impacts their products are having on the environment and human health. In other words, the electronic companies would be redesigning their products for the environment (Esty and Winston, 2009). The best stage to reduce a product's ecological footprint[15] is during its design (The Zoi Environment Network and Grid-Arendal, 2012). Thus, they would be reducing their ecological footprint.

Reuse – They could also extend the life of their products by encouraging customers to reuse their gadgets. For example, they could offer new software on their customers' existing EEE to extend the useful life of their products. This would reduce the ever increasing throwaway culture and some of its unintended impacts. For example, Patagonia (an American outdoor apparel company) has successfully pursued sustainability while achieving a yearly increase of 6% in sales, by implementing a Common Threads Recycling Program. This program encourages customers to consume responsibly and to recycle polartech fleece. Although it is a different industry, the

[15] "The Ecological Footprint measures the amount of productive land area needed to support a nation's consumption and waste." (Baker, 2004, p. 14).

electronic company could learn some sustainability practices from Patagonia. Thus the electronic companies will be "re-engineering their processes to reduce consumption, reduce pollution and reduce risks" (Epstein & Buhovac, 2014 p. 209). This will also reduce the depletion of natural resources and the consumption of energy used in the manufacturing of their products as well as wastes generated in their operations. Again, they would be reducing their ecological footprint.

Recycle- The electronic industry should be responsible for the life of their products through take back programs or Extended Producer Responsibility (EPR) to ensure safe disposal of their products. According to Lindhqvist (2000) EPR is defined "as an environmental protection strategy that makes the manufacturer of the product responsible for the entire life cycle of the product and especially for the take back, recycling and final disposal of the product" (Khetriwal, et al., 2009, p. 154). EPR policies make the producer instead of local governments responsible for the cost of negative externalities of their products; therefore making the manufacturers find ways of reducing the toxicity of their products (Lundgren, 2012). Widmer et al. (2005) claim EPR policies are progressively part of legislations for waste management and Lundgren (2012) states that most Global North countries' regulations are based on EPR. Nonetheless, the e-waste trade still exists. Thus, the EPR should be regulated by the government to meet a set quota of recycling through a joint industry effort (Khetriwal, et al., 2009). EPR, according to the OECD has the following four objectives;

(i) Source reduction (natural resource conservation/materials conservation). (ii) Waste prevention. (iii) Design of more environmentally compatible products. (iv) Closure of material loops to promote sustainable development. (OECD as cited in Khetriwal, et al., 2009, p.155).

The electronic industry should also be regulated on an international level to ensure compliance with the above objectives.

Moreover, the producers of EEE should recycle the reusable contents of e-waste in the short term. In the long term, they should build regional state of the art recycling centres in the Global South to assist with their take back efforts. These efforts could ultimately reduce the adverse effects their products have on human health and the environment. Patagonia discussed above recycled 96% of their waste in its operations (Reinhardt et al., 2010) by being responsible for their products at the end of its life. The electronic industry could strive to continuously achieve such high recycling rates. Additionally, they could sell their wastes as input to other industries[16] to make efficient use of their waste and to make money as well.

All the strategies associated with the reduce, reuse and recycle concept discussed above would reduce the electronic companies ecological footprint and contribute to some level of sustainable development. The electronic companies could in turn use sustainability as a form of competitive advantage, as most stakeholders are advocating for green initiatives (Esty and Winston, 2009). Thus they will be creating shared value[17] (Kramer & Porter, 2011).

Stakeholders for this research made invaluable contributions to the recommendations provided herein.

According to the Business Council for Sustainable Development, "Stakeholder dialogue is a powerful catalyst for change. It promotes greater transparency, information sharing and inspires society to work together," (Kaptein & Tulder, 2003, p. 208). The importance of stakeholders

[16] This is known as Industrial symbiosis (Esty and Winston, 2009).

[17] The concept of shared value can be defined as policies and operating practices that enhance the competitiveness of a company while simultaneously advancing the economic and social conditions in the communities in which it operates. Shared value creation focuses on identifying and expanding the connections between societal and economic progress" (Porter and Kramer, 2011).

cannot be underestimated. According to Lyon and Maxwell (2004), "substantial evidence indicates that stakeholder pressure is an important factor motivating corporate environmental activity" (p. 23). Various stakeholders such as the international Media, NGOs and researchers have written on the plight of places such as Agbogbloshie (Prakash et al., 2010, Bridgen et al., 2008). Stakeholders such as Greenpeace have created public awareness on the challenges facing Global South countries such as Agbogbloshie (Prakash et al., 2010). Stakeholders can thus make the electronic industry and the Government of Ghana more responsible for the atrocities at Agbogbloshie and its environs. According to Mohai et al. 2009, global organizations and networks are a force to reckon with at the formulation of international treaties, "within corporate shareholder meetings; in the halls of congresses, parliaments, and city councils; and within local community settings" (Mohai et al., 2009 p. 421). Therefore stakeholders can continuously use environmental justice strategies to push for changes to make the electronic industry more responsible.

On an international level, stakeholder engagement could be utilized continuously to improve ineffective global legislation such as the Basel Convention. It could also be used to engage and encourage global actors such as the US, which have refused to ratify the Basel Convention (Pellow, 2007) to support it. Additionally, to make the Basel Ban more effective, they can for example, require exporting countries to certify that second hand equipment leaving their ports, are not only functional but also have reasonable reusable lifespans. The government of Ghana could also form collaborative and strategic international partnerships between Global North and Global South countries to educate and train the informal workers to improve their working conditions and health and safety standards to internationally acceptable standards.

Indeed “two heads are better than one”! Over the past several years challenging issues such as climate change and HIV/AIDS have shown that governments alone cannot effectively address these global issues. Stakeholders can share important information and knowledge as well as increase their effectiveness when they work together (Silanpaa, 2010).

On the local level, the government of Ghana has a major role to play in stakeholder meetings especially in the regulation of the e-waste industry and for moving towards a more environmentally friendly management of e-waste. The government needs to address this issue sooner than later. First, it needs to fully understand and appreciate the nature and the challenges associated with the e-waste industry; this will enable it to assess the gravity of the problem. It also needs to reduce the attractiveness of this trade to the youth who continuously come down to Agbogbloshie from the Northern part of Ghana to indulge in this risky business. The government of Ghana could come up with social interventions (Academic interview). They could for instance retrain the informal workers so they can improve their job skill sets and work in other industries. They could also train some of the existing informal workers and create a formal recycling e-waste management in Ghana and employ them in a safer environment (Medical Expert interview and ENGO representative).

Unfortunately the government’s view of such a research project was not explored in this study. The Environmental Protection Agency(Ghana) was selected to represent the Government of Ghana as a stakeholder (see appendix F, for questions that were formulated for EPA Ghana). Attempts at obtaining the government’s position on this research, were not forthcoming. This could be due to the following; there is a possibility that they are not interested in this research and that this issue is not much of a priority for the government. It could also be political, due to the pending elections, they may not want to participate in any research and/or, publication that

can generate negative media attention. Or it may very well be that the key informant is being careful, as it may be a sensitive political issue that could get one into trouble with the authorities. Notwithstanding, the government of Ghana is a very important stakeholder and the absence of their view in my paper is a limitation on my research.

