DIGITAL DUMPING GROUND IN GHANA:

A STUDY ON POTENTIAL IMPACTS OF

E-WASTE IN AGBOGBLOSHIE

by

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ABSTRACT

Despite the growing use of electronic products, waste recycling efforts are not expanding at a proportional pace, and places in the Global South like Ghana are left with toxic waste sites like the one at Agbogbloshie that are arguably an indirect result of Western consumer capitalism. In spite of significant international attention, the e-waste trade in Agbogbloshie continues to persist, prompting the need for a more comprehensive look at the potential impacts of its continuation on the environment and human health. By examining the potential impacts of the e-waste trade in Agbogbloshie through a critical geography lens, it is hoped that a more nuanced account can assist restoration efforts that minimize harm to the communities that live in and rely on the e-waste trade. This thesis presents an analysis of seven video interviews specific to different careers concerning e-waste in Agbogbloshie with a particular emphasis on the identification of the potential impacts of the e-waste trade. Utilizing transcribed interview footage alongside existing literature and applying qualitative analysis techniques, several conclusions were reached based on the main thematic points identified: workers know e-waste is harmful to their health, e-waste is a significant source of income for many people, the disconnect between the formal and informal sectors makes restoration efforts difficult to coordinate, and the future of skilled workers is in jeopardy. Although far from comprehensive given the small sample size, these interviews lend a great deal of insight into the potential human and environmental impacts of electronic waste in Agbogbloshie.

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educating, a fact which necessitates a deeper understanding of the infrastructure that allows us these connections. Thank you to the internet, thank you to technology. Dubiously, but invariably: thank you to e-waste.

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CHAPTER 1

INTRODUCTION AND PURPOSE

Along with the inception of the digital age came the proliferation of personal electronics and a subsequent bounty of electronic waste, also known as e-waste. Although disposal of electronic waste began in the 1970s (Acutate, 2019), the term "e-waste" did not enter the modern English lexicon until the turn of the century, while the first known use of the word came in 1999. Even still, in everyday conversation, the concept of e-waste is one not familiar to many – evidence that the proliferation of e-waste does not necessarily equate to a widespread understanding or awareness of the problems associated with it. Defined as any discarded electronic product (Merriam-Webster), e-waste is often informally processed in developing countries where workers extract valuable but deleterious materials. In the Global North, the inclination to purchase newer, better electronics each season, in tandem with planned obsolescence, sustains and accelerates the production of undesired electronics. Further, with the world's increasing reliance on the internet and digital spaces, so too comes the necessity of the infrastructure to facilitate internet usage –electronics. It is estimated that as much as 50 million tons of e-waste are produced each year (UNEP, 2019). Of course, this prolific waste production necessitates a place to offload. Enter: Agbogbloshie, an infamous e-waste dump located at the heart of Accra, Ghana. While the electronic waste at Agbogbloshie varies far beyond devices that can access the internet, Agbogbloshie is particularly relevant to modern e-waste disposal efforts because of the sheer volume of global electronic waste that finds its way to the dumpsite.

Given the prolific nature of electronic products in the current digital age, one may assume the global community would express a pronounced interest in what happens to electronics after they are no longer wanted, or have reached the end of their lifespan. Unfortunately, this is only a half-truth. While general interest in where waste goes has manifested through the burgeoning popularity of environmentally and socially-conscious consumerism in the Global North (Moisander, 2007; Skogen, 2018; Yue, 2020), the growth of e-waste awareness specifically could hardly be called widespread (Bhutta et al., 2011; Franklin, 2011). Many have a loose idea of what electronics recycling entails but do not have a firm grasp on the sheer volume of Electrical and Electronic Equipment (EEE) that gets exported, often illicitly, and becomes Waste Electrical and Electronic Equipment (WEEE) for the global poor to contend with (Shah, 2014). To those familiar with the e-waste problem, Agbogbloshie is one of the most notorious e-waste sites in the world, sometimes referred colloquially to as the biblical "Sodom and Gomorrah" (Nee, 2013) due to the sheer amount of smoke produced from the near-constant burning of copper wire and other e-waste materials. Despite the magnitude of the problem, Agbogbloshie and other e-waste sites like it seem to have experienced stagnation when it comes to any sort of reform or efforts at restoration, so much so that studies, interviews, and articles from ten years ago concerning problems at the site remain relevant to this day (Daum et al., 2017). Agbogbloshie has been partially immortalized as an e-waste dump by several media outlets, but the stories told often only offer a single narrative with little awareness of a more informed rendering.

The reality of the e-waste problem is not as cut-and-dry as developed countries dumping their waste into developing countries. In fact, around eighty-five percent of the e-waste in Ghana is produced domestically, or regionally, in neighboring West African nations (UNEP, 2011).