Stakeholder engagement is relevant to any type of organization: business, public or civil society. It is particularly important in the context of running an organization responsibly and is integral to the concept of Corporate social responsibility" (Jeffery, 2009, p.3). Stakeholders try to "influence companies' activities and reporting" through various means such as "cooperation, antagonism and collaborating" (Tilt, 2007, p. 120). Orr identifies three attributes of a stakeholder as; power to influence, the legitimacy of a relationship to the firm and the urgency of the stakeholder's claim (Orr, 2014, p. 23). Stakeholders are therefore important in today's society, as firms, institutions and governments or individuals who want to increase the likelihood of a decision, policy, change and project's success, involve stakeholders in the process (Arora, 2014).

According to the Academic, the stakeholders for Agbogbloshie hold differing positions regarding the root of e-waste challenges at Agbogbloshie, which makes stakeholder engagement difficult (Unerman & Bennett, 2004). However, despite the conflicting stakeholder views the various stakeholders might have, it does not always have to be a zero sum mentality (Fisher & Patton, 2011). Zandvliet (2015) suggests exploring outcomes in negotiation that adds value by focusing on interests and not positions of various stakeholders in order to navigate the conflicting positions various stakeholders hold.(Luc Zandvliet, stakeholder seminar at Schulich School of Business, March 5, 2015).

The stakeholders can also collaborate to find the best steps to follow in order to achieve a more sustainable e-waste management and disposal system in Ghana. Dialoguing with stakeholders as Unerman, & Bennett (2004) put it, is the foundation of numerous "recent developments in corporate social and environmental governance and accountability practices" (p. 685).

Stakeholder engagement could thus be used to communicate. The Greater Accra Scrap Dealership Association's leadership could consult with members to find out what is important to the informal recyclers. The leaders could also inform and educate them on issues that may be beneficial to them. Consulting with their members, could increase the successful implementation of an improved and safer process. Again, the leaders can also promote the importance of engaging with stakeholders to their membership. Additionally, stakeholders coming into Agbogbloshie in the future can be informed by the leaders what their membership deem important. The stakeholders can then incorporate the identified needs into their engagement with the informal recyclers. Lastly, the leadership should make it a point to always inform their membership of important developments at Agbogbloshie (informal recycler), especially, if it leads to a better and safer working environment for their membership.

All of the above, if implemented effectively alongside other sustainable solutions could move the e-waste industry a few steps closer to sustainable development. These strategies may not totally stop the increasing rate of e-waste production and its associated challenges; they could nevertheless reduce the amount of e-waste generated and impact the e-waste trade and, if implemented effectively, ensure a safer and healthier environment.

6.2 Conclusion

In this paper, we see that the lack of a universal definition of e-waste, increased wealth, increased global demand for EEE, consumerism and its associated throwaway culture, less durable electronics, planned obsolescence, toxic components of electronics, cost saving measures of industry, unemployment, poverty, NIMBYism in the Global North, stiffer regulation and costly disposal of hazardous waste in Global North, Global South indebtedness and SAPs, unequal power, racist ideologies, bridging the digital divide and ineffective regulations make it difficult to control the hazardous waste trade. This paper highlights the avoidable and adverse health effects this trade has on human health as well as on the environment and one can clearly see that it is not worth the benefits the local communities in Agbogbloshie, Ghana, gain from this industry.

An ILO study claims that most e-waste is generated domestically within all countries and as such making the e-waste trade illegal will not solve the problem associated with e-waste management in Global South countries (Lundgren, 2012). This may be true for some countries; however, Balde et al. (2015) state that illegal waste trade is a main e-waste "generator" for Ghana and as such in Ghana's case, one of the goals of e-waste legislation should be to ban e-waste shipments into Ghana.

There is therefore an urgent need to permanently ban the export of toxic waste to Ghana. Global and national legislations should be enacted with stiff penalties and enforced to effectively regulate business' production and disposal of hazardous products and wastes and to make businesses responsible for the entire life cycle of their products. This could protect workers'

health and safety in the workplace globally; reduce the negative impacts of e-waste on public health and regulate environment depredation for current and future generations. In my opinion, this will in some way lead to a more "sustainable" world in which the future generations may prosper because they have a healthier environment and enjoy a fuller ecosystem service.

Most importantly, industry, governments and the international community should work together to stop this trade because as the saying goes 'what goes around comes around". What happens in a remote part of the world may have a global impact. As seen earlier, the boomerang effect of e-waste can affect anyone anywhere in the world through agricultural produce, toys, jewelry, security breaches of personal information and increase in cybercrime hotspots. Indeed an "injustice to one is an injustice to all" (Bullard & Lewis, 1996, p. xiii).

Furthermore, in a World Health Organization publication, Prüss-Üstün and Corvalán (2006) reported that "Globally, an estimated 24% of the disease burden (healthy life years lost) and an estimated 23% of all deaths (premature mortality) was attributable to environmental factors" (World Health Organization publication, 2006). It is therefore important how we treat our environment. The environment is vital in human lives, because "Nature is a source of raw materials, the "sink" for the disposal of wastes and the ultimate foundation of public health" (Boyce et al., 2007). I believe if we overexploit or "abuse" nature, there will be depletion of natural resources, if we over pollute the earth we will reduce the earth's ability to act as a "sink" for waste disposal and increase our disease burden and mortality rates.

Moreover, all stakeholders especially NGOs should continuously utilise environmental justice strategies to bring the following environmental and societal issues to the forefront; sustainability/CSR, the environment, technology, increasing e-waste generation, toxic content of

e-waste, "mismanagement' and disposal of e-waste, low recyclability of EEE, complex EEE design, depletion of natural resources, effective stakeholder engagements, health impacts of environmental pollution, climate change, child labour, poor working conditions of marginalized peoples, irresponsible consumption and other environmental justice related issues. They could employ the use of media especially social media to create awareness of these issues. This is because it is important to learn about these issues and the consequences of our inaction or action.

And as such, strategies such as sustainable business practices, stakeholder engagement, effective and enforceable regulation, creating awareness and environmental justice strategies should be explored to find out the best ways of utilizing these strategies to ensure the elimination or reduction of the impacts of this trade on us and on future generations. Businesses could implement sustainable business practices that are in line with sustainable development. Practices of corporate sustainability could thus potentially reduce the incidences of environmental disasters. By investigating practices that are more sustainable and gaining insights from various local stakeholders in Ghana, this research could provide significant contributions to how e-waste can be managed and regulated more effectively in other Global South Communities.

Finally, as illustrated above, hazardous waste management and disposal is truly a challenging global problem. Evidently, the urgency of e-waste challenges is accurately captured by a UN report; which calls it a "toxic time bomb" (Bournay, 2006) which needs to be addressed to change the above trajectory in the near future. Bullard (2000) claims "We are all guilty" and also emphasises the need for everyone to consume responsibly[18] (Bullard, 2000). Thus, the international communities, the Ghana Government and everyone especially, the industries, owe it

[18]" Responsible consumption. Although it sounds like an oxymoron, responsible consumption reduces the demand for stuff and its associated pollution. Consumers make better-informed based on a product'splace of ortigin, the labor conditions under which it was made, its ingredients, its packaging, its life-cycle ecological footprint, and other sustainability-related criteria"(Willard, 2012, p. 18).

to the future of humanity and planet earth (the source of our well being) to act now and to act justly. The sustainability proverb below admonishes us to endeavour to *"Treat the earth well: it was not given to you by your parents, it was loaned to you by your children. We do not inherit the Earth from our Ancestors, we borrow it from our Children"* (Native American quotes, 1996).

6.3 Further Research

There are some issues that came to light during the research that require more research. First, health risk assessments are needed to examine the impacts of e-waste management and disposal in the Global South (Osibanjo and Nnorom 2007). Thus, more research is needed to be done on how e-waste impacts human health and the environment. This could validate the universal use of the precautionary principle across polluting industries worldwide.

As the government of Ghana was not part of the stakeholders for this paper, research is needed to explore the government of Ghana' s views on issues associated with e-waste management and disposal as well as the e-waste trade that culminates in Ghana.

Moreover, at the time of the research there was no e-waste regulation; however, the government of Ghana recently passed a regulation (Cudjoe, 2016), thus future research is needed to find out how effective the new regulation is.

Furthermore, a more comprehensive study, that has more and varied stakeholders at the end of this e-waste supply chain at Agbogbloshie, as well as the whole supply chain originating from the Global North will be needed to give a fuller picture of the e-waste trade, e-waste management and its challenges worldwide.

BIBLIOGRAPHY

Adeola, F. O. (2011). *Hazardous wastes, industrial disasters, and environmental health risks: Local and global environmental struggles*. New York, NY: Palgrave Macmillan.

Agyei-Mensah, S., & Oteng-Ababio, M. (2012). Perceptions of health and environmental impacts of e-waste management in Ghana. *International journal of environmental health research*, *22*(6), 500-517.

Agyeman. H, (April 2015) Visual: The Gaze on Agbogbloshie: The Misrepresentation of West Africa as Dystopia. Retrieved from **http://www.aintiawomancollective.com/visual-the-gaze-on-agbogbloshie/.**

Agyeman, J. (2009). *Speaking for ourselves: Environmental justice in Canada*. Vancouver: UBC Press.

Akormedi, M., Asampong, E., & Fobil, J. N. (2013). Working conditions and environmental exposures among electronic waste workers in Ghana. *International journal of occupational and environmental health*, *19*(4), 278-286.

Allotey A. G., & Opoku Mensah D., (2016). 48% Ghanaian youth jobless – World Bank Retrieved from http://citifmonline.com/2016/05/12/48-ghanaian-youth-jobless-world-bank/ Thursday 12th May , 2016.

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

Aulakh, R. (2013) *The Top 10 Most Toxic Cities in the World and How they Got That way*. Toronto Star Tuesday November 19, 2013. Retrieved from http://www.thestar.com/news/world/2013/11/19/the_top_10_most_toxic_places_on_earth_and_how_they_got_that_way.html.

Baker, E. (2004). *Vital waste graphics*. United Nations Pubns.

Baldé, C. P., Wang, F., Kuehr, R., & Huisman, J. (2015). The global e-waste monitor–2014. *United Nations University, IAS–SCYCLE, Bonn, Germany*.

Basel Convention (1989). Retrieved from http://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx.

Blacksmith Institute and Green Cross report, 2013. The World's worst 2013: The top ten toxic threats: Cleanup, progress and ongoing challenges. Retrieved from http://www.greencross.ch/uploads/media/pollution_report_2013_top_ten_wwpp.pdf.

Boadi, K. O., & Kuitunen, M. (2002). Urban waste pollution in the Korle lagoon, Accra, Ghana. *Environmentalist*, *22*(4), 301-309.

Bournay, E. (2006). *Vital waste graphics 2* (Vol. 2). UNEP/Earthprint.

Boyce, J. K., Narain, S., & Stanton, E. A. (2007). *Reclaiming nature: Environmental justice and ecological restoration*. London ; New York: Anthem Press.

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.

Brulle, R. J., & Pellow, D. N. (2006). Environmental justice: human health and environmental inequalities. *Annu. Rev. Public Health*, *27*, 103-124.

Bryman, A., Bell, E. A. 1., & Teevan, J. J. (2009). *Social research methods* (2nd Canadian ed.). Don Mills, Ont.: Oxford University Press.

Bullard, R.D. (1996). Environmental Justice: It's more than waste facility siting. Social Science Quarterly, 773(3), 493 -499.

Bullard, R. (2000). Environmental justice in the 21st century. *People of color environmental groups. Directory*, 1-21.

Bullard, R. D., & Lewis, J. (1996). *Environmental Justice and Communities of Color*. Sierra Club Books: San Francisco, CA, USA.

Caravanos, J., Clark, E., Fuller, R., & Lambertson, C. (2011). Assessing worker and environmental chemical exposure risks at an e-waste recycling and disposal site in Accra, Ghana. *Journal of health and pollution*, *1*(1), 16-25.

Caravanos, J., Clarke, E. E., Osei, C. S., & Amoyaw-Osei, Y. (2013). Exploratory health assessment of chemical exposures at e-waste recycling and scrapyard facility in Ghana. *Journal of Health and Pollution*, *3*(4), 11-22.

Carroll, A. B., & Buchholtz, A. K. (2012). *Business & society: Ethics, sustainability, and stakeholder management* (8th ed.). Mason, OH: South-Western Cengage Learning.

CIA world fact book 2015 Retrieved from https://www.cia.gov/library/publications/the-world-factbook.

Cole, L. W., & Foster, S. R. (2001). *From the ground up: Environmental racism and the rise of the environmental justice movement*. NYU Press.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks: SAGE Publications.

Clapp, J. (2001). *Toxic exports: The transfer of hazardous wastes and technologies from rich to poor countries*. Ithaca: Cornell University Press.

Clinard, M., & Yeager, P. (1980). Corporate Crime. New York: Free Press.

Cudjoe, J. (July, 2016). Ghana's Parliament has passed the Hazardous and Electronic Waste Control Management Bill, 2016 into Law Retrieved from http://ghanajustice.com/parliament-passes-hazardous-and-electronic-waste-control-and-management-bill-2016-into-law/

Cutter, S. L. (1995). Race, class and environmental justice. *Progress in human geography*, *19*, 111-111.