Though, a large portion of this figure —about sixty percent— consists of electronics that are produced abroad, subsequently refurbished, and sold as used electronics in Ghana (24). It can also be difficult to quantify exactly where Ghana's e-waste is coming from because a lot of these flows are illicit. The Basel Convention, which was effective May 5, 1992, outlawed the export of e-waste in the European Union. However, an oft-abused loophole of this treaty is to claim that e-waste shipments are not, indeed, waste, but that they are electronics that are still usable, being exported in the name of aid (Daum et al., 2017; Perkins, 2014; Wang, 2020). While that is occasionally the case, more often than not the products that end up in Agbogbloshie are only useful in the sense that valuable materials can be extracted from them. As mentioned, some countries will illegally dump their waste to bypass restricted flows altogether making it near impossible to quantify where exactly the WEEE comes from.

Understandably, the persistent use of the loophole makes sense given the relative difference in technological capability between Ghana and Western developed nations. However, bridging the digital divide while still being aware of the environmental and human health costs of doing so should lead to creative problem-solving. If anything, increased awareness about the detriments of mass consumer culture should encourage more accountability on the part of consumers as well as tech giants who have the ability to be more responsible about maximizing the longevity of their products and making recycling of the valuable components within them easier. Then, the purpose of this research is to understand how the processing of e-waste, as fueled by the digital age, has the potential to impact the environment and human health in Agbogbloshie. The resulting policy implications are discussed in this thesis.

CHAPTER 2

THEORETICAL UNDERPINNINGS OF THE E-WASTE TRADE

The topic of e-waste is simply too nuanced and ensnared in an entanglement of different issues to distill into generalized notions of "good" or "bad." Informed discourse is cognizant of the ways in which e-waste can exist simultaneously and at the intersection of these dimensions. As a part of the informal sector, e-waste processing is not formally recognized as a legitimate industry by the Ghanaian government (Stowell, 2019). This lack of acknowledgment perpetuates unsafe working conditions and keeps workers utilizing recycling techniques that may pose health risks. Indeed, all around the globe, workers involved in so-called "informal economies" work jobs without the regulation and structure that many employed in the formal sector have grown to expect and demand of their employers. Yet, even when given the opportunity of employment in the formal sector, the inflexibility of scheduling, and rigidly structured timing of payouts limit the viability of the job for many individuals (Millar, 2018). To a plethora of these workers, there is a great deal of value to be found in a work schedule that they can bend at will, as well as the prospect of leaving every day with cash in their hands –something that a nine-to-five job with fortnightly or once-monthly paychecks cannot compete with.

Features of the informal economy imply a low barrier to entry –as little to no formal education is necessary– work is generally labor-intensive, and there is minimal if any government regulation (Hansen, 2015). Increasingly characterized as "actions [that] fail to adhere to the established rules, or are denied their protection," (Feige, 1990) mass employment

in the informal sector has historically been dismissed from an institutional stance as an indicator of poverty. Taken straight from the International Labor Office's (ILO) website, the organization postulates that "without formalization, decent work for all and equity in society will remain an illusion," (International Labor Office) which is followed by a PDF link to a resolution making recommendations for transitioning from an informal to a formal economy. Unfortunately, this mentality is not just limited to those at the ILO. Other development giants like the World Bank overwhelmingly cast a negative vignette on the informal sector, emphasizing that the vast majority of the informal workforce are simply those who were unable to gain entry into the formal economy (Haller, 2005). Other discourse, though, positions the informal economy as a means of capital generation that allows for greater autonomy, and reasons that the diversification of income streams it encourages lends well to risk mitigation in precarious urban geographies (Thieme, 2015). Hart (1973), who coined the term "informal sector" in the 1970s in reference to migrant workers in Accra, offers a more enthusiastic take that bolsters informal activities as vibrant and dynamic, arguing that they supply the city with essential services. Even beyond the informal economy, Thieme (2018) posits that in urban environments where uncertainty abounds, individuals must participate in a "hustle economy" in order to get by. Moreover, she argues that this sense of the need to "hustle" should not be viewed only as a dire necessity but, being borne of an everyday reality, as a normalized lived experience. Essentially, many post-development geographers insist that the optics shift from this portrayal of a perilous existence to a view of "hustle" as normal, everyday practice –simply, the daily grind.

Encountering this swirl of differing narratives, it is important to clarify the lens through which this research was carried out. While a multitude of theoretical frameworks for development geography exist, arguably the one with the most contemporary relevance and

historically aware accounts stem from research executed with a post-colonialist approach. A post-colonial, or post-development perspective is informed by the complicated past of development geography, and development work. Coming full circle in a sense, post-development scholarship is critical of concepts like modernity and other ascribed development markers that have served as a means of justification for certain actors or countries to perform development on others. In the past, development work on the sole basis of "modernizing" in Western terms has facilitated the perpetuation of unequal power relations, given that the origins of "modernity" are largely based on cultural and economic factors linked inextricably to the West (Dinc, 2007). More radical post-development critics even refute development outright. For example, prolific post-development writer Arturo Escobar (1995) rejects development altogether under the claim that the concept of "underdevelopment" was merely invented as a means to validate the spread of neoliberalism. However, some thinkers like Sarah Radcliffe (2005) propose post-colonial approaches that are aware of power relations and acknowledge them but still view development as a tangible concept that should not be completely abandoned. Radcliffe's line of thinking inspired this study. Development work can still be effective and better informed by taking heed of the detriments of the past, as well as a measured consideration of positionality on behalf of the development actor.

"Development" as the term operates today was "a discursive regime formally inaugurated by the United States in 1949, when the 'discovery' of mass poverty in the Third World came to preoccupy Western policymakers and political elites" (Hodge, 2016). A distinct and pervasive theme of early development work was a savior mentality, in the sense that development actors in the Global North saw themselves as capable of "fixing" what was "broken" in the Global South. To some degree, engaging in development activities in this way

was an active display of cognitive dissonance surrounding the North-South divide that in actuality had been created by the Global North's own imperialist settler-colonial agenda. Then it follows that many vestiges of late colonialism transferred smoothly into contemporary development practices (Hodge, 2016).

In many ways, being aware of the history of Ghana is absolutely vital to understanding its current predicament with e-waste. The transatlantic slave trade, which peaked in the 18th century involved the forceful theft of people all throughout West Africa, including Ghana (Digital History). The colonial era immediately following came the "scramble for Africa," a struggle which was shaded by violent competitive settlement and resource extraction due in large part to a desire on behalf of European powers to assert dominance over their counterparts (NYPL). The global conditions created by imperialism and subsequent contemporary capitalism gave rise to and certainly perpetuated the stark power imbalances that exist today between the Global North and Global South. Of course, these very broad, sometimes nebulous ideas have been distilled to some rather simple statements here, and are no doubt more nuanced. For the purposes of this research though, this is the essence of the big-picture ideas on which the trends observed in the current e-waste trade are predicated.

The digital divide that exists today as it did at the inception of the e-waste trade in Ghana around the year 2000 (Stowell, 2019) is a testament to the aforementioned power imbalances. Reasonably, people in Ghana initially believed that shipments of e-waste were donations from the West to try and close the digital divide (Frontline). Of course, this belief was short-lived upon discovery that much of the discarded electronics were essentially useless, and were only functional in the sense that valuable materials could be gleaned from them. Although used here as an example, Western media coverage of the dump like this documentary from Frontline must

be critically examined. While well-intentioned, coverage tends to sensationalize the site at Agbogbloshie as particularly egregious, when in reality the problems experienced here are certainly not endemic, but rather a product of modern capitalism. Beyond just a simple breakdown of e-waste recycling in Agbogbloshie, it is important to uncover the underlying factors that contribute to its continuance. Foremost, this translates to critically unpacking the digital divide, and the world's increasing reliance on technology.

The multitude of underlying factors identified that contribute to the production of e-waste can all be linked back quite easily to colonialist pursuits that have manifested today in globalized capitalism; these are the digital divide in the information age and mass consumer culture. To some degree, the sheer volume of electronics circulating in the e-waste trade can be attributed to a growing desire for the latest and greatest in technology –a technological appetite that has outfitted a vast number of people in the United States with the newest iPhone each year. More broadly, Americans across the board possess some kind of smartphone, at a whopping estimated 81% (Pew Research Center). While certainly not all of those smartphones are the newest, shiniest models, this huge percentage speaks volumes about the sheer number of people engaging in a digital space, which necessitates the physical infrastructure of a device, and the eventual disposal of it (read: e-waste). Ideations of the digital divide become increasingly important when considering how much of the world operates today with an increasing reliance on the internet. It is no question that with the almost instantaneous exchange of information that the internet enables, access to the internet has become a vital part of staying informed and connected to the global community. For over 50% of the world, access to the internet has become a fundamental part of everyday life and has even been deemed so crucial that some nations, like the Indian state of Kerala, have declared internet access to be a basic human right (Lonely Planet). However, in

many ways, a second digital divide is opening, this time not in relation to technological access, but rather the means to keep discarded electronics at an arm's length (Robbins et al., 2010).