Diaz, L. F., Savage, G. M., Eggerth, L. L., UNEP International Environmental Technology Centre., & CalRecovery, I. (2005). *Solid waste management*. Paris: United Nations Environment Programme

Epstein, M. J., & Rejc, A. (2014). *Making sustainability work: Best practices in managing and measuring corporate social, environmental, and economic impacts* (Second Edition, Completely Revised and Updated.). Greenleaf Publishing/Berrett-Koehler Publishers, Inc.

Envirolist (2016-2016). Retrieved from http://envirolist.tumblr.com/post/116532117894/agbogbloshie-in-the-suburb-of-accra-ghana-is.

Esty, D. C., & Winston, A. S. (2009). *Green to gold: How smart companies use environmental strategy to innovate, create value, and build competitive advantage* (Rev. & updated [ed.].). Hoboken, N.J.: Wiley

Fisher, R., Ury, W., & Patton, B. (2011). *Getting to yes: Negotiating agreement without giving in* (Rev. ed. / by Fisher, Ury, and Patton.). New York: Penguin.

Frazzoli, C., Orisakwe, O.E., Dragone, R., & Mantovani, A. (2010). Diagnostic health risk assessment of electronic waste on the general population in developing countries' scenarios.

Friedman, A. L., & Miles, S. (2006). *StakeholdersTheory and practice*. Oxford ; New York: Oxford University Press:.

Gabel DA. E-waste dump in Africa contaminating community. Global Pollut Prev News. Retrieved from: www.enn.com/pollution/article/43495

Gosine, A., & Teelucksingh, C. (2008). *Environmental justice and racism in Canada: An introduction*. Toronto: Emond Montgomery Pub.

Grant, R. (2006 January) Out of place? Global citizens in local spaces: A study of the informal settlements in the Korle Lagoon environs in Accra, Ghana. In *Urban Forum* (Vol. 17, No. 1, pp. 1-24). Springer Netherlands.

Grant, R., & Oteng-Ababio, M. (2012). Mapping the invisible and real" African" economy: urban e-waste circuitry. *Urban Geography*, *33*(1), 1-21.

Gwam, C. U. (2001). Adverse Effects of the Illicit Movement and Dumping of Hazardous, Toxic, and Dangerous Wastes and Products on the Enjoyment of Human Rights. *Fla. J. Int'l L.*, *14*, 427

Iles, A. (2004). Mapping environmental justice in technology flows: Computer waste impacts in Asia. *Global Environmental Politics*, *4*(4), 76-107.

Jeffery, N. (2009). Stakeholder Engagement: A Road Map to Meaningful Engagement Doughty Centre, Cranfield School of Management.

Kaminsky, H. S. (1992). Assessment of the Bamako Convention on the Ban of Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa. *Geo. Int'l Envtl. L. Rev.*, *5*, 77.

Kaptein, M., & Van Tulder, R. (2003). Toward effective stakeholder dialogue. *Business and society review*, *108*(2), 203-224.

Khalili, N. R. (2011). *Practical sustainability: From grounded theory to emerging strategies* (1st ed.). New York: Palgrave Macmillan.

Kiddee, P., Naidu, R., & Wong, M. H. (2013). Electronic waste management approaches: An overview. *Waste Management*, *33*(5), 1237-1250.

Kimani, N. G. (2007). Environmental Pollution and Impacts on Public Health; Implications of the Dandora Municipal Dumping Site in Nairobi, Kenya. *UNEP, Kenya*.

Kone, L. (2014). The Illicit Trade of Toxic Waste in Africa: The Human Rights Implications of the New Toxic Colonialism. *Available at SSRN 2474629*.

Knowles, E., (2009). Little Oxford Dictionary of proverbs. Oxford , New York. Oxford University Press.

Kramer, M. R., & Porter, M. E. (2011). Creating shared value. *Harvard business review*, *89*(1/2), 62-77.

Krueger, J. (2001). The Basel Convention and the international trade in hazardous wastes. *Yearbook of international co-operation on environment and development*, *2002*, 43-51.

Lundgren, K. (2012). *The global impact of e-waste: Addressing the challenge*.

Lyon, T. P., & Maxwell, J. W. (2004). *Corporate environmentalism and public policy*. Cambridge, UK ; New York: Cambridge University Press.

MacKendrick, N. (2010). "Media Framing of Body Burdens: Precautionary Consumption and the Individualization of Risk" *Sociological Inquiry* 80(1):126-149.

Manhart, A. (2011). International cooperation for metal recycling from waste electrical and electronic equipment. *Journal of Industrial Ecology*, *15*(1), 13-30.

Marbury, H. J. (1995). Hazardous waste exportation: the global manifestation of environmental racism. *Vand. J. Transnat'l L.*, *28*, 251.

Margai, F. M. (2010). *Environmental health hazards and social justice: Geographical perspectives on race and class disparities*. London, UK; Washington, DC: Earthscan.

Marsh, S., & Wynde, R., (2011). Biodiversity and Conservation. In J. Brady, A. Ebbage, R. Lunn & Institute of Environmental Management and Assessment. *Environmental management in organizations: The IEMA handbook* (2nd ed.). London ; Washington, DC: Earthscan.

Mohai, P., Pellow, D., & Roberts, J. T. (2009). Environmental justice. *Annual Review of Environment and Resources*, *34*, 405-430.

Mohit A. (2014) Project management class, (SB/MGMT 6700 3.0) Summer, 2014. Schulich school of Business,York University.

Native American quotes, 1996, Ancient Indian Proverb Retrieved from www.ilhawaii.net/~stony/quotes.html Quotes from our Native Past.

Ng, G. (2015) Management Practices for Sustainable Business class (SB/BSUS 6300 3.0) Winter 2015 culich School of Business, York University

Nnorom, I. C., & Osibanjo, O. (2008). Overview of electronic waste (e-waste) management practices and legislations, and their poor applications in the developing countries. *Resources, conservation and recycling*, *52*(6), 843-858

Orr, S. K. (2014). *Environmental policymaking and stakeholder collaboration: Theory and practice*. CRC Press.

Osibanjo, O., & Nnorom, I. C. (2007). The challenge of electronic waste (e-waste) management in developing countries. *Waste Management & Research*, *25*(6), 489-501.

Oteng-Ababio, M. (2012). Electronic Waste Management in Ghana–Issues and Practices. *eds. Curkovic, S and Cao, J. Sustainable Development–Authoritative and Leading Edge Content for Environmental Management, Rijeka, Croatia: InTech*, 149-166.

Oteng-Ababio, M. (2010). E-waste: an emerging challenge to solid waste management in Ghana. *International Development Planning Review*, *32*(2), 191.

Oteng-Ababio, M. (2012). When necessity begets ingenuity: e-waste scavenging as a livelihood strategy in Accra, Ghana. *African Studies Quarterly*, *13*(1), 1-21.

Oteng-Ababio, M. M., & Amankwaa, E. F. (2014). The e-waste conundrum: Balancing evidence from the North and on-the-ground developing countries' realities for improved management. *African Review of Economics and Finance*, *6*(1), 181-204.

Oteng-Ababio, M., Owusu, G., & Chama, M. (2015). Intelligent enterprise: wasting, valuing and re-valuing waste electrical and electronic equipment. *The Geographical Journal*. Pegg, J. R, 2004. "State of the World Report: Rising Consumption Unsustainable." Environmental News Service, January 8.

Pegg, J. R, 2004. "State of the World Report: Rising Consumption Unsustainable." Environmental News Service, January 8.

Pellow, D. N. (2007). *Resisting global toxics: Transnational movements for environmental justice*. Cambridge, Mass.: MIT Press.

Peil, M., 1976: African squatter settlements: a comparative study, Urban Studies, 13, 155-166.

Porterfield, A., and Weir, D. (1987). "The Export of U.S. Toxic Watses."Nation, October 3.

Prakash, S., Manhart, A., Amoyaw-Osei, Y., & Agyekum, O. O. (2010). Socio-economic assessment and feasibility study on sustainable e-waste management in Ghana. *Öko-Institut eV in cooperation with Ghana Environmental Protection Agency (EPA) & Green Advocacy Ghana, Ministry of Housing, Spatial Planning and the Environment, VROM-Inspectorate*.

Prakash, S., Manhart, A., Agyekum, O. O., Amoyaw-Osei, Y., Schluep, M., Müller, E., & Fasko, R. (2010). Informal e-waste recycling sector in Ghana: An indepth socio-economic study.

Preventing disease through healthy environments. *Towards an estimate of the environmental burden of disease.* 2006, France, World Health Organization publication. Retrieved from http://www.who.int/quantifying_ehimpacts/publications/preventingdisease.pdf .

Puckett, J., Byster, L., Westervelt, S., Gutierrez, R., Davis, S., Hussain, A., & Dutta, M. (2002).Exporting Harm: The High-Tech Trashing of Asia. Basel Action Network and Silicon Valley Toxics Coalition.

Raphael, Dennis (2004) "Chapter 1: Introduction to the Social Determinants of Health" pages 1-18 in *Social Determinants of Health: Canadian Perspectives*. Dennis Raphael (Ed) Toronto: Canadian Scholars Press.

Rechtschaffen C, Gauna E., (2002). Environmental Justice: Law, Policy & Regulation. Durham: Carolina Academic Press

Reinhardt, F., Casadesus-Masanell, R., Hyun, J.K. (Rev. 2010, Oct 19). Patagonia. *Harvard Business Review Case*, 9-711-020.

Robinson B.H.(2009) . *E-waste: An assessment of global production and environmental impacts.* Science of The Total Environment, 408(2), 183-191

Rucevska I., Nellemann C., Isarin N., Yang W., Liu N., Yu K., Sandnæs S., Olley K., McCann H., Devia L., Bisschop L., Soesilo D., Schoolmeester T., Henriksen,R., Nilsen, R. 2015. Waste Crime: Low Risks-High Profits. Gaps in Meeting the Global Waste Challenge. A Rapid Response Assessment. *UNEP Rapid Response Assessment*.

Sangani, K. (2011, December 5). Disagreements stall WEEE Directive revision Engineering and Technology Magazine (E T Magazine).
Retrieved from **http://eandt.theiet.org/news/2011/dec/weee-directive.cfm**

Sillanpaa, B. (2010) Stakeholder Engagement. In Visser, W., Matten, D., Pohl, M., & Tolhurst, N.,(eds.), *The A to Z of corporate social responsibility* (Rev. and updated ed.). Hoboken, NJ: Wiley.

Sustainable **E**lectronics **R**ecycling **I**nternational, (SERI), (2014). Quick Facts on Electronics. Retrieved at http://www.sustainableelectronics.org/understanding-electronics/

Solving the E-waste problem (STEP)(2014) White paper. One Global Definition of E-waste. Retrieved from
http://www.stepinitiative.org/files/step/_documents/StEP_WP_One%20Global%20Definition%20of%20E-waste_20140603_amended.pdf

Souppouris, V. (2016) The human cost of electronic waste (Image by Michael Ciaglo) Retrieved from http://www.engadget.com/2016/02/18/the-big-picture-e-waste/

The Brundtland Report, 1987). Report of the World Commission on Environment and Development: Our Common Future , Chapter 2: Towards Sustainable Development, UN Documents: Gathering a Body of Global Agreements compiled by the *NGO Committee on Education* of the *Conference of NGOs.* Retrieved from United Nations web sites http://www.un-documents.net/ocf-02.htm

The Lancet. *Electronic Waste – time to take stock.* Volume 381, Issue 9885, p.2223 June 29, 2013. Retrieved from www.thelancet.com

The US EPA, (2016) United States Environmental Protection Agency "Environmental Justice", Retrieved from https://www.epa.gov/environmentaljustice/learn-about-environmental-justice .

The Zoi Environment Network and Grid-Arendal (2012). *Vital waste graphics 3*. The Secretariat of the Basel Convention.

Tilt, C. (2007) External stakeholders perspectives on sustainability reporting in Unerman, J., Bebbington, J., & O'Dywer, R.(eds.) *Sustainability accounting and accountability*. London; New York: Routledge.

Tschakert, P. (2009). Digging deep for justice: A radical re-imagination of the artisanal gold mining sector in Ghana. *Antipode*, *41*(4), 706-740.

Unerman, J., & Bennett, M. (2004). Increased stakeholder dialogue and the internet: towards greater corporate accountability or reinforcing capitalist hegemony? *Accounting, Organizations and Society*, *29*(7), 685-707

UNEP, 1972. Declaration of the United Nations Conference on the Human Environment. Retrieved from http://www.unep.org/Documents.multilingual/Default.asp?DocumentID=97&ArticleID=1503

United Nations Human Settlement Programme, 2003: The challenge of the Slums: Global Report on Human Settlements 2003, Earthscan Publications, London.

United Nations Environmental Program (UNEP), (2011). The Basel Convention at a Glance, Basel Convention. Retrieved from http://www.basel.int/Portals/4/Basel%20Convention/docs/convention/bc_glance.pdf

United Nations Environment Programme (UNEP)(2007a). Division of Technology, Industry and Economics (DTIE), International Environmental Technology Centre. 2007a. *E-waste: Volume 1: Inventory assessment manual* (Osaka/Shiga). Retrieved from: http://www.unep.or.jp/ietc/Publications/spc/EWasteManual_Vol1.

United Nations Environment Programme (UNEP) (2007b). E-waste: Volume II: E-waste management manual (Osaka/Shiga). Retrieved from http://www.unep.or.jp/Ietc/Publications/spc/EWasteManual_Vol2.pdf .