Modernization theory as it relates to Ghana is fraught with multitudes that are often paradoxical. At once, Ghana must contend with the desire to "modernize" while coming to terms with the real human cost of doing so. Marked by poverty and "underdevelopment" by Western standards for decades (Ohemeng & Ofosu-Adarkwa, 2014), Ghana had little to no choice at the beginning of the technological race to accept secondhand electronics for what they largely were: unusable waste products. Such an attitude towards attracting foreign direct investment at the expense of environmental regulations is in line with the "pollution haven hypothesis" (Robbins et al., 2010). While proximity and access to electronics and electrical goods became a new reality, the burden of waste disposal materialized along with it. As with most countries in the Global South, Ghana has a complicated relationship with the Global North, marked by dependency and other vestiges of colonialism that have rendered the nation materially reliant on more developed countries (Adams & Atsu, 2014). The technological realm is no exception; shipments of secondhand electronics and e-waste in the name of "aid" is an oft-exploited loophole in the Basel Convention (Wang et al., 2020). General managerial problems with waste in the Global North also contribute to e-waste streams (Daum et al., 2017). Often, internal regulation in more developed nations is fairly lax, leading to waste proliferation in the Global South (Daum et al., 2017). In the United States for example, regulations regarding waste are sorely lacking, so much so that the USEPA is the sole "source of accountability for e-waste streams destined for Africa" (Daum et al., 2017). In this sense, the Global North managed to find additional value in the Global South —beyond opportunities for resource extraction, developed nations realized an outlet for their waste. This pattern has increasingly characterized waste flows.

As developed countries ramp up consumption, so too comes a need for dump sites, either in the form of landfills, or simple export, as a way for countries to externalize their waste as a sort of spatial fix (Robbins et al., 2010). Such externalities are an unsurprising outcome of Western consumer culture, and point to the mentality held by many Westerners regarding waste as "out of sight, out of mind" (Mauch, 2015).

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

In line with Sovacool's paper regarding e-waste in Ghana, there must be a critical acknowledgement of the ways in which development research can be largely extractive (2019). Sovacool suggests that future avenues of research need to be more longitudinal and purposeful to try and minimize research efforts that are rushed and only treat workers as disposable data mines. Nevertheless, given the short time constraints of research in a master's thesis setting, a longitudinal study was simply not possible. Methods of this project began after a critical acknowledgment of the ways in which this research had the potential to be mostly extractive. After all, accountability to the community and people whom this research is meant to benefit was absolutely necessary. It is with this acknowledgment that the ability of good scholarship to be transformative and helpful -if even only minutely- must still be underscored. Potential harm reduction must also take place by making note of the ways in which patterns of colonial violence are sometimes replicated in North to South research which has the propensity to imply a "West knows best" sentiment, which was certainly not the intent behind this study.

3.2 RESEARCH GOAL & OBJECTIVES; OVERARCHING QUESTION

The overall goal of this study was to assess the potential impacts of e-waste on the community of Agbogbloshie. Such an assessment required the completion of several objectives; these are: **1)** to evaluate local worker perceptions of electronic waste processing, **2)** to explore

the socioeconomic background of participants in the local e-waste industry, **3)** to identify how e-waste is processed and the potential impacts **4)** to determine what types of e-waste are processed and the potential impacts, and **5)** to assess the government response, both domestically in Ghana and internationally. To put it more concisely, the general question this research seeks to answer is: what are the potential environmental and human health impacts of e-waste in Agbogbloshie?

3.3 STUDY AREA

Figure 1 Aerial view of Agbogbloshie (Source: Oteng-Ababio & van der Velden, 2019)

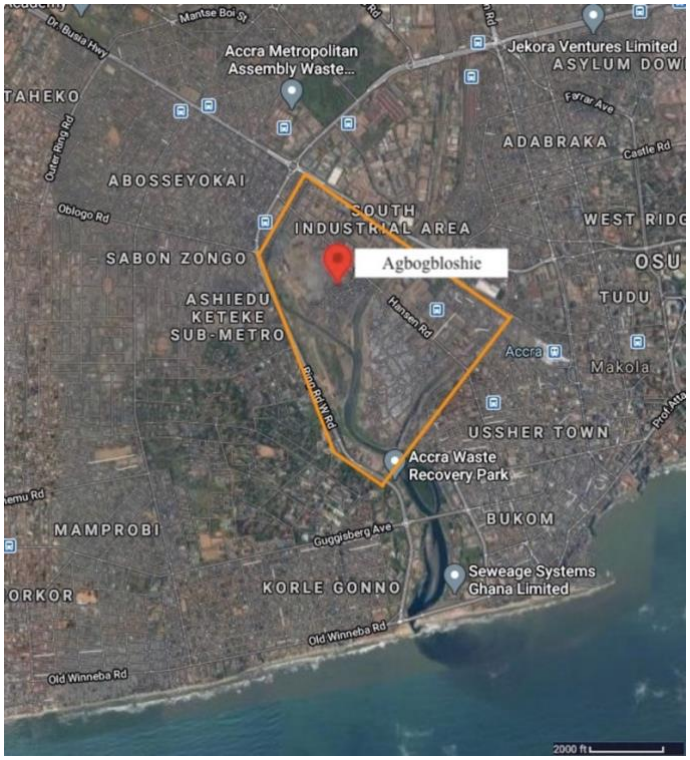

Figure 2 Agbogbloshie's situation in the South Industrial Area of Accra, Ghana (Source: NASA, TerraMetrics, Map data, 2021)