United Nations Environment Programme (UNEP) (2011) E-waste Manual 3 WEEE/E-waste "Take back System" Draft. Retrieved from http://www.unep.org/ietc/Portals/136/Events/WEEE-E%20workshop%20July%202011/UNEP_Ewaste_Manual3_TakeBackSystem.pdf

Warren, C. A. B., & Karner, T. X. (2015). *Discovering qualitative methods: Ethnography, interviews, documents, and images* (Third edition.). Oxford University Press.

Warner, J. (2011). Understanding cyber-crime in Ghana: A view from below. *The International Journal of Cyber Criminology*, *5*, 736-749.

Weidenhamer, J. D., & Clement, M. L. (2007). Leaded electronic waste is a possible source material for lead-contaminated jewelry. *Chemosphere*, *69*(7), 1111-1115.

Widmer, R., Oswald-Krapf, H., Sinha-Khetriwal, D., Schnellmann, M., & Böni, H. (2005). Global perspectives on e-waste. *Environmental impact assessment review*, *25*(5), 436-458.

Willard, B. (2002). *The sustainability advantage: Seven business case benefits of a triple bottom line*. Gabriola Island, B.C.: New Society Publishers.

World Health Organization publication (2006). *Preventing disease through healthy environments. Towards an estimate of the environmental burden of disease.* France, World Health Organization publication. Retrieved from http://www.who.int/quantifying_ehimpacts/publications/preventingdisease.pdf

Wong, M. H., Wu, S. C., Deng, W. J., Yu, X. Z., Luo, Q., Leung, A. O. W., & Wong, A. S. (2007). *Environmental Pollution*, *149*(2), 131-140.

Zandvliet, L., Stakeholder seminar at Schulich School of Business, York University, ON Canada. March 5, 2015.

APPENDICES

Appendix A

Principles of Environmental Justice

PREAMBLE

WE, THE PEOPLE OF COLOR, gathered together at this multinational People of Color Environmental Leadership Summit, to begin to build a national and international movement of all peoples of color to fight the destruction and taking of our lands and communities, do hereby re-establish our spiritual interdependence to the sacredness of our Mother Earth; to respect and celebrate each of our cultures, languages and beliefs about the natural world and our roles in healing ourselves; to ensure environmental justice; to promote economic alternatives which would contribute to the development of environmentally safe livelihoods; and, to secure our political, economic and cultural liberation that has been denied for over 500 years of colonization and oppression, resulting in the poisoning of our communities and land and the genocide of our peoples, do affirm and adopt these Principles of Environmental Justice:

1) **Environmental Justice** affirms the sacredness of Mother Earth, ecological unity and the interdependence of all species, and the right to be free from ecological destruction.

2) **Environmental Justice** demands that public policy be based on mutual respect and justice for all peoples, free from any form of discrimination or bias.

3) **Environmental Justice** mandates the right to ethical, balanced and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things.

4) **Environmental Justice** calls for universal protection from nuclear testing, extraction, production and disposal of toxic/hazardous wastes and poisons and nuclear testing that threaten the fundamental right to clean air, land, water, and food.

5) **Environmental Justice** affirms the fundamental right to political, economic, cultural and environmental self-determination of all peoples.

6) **Environmental Justice** demands the cessation of the production of all toxins, hazardous wastes, and radioactive materials, and that all past and current producers be held strictly accountable to the people for detoxification and the containment at the point of production.

7) **Environmental Justice** demands the right to participate as equal partners at every level of decision-making, including needs assessment, planning, implementation, enforcement and evaluation.

8) **Environmental Justice** affirms the right of all workers to a safe and healthy work environment without being forced to choose between an unsafe livelihood and unemployment. It also affirms the right of those who work at home to be free from environmental hazards.

9) **Environmental Justice** protects the right of victims of environmental injustice to receive full compensation and reparations for damages as well as quality health care.

10) **Environmental Justice** considers governmental acts of environmental injustice a violation of international law, the Universal Declaration On Human Rights, and the United Nations Convention on Genocide.

11) **Environmental Justice** must recognize a special legal and natural relationship of Native Peoples to the U.S. government through treaties, agreements, compacts, and covenants affirming sovereignty and self-determination.

12) **Environmental Justice** affirms the need for urban and rural ecological policies to clean up and rebuild our cities and rural areas in balance with nature, honoring the cultural integrity of all our communities, and provided fair access for all to the full range of resources.

13) **Environmental Justice** calls for the strict enforcement of principles of informed consent, and a halt to the testing of experimental reproductive and medical procedures and vaccinations on people of color.

14) **Environmental Justice** opposes the destructive operations of multi-national corporations.

15) **Environmental Justice** opposes military occupation, repression and exploitation of lands, peoples and cultures, and other life forms.

16) **Environmental Justice** calls for the education of present and future generations which emphasizes social and environmental issues, based on our experience and an appreciation of our diverse cultural perspectives.

17) **Environmental Justice** requires that we, as individuals, make personal and consumer choices to consume as little of Mother Earth's resources and to produce as little waste as possible; and make the conscious decision to challenge and reprioritize our lifestyles to ensure the health of the natural world for present and future generations.

Source: Gosine *& Teelucksingh* (2008, p. 9 -11)

Appendix B

European Commission Directives categories and subcategories of EEE

Annex IA
Categories of electrical and electronic equipment covered by this Directive

1. Large household appliances
2. Small household appliances
3. IT and telecommunications equipment
4. Consumer equipment
5. Lighting equipment
6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
7. Toys, leisure and sports equipment
8. Medical devices (with the exception of all implanted and infected products)
9. Monitoring and control instruments
10. Automatic dispensers

Annex IB
List of products, which fall under the categories of Annex IA are given below.

1. **Large household appliances**

• Large cooling appliances
• Refrigerators
• Freezers
• Other large appliances used for refrigeration, conservation and storage of food
• Washing machines
• Clothes dryers
• Dish washing machines
• Cooking
• Electric hot plates
• Microwaves
• Other large appliances used for cooking and other processing of food
• Electric heating appliances
• Electric radiators
• Other fanning, exhaust ventilation and conditioning equipment

2. **Small household appliances**

• Vacuum cleaners
• Carpet sweepers
• Other appliances for cleaning
• Appliances used for sewing, knitting, weaving and other processing for textiles
• Iron and other appliances for ironing, mangling and other care of clothing
• Toasters
• Fryers

• Grinders, coffee machines and equipment for opening or sealing containers or packages
• Electric knives
• Appliances for hair-cutting, hair drying, tooth brushing, shaving, massage and other body care appliances
• Clocks, watches and equipment for the purpose of measuring indicating or registering time Scales.