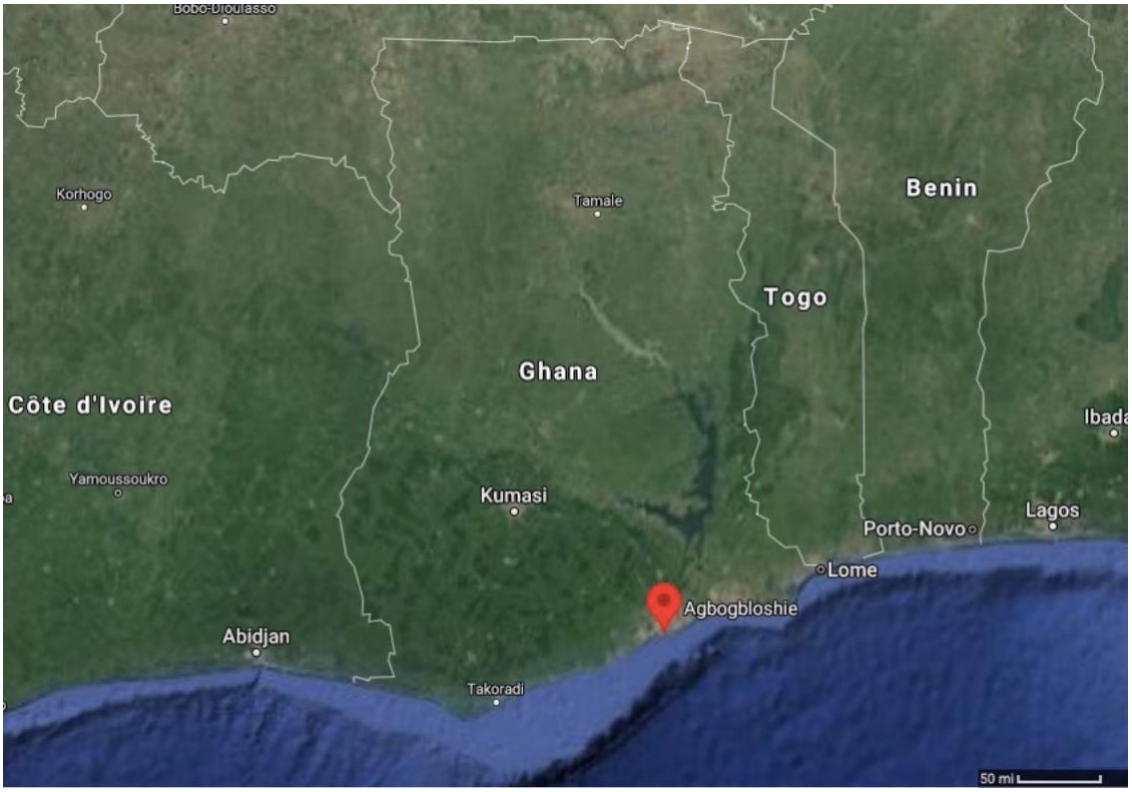

Figure 3 Agbogbloshie's situation along Ghana's coast (Source: NASA, TerraMetrics, Map data, 2021)

The general study area for this research was Agbogbloshie, a site located in Accra, Ghana. Although the problem of e-waste is certainly not unique to Ghana, Agbogbloshie provides a strong backdrop for understanding how the industry can have a community-wide impact. A common misconception about Agbogbloshie, and places like it, is that it is merely a dumping ground. That is far from the whole truth. In reality, Agbogbloshie is a robust community with a telltale heartbeat home to over 40,000 residents (Akortia et al., 2017). Moreover, the operations carried out at the site sustain the livelihoods of roughly 200,000 people (Daum et al., 2017), which is a sizeable number of people even given the population of Accra's broader metropolitan area which is estimated to be 2.5 million (World Population Review, 2021). Covering just under half a square kilometer, Agbogbloshie is surprisingly variegated; part of the Odaw River runs through the area, there is a residential neighborhood called Old Fadama, and there are a couple of markets. For the purpose of this research, the main focus will be on the e-waste scrapyard outlined in white (Figure 1). In the larger context of Ghana and the African continent, Agbogbloshie is located less than five kilometers from the coast (Figure 2, Figure 3). In fact, water running from the Odaw River into the Korle Lagoon eventually empties into the South Atlantic Ocean.