3. **IT and telecommunications equipment**

• Centralized data processing
• Mainframes
• Minicomputers
• Printer units
• Personal computing:
• Personal computers (CPU, mouse, screen and keyboard included)
• Laptop computer (CPU, mouse, screen and keyboard included)
• Notebook computers
• Notepad computers
• Printers
• Copying equipment
• Electrical and electronic typewriters
• Pocket and desk calculators
• And other products and equipment for the collection, storage, processing, presentation or communication of information by electronic means
• User terminals and systems
• Facsimile
• Telex
• Telephones
• Pay telephones
• Cordless telephones
• Cellular telephones
• Answering systems
• And other products or equipment of transmitting sound, images or other information by telecommunications

4. **Consumer equipment**

• Radio sets
• Television sets
• Video cameras
• Video recorders
• Hi-fi recorders
• Audio amplifiers
• Musical instruments

• Other products or equipment for the purpose of recording or reproducing sound or image, including signals or other technologies for the distribution of sound and image than by telecommunications

5. **Lighting equipment**

• Luminaries for fluorescent lamps with the exception of luminaries in households
• Straight fluorescent lamps
• Compact fluorescent lamps
• High intensity discharge lamps, including pressure sodium lamps and metal lamps
• Low pressure sodium lamps
• Other lighting or equipment for the purpose of spreading or controlling light with the exception of filament bulbs

6. **Electrical and electronic tools (with the exception large-scale stationary industrial tools)**

• Drills
• Saws
• Sewing machines
• Equipment for turning, milling, sanding, grinding, sawing, cutting, shearing, drilling, making, holes, punching, folding, bending or similar processing of wood, metal and other materials
• Tools for riveting, nailing or screwing or removing rivets, nails, screws or similar uses
• Tools for welding, soldering or similar use
• Equipment for spraying, spreading, dispersing or other treatment of liquid or gaseous substances by other means
• Tools for mowing or other gardening activities

7. **Toys, leisure and sports equipment**

• Electric trains or car racing sets
• Hand-held video game consoles
• Video games
• Computers for biking, diving, running, rowing, etc.
• Sports equipment with electric or electronic components
• Coin slot machines

8. **Medical devices (with the exception of all implanted and infected products)**

• Radiotherapy equipment
• Cardiology
• Dialysis
• Pulmonary ventilators
• Nuclear medicine
• Laboratory equipment for *in-vitro* diagnosis
• Analysers

• Freezers
• Fertilization tests
• Other appliances for detecting, preventing, monitoring, treating, alleviating illness, injury or disability

9. Monitoring and control instruments

• Smoke detector
• Heating regulators
• Thermostats
• Measuring, weighing or adjusting appliances for household or as laboratory equipment
• Other monitoring and control instruments used in industrial installations (e.g. in control panels)

10. Automatic dispensers

• Automatic dispensers for hot drinks
• Automatic dispensers for hot or cold bottles or cans
• Automatic dispensers for solid products
• Automatic dispensers for money
• All appliances which deliver automatically all kind of products

Source: UNEP DTIE 2007a

Appendix C

Larry Summer's Memo

World Bank memo form Lawrence Summers (Chief economist and vice president of the World Bank).

> *Shouldn't the World Bank be encouraging MORE migration of the dirty industries to the LDC (lesser developed countries)? I can think of three reasons….*
>
> *1) A given amount of health impairing pollution should be done in the country with the lowest cost, which will be the country with the lowest wages. I think the economic logic behind dumping a load of toxic waste in the lowest wage country is impeccable and we should face up to that.*
>
> *2) I've always thought that under populated countries in Africa are vastly UNDER polluted, their air quality is probably inefficiently low compared to Los Angeles or Mexico City.*
>
> *3) The concern over an agent (pollutant) that causes a one in a million change in the odds of prostate cancer is obviously going to be higher in a country where people (actually) survive to get prostate cancer than in country (with higher mortality rates) Summers 1991World Bank Internal Memo December 12 (Pellow, 2007 p 9)*

Appendix D

Greenpeace report on Summary of key chemicals found at e-waste recycling sites in Ghana

Cadmium (Cd) occurs in electronics both as cadmium metal, in some switches and solder joints, and as cadmium compounds in rechargeable batteries, UV stabilisers in older PVC cables and "phosphor" coatings in older cathode ray tubes. Like lead, cadmium can accumulate in the body over time, with long-term exposure causing damage to the kidneys and bone structure. Cadmium and its compounds are known human carcinogens, primarily through inhalation of contaminated fumes and dusts.

Lead (Pb) is widely used in electronic goods, as a major component of solders (as an alloy with tin) and as lead oxide in the glass of cathode ray tubes (televisions and monitors), as well as in lead-acid batteries. Its compounds have also been used as stabilisers in some PVC cables and other products. Lead is highly toxic to humans, as well as to animals and plants. It can build up in the body through repeated exposure and have irreversible effects on the nervous system, particularly the developing nervous system in children.

Phthalates are commonly used to soften plastics, especially PVC. There are substantial concerns about their toxicity. The phthalate DEHP, for example, is capable of interfering with development of the testes in early life. Both DEHP and DBP are classified as "toxic to reproduction" within Europe. There are few controls on the marketing and use of phthalates, despite their toxicity, the volumes used and their ability to leach out of products throughout their lifetime. Of the controls which do exist, the best known is the EU-wide ban on the use of six phthalates in children's toys and childcare articles. While this addresses one important exposure

route, exposures through other consumer products remain unaddressed, including electrical and electronic equipment.

Antimony (Sb) is a metal with a variety of industrial uses, including as a flame retardant (as antimony trioxide) and as a trace component of metal solders. In some forms, antimony shows many chemical similarities to arsenic, including in its toxicity. Exposure to high levels in the workplace, as dusts or fumes, can lead to severe skin problems and other health effects. Antimony trioxide is recognised as a possible human carcinogen.

Until the late 1970s, **PCBs (polychlorinated biphenyls)** were widely used in insulating fluids for electrical transformers and capacitors, as well as flame-retardant plasticisers in PVC and other polymer applications. These chemicals can also be produced during the combustion of chlorinated organic materials, including PVC. They are highly persistent and bio accumulative chemicals, which rapidly become widespread through the environment and build up several thousand-fold in body tissues of wildlife. PCBs exhibit a wide range of toxic effects including suppression of the immune system, liver damage, cancer promotion, damage to the nervous system, behavioural changes and damage to both male and female reproductive systems.

Chlorobenzenes have been used as solvents in PCB formulations (historically used in transformers), and can also be formed during the combustion of the chlorinated plastic PVC. These chemicals are relatively persistent and bioaccumulate. Effects of exposure depending on the type of chlorobenzene, with common impacts include those on the liver, thyroid and central nervous system (CNS). Hexachlorobenzene (HCB), the most toxic and persistent chemical of this group, is also an endocrine disruptor and a possible human carcinogen.

PBDEs (polybrominated diphenyl ethers) are one of several classes of brominated flame retardants used to prevent the spread of fire in a wide variety of materials, including casings and components of many electronic goods. They are environmentally persistent chemicals, some of which are highly bioaccumulative and capable of interfering with normal brain development in animals. Several PBDEs are suspected endocrine disruptors, demonstrating an ability to interfere with hormones involved in growth and sexual development. Effects on the immune system have also been reported.