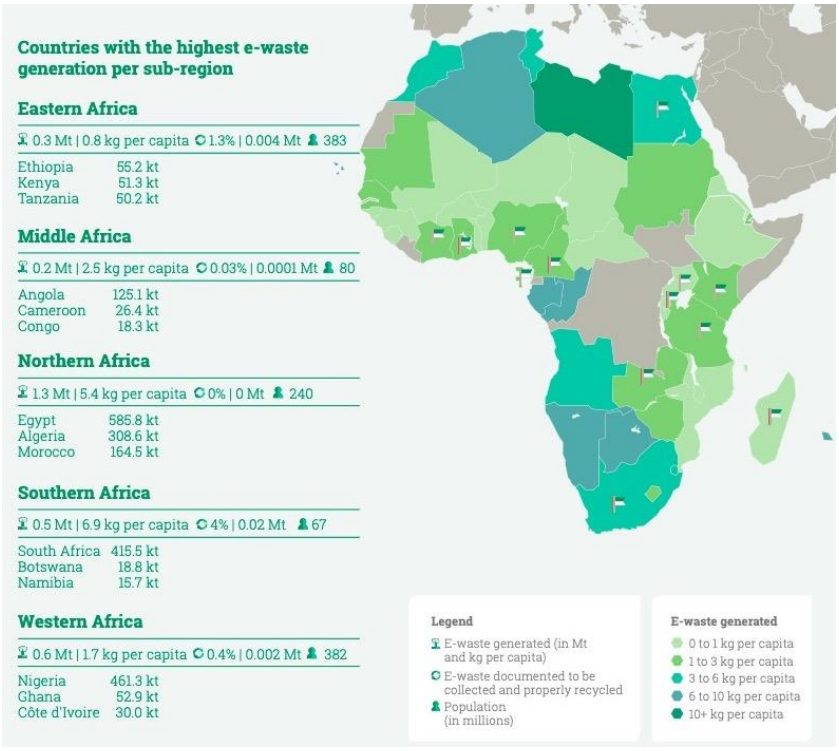

Figure 4 E-waste generation by African subregion (Source: Forti et al., 2020)

To contextualize the e-waste trade in Ghana on the African continent, Nigeria and Kenya have similar informal recycling sites to the one at Agbogbloshie (Forti et al., 2020). The flags on Figure 4 indicate the 13 countries (including Ghana) that have national e-waste policies or some form of regulation in place.

3.4 METHODS

Unfortunately, plans for summer 2020 to conduct in-person field research that could yield responses to questionnaires and contextual inquiries were scrapped in response to the COVID-19 pandemic. With this in mind, suitable alternatives were explored, and the most viable option for this research was qualitative content analysis.

3.4.1 QUALITATIVE CONTENT ANALYSIS

In large part this research relied upon mixed-media content analysis; involving any form of recorded communication, this method entails the use of videos containing interview footage

and naturalistic site observations, articles published in peer-reviewed journals, and the like. Given the varying forms of material that were analyzed in this process, it was important to outline a standard procedure for this task, no matter the medium. Written content was analyzed in its original form, while video content first required transcription before proper analysis could begin. For the purposes of coding and categorizing interview data from videos, methods were adapted from Erlingsson and Brysiewicz's "A Hands-on Guide to Doing Content Analysis." Qualitative content analysis, although generally conducted on raw interview data, can quite easily be applied to existing video interviews. When used properly, this method of analysis has the ability to elucidate powerful conclusions from qualitative data, as it gives much weight to each individual voice (Erlingsson & Brysiewicz, 2017). However, challenges to doing content analysis well prove to be inherent to the method and data itself. Given that these interviews are very much life-based, answers are seldom clear-cut. The same messiness of life is reflected in the data (Erlingsson & Brysiewicz, 2017), and the multifaceted nature of the data often makes it difficult to form mutually exclusive categories to divide answers up into. That said, Erlingsson and Brysiewicz provide three templates and useful examples alongside their manuscript that help break down the process of abstraction from manifest to latent content (Figure 5). Essentially the guide lays out three main steps for analysis; these are: 1) to identify and condense meaning units, 2) code these meaning units, and 3) form categories and themes. While the objectives outlined at the outset of this thesis were used as the themes, coding and categorization took place independently, and were guided solely by the interviews themselves. A simple walkthrough of the process for this work was to first watch each interview in its entirety to get a firm grasp on the overall ideas present, transcribe the interview, re-read it, then begin the coding process. Each interview was broken down into sentences which were then shortened into condensed meaning

units (CMU), which are essentially just shortened versions of the raw dialogue that still maintain the core meaning. These CMU were then assigned a code, which is merely a label to describe what the CMU is about. After coding, categories were formed after sifting through all the codes and grouping the relevant ones together. These categories were then fit into the larger themes, which matched up with the objectives, which were pre-determined.

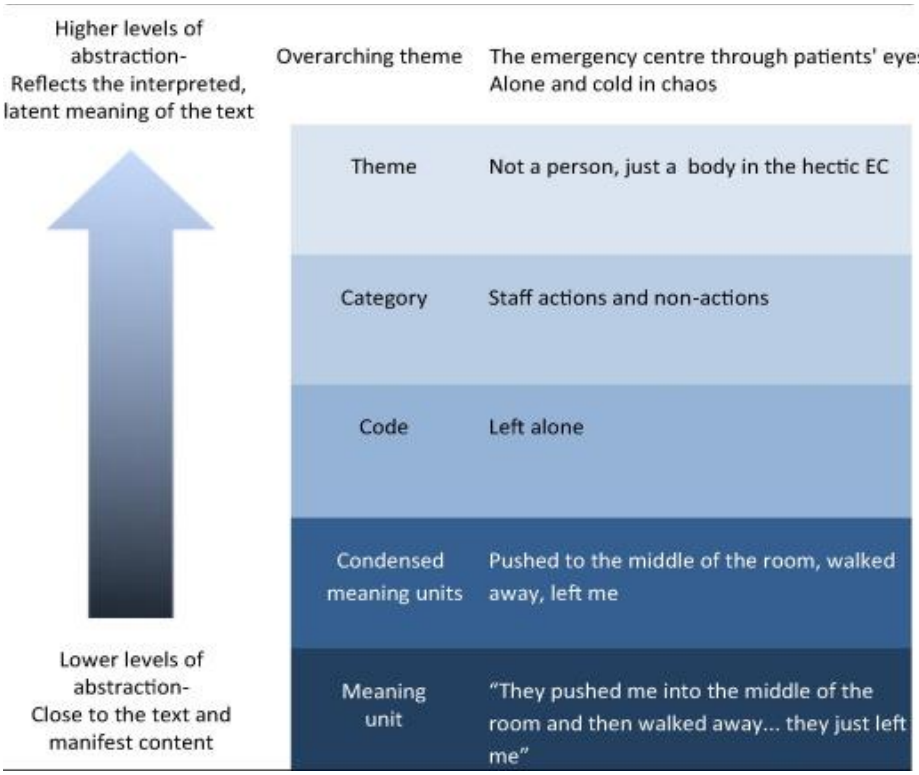

Figure 5 Example of the analysis process (Source: Erlingsson and Brysiewicz, 2007)

Aside from using the actual spoken dialogue observed in the videos and documentaries as data, video research also has the potential to mimic naturalistic site observations. By simply observing scenes laid out on video, it was hoped that initial observations could validate conclusions made from the interviews and offer more objective accounts of what was happening on the ground. As far as analysis of the information gained using these methods, observations recorded from video research and quotes pulled from individual interviews will be placed alongside relevant information from the literature (Burnard et al., 2014). In this case, primary

data like that gained from the videos are particularly relevant because much of this research hinged on the ability to actually interact with and gain firsthand accounts of the community's relationship with the e-waste industry.

The interviews used as primary sources came from the YouTube channel of Danwatch, a Danish investigative journalist outfit focused on telling stories on global issues concerning human rights and the environment (Seidenfaden, 2017). The playlist on the Danwatch channel titled "What a waste" takes care to interview seven individuals over nine videos, each ranging from around five to fifteen minutes each. While it is not exactly clear how interviewees were selected, or the protocol for conducting the interviews, it seems that Danwatch attempted very purposefully to cover the bases of the e-waste trade (Table 1) and asked probing follow-up questions to ascertain a clear picture of their experiences. Thus, important to acknowledge is the lack of a unifying question set to guide the collection of this interview data.

The seven interviewees each had different occupations garnering perspectives from a scrapyard laborer, to a multimedia journalist, an e-waste researcher and educator, a local advocacy organization, a government official, a refurbished electronics shop owner, and a recycling company manager. For ethical reasons, their real names have been omitted and replaced with anonymized monikers. With the exception of the sixteen-year-old scrapyard worker, the ages of the interviewees, all of whom were male, are unclear. Thanks to the broad range of professions and roles covered, this relatively small collection of interviews reveals a great deal of insight into the e-waste trade in Agbogbloshie. Perhaps the greatest potential pitfall of these interviews is their age: they were filmed about ten years ago.

Table 1 Names and occupations of Danwatch interviewees.