Triphenyl phosphate (TPP) is one of several organophosphorus flame-retardants used in electronic equipment, for example in the casings of computer monitors. TPP is acutely toxic to aquatic life and a strong inhibitor of a key enzyme system in human blood. It is also known to cause contact dermatitis in some individuals and is a possible endocrine disruptor.

Source Bridgen et al., 2008 *Poisoning the poor.*

Appendix E

Detailed information about the stakeholders

Stakeholder/Techniques/Tools/Interviewees for the field research during April-May 2016

Stakeholder/Title	Techniques used	Tool	Pseudonym Y/N	Comments and/or characteristics
Environmental Protection Agency Representative				Unfortunately there was no interview
Informal Recyclers	Focus Group Discussion 1	Interview Guide and Observation	Faisal, Sule, Sumani, Baba, Wala and Amir **Y**	Aged between 15 and 40, males, mainly school drop outs and from the Northern part of Ghana
Informal Recyclers	Focus Group Discussion 2	Interview Guide and Observation	Karikari, Mo, Ahmed, Ameen, Raseem and Sayeed Y	Aged between 15 and 40, males, mainly school drop outs and from the Northern part of Ghana
Informal Recycler	Key informant interview 1	Interview Guide and Observation	Referred to as key informant	
Informal Recycler	Key informant interview 2	Interview Guide and Observation	Referred to as key informant	
Informal Recycler	Key informant interview 3	Interview Guide and Observation	Referred to as key informant	
Informal Recycler	Key informant interview 4	Interview Guide and Observation	Referred to as key informant	
Academic expert on E-waste	Key informant interview	Interview Guide	Professor Martin Oteng-Ababio **N.** Also referred to as Academic Expert.	Faculty member at the University of Ghana
Environmental Non-Governmental Organisation Representative	Key informant interview	Interview Guide	Bennett Nana Akuffo **N.** Also referred to as ENGO representative	Project/Field Operations Officer
Medical Doctor	Key informant interview	Interview Guide	Referred to as Medical Expert	Medical Doctor from the Community Health department in neighbouring hospital

Appendix F

Questions/Interview Guide

Government agency/Environmental Protection Agency (EPA, Ghana)

1. What are the benefits of the importation of e-waste into Ghana for the local communities at Agbogbloshie?(Local communities include informal workers, residents, other workers in the area and communities nearby Agbogbloshie)
    - What are the benefits of the informal recycling of e-waste at Agbogbloshie for the local communities?

2. What are the potential risks associated with recycling of e-waste by the informal sector at Agbogbloshie (its potential impacts on health and the environment)?

3. What are the next steps for ensuring a move towards a more sustainable e-waste management and disposal system at Agbogbloshie?
    - What policies are being formulated to facilitate the implementation of a more environmentally friendly e-waste management and disposal system?
    - What challenge is the government facing in regulating the e-waste trade and the informal recycling of e-waste?
    - How will a WEEE regulation be enforced, when one is passed?

4. How much responsibility /authority does the EPA have as an arm of government to influence policy regarding the safe disposal and management of e-waste?

5. Has the government previously utilized stakeholder engagement as a means of resolving this issue?
    - If not, is the government willing to utilize stakeholder engagement as a means of finding a solution to the e-waste challenges in Ghana?
    - If the government has utilized stakeholder engagement, what was the outcome?
    - Will the government continue to use stakeholder engagement?

Environmental NGO (Green Advocacy)

1. What are the benefits of the importation of e-waste into Ghana for the local communities at Agbogbloshie? (Local communities include informal workers, residents, other workers in the area and communities nearby Agbogbloshie)
    - What are the benefits of the informal recycling of e-waste at Agbogbloshie for the local communities?

2. What are the potential risks associated with recycling of e-waste by the informal sector at Agbogbloshie (its potential impacts on health and the environment)?

3. What next steps would you recommend for the government in terms of implementing a more sustainable e-waste management and disposal system?
    - What in your opinion should the next steps in ensuring the reduction/elimination of importing e-waste to Ghana be?
    - What challenges do you believe the government faces in the regulation of the e-waste trade and the informal recycling of e-waste?

4. How can local NGOs influence and shape policy regarding e-waste?

5. Have you previously utilized stakeholder engagement as a means of resolving this issue?
    - If not, are you willing to utilize stakeholder engagement as a means of finding a solution to the e-waste challenges in Ghana?
    - If you have utilized stakeholder engagement, what was the outcome?
    - Will you continue to use stakeholder engagement to address current and future challenges?

Academic Expert

1. What are the benefits of the importation of e-waste into Ghana for the local communities at Agbogbloshie?
    - What are the benefits of the informal recycling of e-waste at Agbogbloshie for the local communities?

2. What are the potential risks associated with recycling of e-waste by the informal sector at Agbogbloshie (its potential impacts on health and the environment)?
    - What next steps would you recommend for the government, in terms of implementing a more sustainable e-waste management and disposal system?

- What in your opinion should the next steps in ensuring the reduction/elimination of importing e-waste to Ghana be?
- What challenges do you believe the government faces in the regulation of the e-waste trade and the informal recycling of e-waste?

3. Have you previously been involved in a stakeholder engagement process as a means of resolving this issue?
   - If not, are you willing to utilize stakeholder engagement as a means of finding a solution to the e-waste challenges in Ghana?
   - If you have utilized stakeholder engagement, what was the outcome?
   - Will you continue to use stakeholder engagement?

Informal Recyclers

1. What are your views on the recycling methods you use in the recycling of e-waste?
   - What are your perspectives on the benefits and risks of working in this business?
   - Does the recycling of e-waste impact your health in any way? If so how?

2. What are your perspectives on moving towards a safer e-waste management process?
   - What are your recommendations in moving towards an environmentally friendly process of managing and disposing of e-waste?

3. Have you previously been involved in a stakeholder engagement process to address the issues you have identified?
   - If not, are you willing to utilize stakeholder engagement as a means of finding a solution to the e-waste challenges in Ghana?
   - If you have utilized stakeholder engagement, what was the outcome?
   - Will you continue to use stakeholder engagement?

Medical Expert

1. What are your views on the e-waste recycling and management at the Agbogbloshie scrapyard?
   - What are the benefits of the informal recycling of e-waste at Agbogbloshie for the local communities?
   - What are the potential risks associated with recycling of e-waste by the informal sector at Agbogbloshie (its potential impacts on health and the environment)?

2. What would they like to see differently, in terms of the next steps towards ensuring a more sustainable e-waste management and disposal system?

3. Have you previously been involved in a stakeholder engagement as a means of addressing this issue?
    - If not, are you willing to utilize stakeholder engagement as a means of resolving the e-waste challenges in Ghana?
    - If you have utilized stakeholder engagement, what was the outcome?
    - Will you continue to use stakeholder engagement?