Name	Occupation
Mr. A	Electronics shop owner

Mr. B	Educator & e-waste researcher
Mr. C	Multimedia journalist
Mr. D	Assistant Director & Head of the Science and Technology Department of the Ministry of the Environment
Mr. E	Managing director of e-waste scrap company
Mr. F	GreenAd Representative
Mr. G	Scrapyard worker

However, in accordance with much of the literature, and substantiated by other existing documentaries, not much has changed (Daum et al., 2017; Cazabon et al., 2017). Independent filmmaker Vanessa Kanbi, who has worked on productions for CNN and the BBC uploaded a short film to YouTube in August of 2019 titled "THE WORLD'S BIGGEST E-WASTE SITE - Agbogbloshie, Ghana." While the title is somewhat misleading (Agbogbloshie pales in comparison to the 52 square-kilometer e-waste site in Guiyu, China), several important elements can still be derived from the video. Possibly the most striking aspect of the short was the simple fact that the images and stories captured were virtually indistinguishable from the Danwatch videos, particularly the one of Mr. G, the young scrapyard worker. Where Mr. G stood for his interview to a backdrop of waste piles, Kanbi's coverage of the site might as well have been a projection of the scene where Mr. G's interview was conducted almost 10 years prior. With digital detritus strewn about, any casual observer could easily mistake the two videos as being filmed within the same year; the scenery was nearly identical. The relevance of these videos ten years later speaks to the resilience of the e-waste trade, but also to the need for proper reform to facilitate substantial and lasting harm reduction. E-waste as a harmful trade should be anything but a timeless concept.

The final coding scheme applied to the interviews includes over two-hundred unique codes and covers both foreign and domestic government response to e-waste, stakeholder perceptions, reasons behind the persistence of the industry, human health and environmental impacts, and potential solutions to problems associated with e-waste.

3.5 CHALLENGES AND LIMITATIONS

Several problems arose at the outset of this thesis, primarily given the global context of the COVID-19 pandemic. Still, problems persisted even after establishing a research method that utilized video interview data instead of necessitating in-person data collection. In particular, determination of whether or not the development of the coding scheme was as objective as possible proved difficult even after revisiting each interview several times during the coding process. Typically when developing a coding scheme, one interview is coded independently by two to three researchers, and these results are compared, discussions are had, and the coding scheme is amended to agreement. This was simply not possible for this thesis. Unfortunately, because there was only one coder there was no way to check for agreement which would indicate a greater sense of objectivity.

Additionally, transcription of videos was quite time-consuming and tedious given personal unfamiliarity with the accent, and occasionally even the sentence structure used by some interviewees. Often, one minute of footage would take around five minutes to transcribe, making transcription times much longer than the duration of the video itself. Having to pause the video, go back to a word document to type out what was said, and even having to rewind a few times to catch each word racked up hours of transcription time. Another limitation of the research was difficulty in finding raw interview footage. More often than not, interviews could easily be found in the larger context of a documentary, but not as standalone videos. In

documentaries, interview answers are often split up depending on the theme of a certain central question that is meant to be answered. However, for the purposes of this research, interviews that were not already framed and edited for a certain rhetorical effect were the standard. Of course, given the conduct of the questions asked the answers given could easily be influenced in a certain direction, but interviews without the added layer of edited disruption and strategic placement in a larger piece were ideal.

Of course, certain inherent limitations come along with using video resources as a substitution for in-person naturalistic site observations. No matter what, a video will never be able to reproduce reality. In a strictly visual sense, the sensation can be quite similar, but devoid of the real-time audio and other sensory factors like smell and touch, the depiction will never be the same. Moreover, video resources are often presented alongside commentary so it is very possible that the intended narrative with the visual could skew the information gleaned from them. In the same vein, another detail to think about is the way in which research is always shaped by the archive, or search engine algorithm, which also impacts whose narratives and voices are centered, valued, and uplifted. Perhaps the most unfortunate limitation of this research is that it will only examine the potential impacts. Of course, in the context of a master's degree, a longitudinal study is simply not possible; this is simply one snapshot of what is happening or has the potential to happen.

However, as previously stated, with global concerns regarding COVID-19, the possibility of in-person fieldwork was denied outright. While alternatives were considered, and are outlined here, the spread of the virus and various other stipulations rendered these alternate solutions unfeasible. The most heavily considered alternative was the prospect of remote fieldwork. If carried out, individuals would have been hired to administer the questionnaires remotely.

Interviews and contextual inquiries could then potentially be conducted over a video calling platform. A number of pitfalls would have come along with remote fieldwork, however. Research in this way would only be possible assuming adequate access to technology and the internet, and the funds to hire in-situ administrators. Hired individuals would also mean the unethical jeopardization of their personal health. After all, interviews on the ground would entail possible exposure to the COVID-19 virus. From a logistical standpoint, the methodology would also become more disjointed with the newly introduced possibility of problems with miscommunication, time differences to take into account, and less overall control of the research which could all be potential points of concern. Then, in lieu of fieldwork, both remote and in-person, it was concluded that using secondary data like videos and documentaries which would mimic imagery as if being in the field was the most viable option. Videos themselves can be inaccurate representations of reality, and the narration could potentially skew the content displayed. Nevertheless, a great deal of useful information and perspective was gleaned from the video resources.

CHAPTER 4

FINDINGS AND DISCUSSION

4.1 LOCAL WORKER PERCEPTIONS

Although much of the literature suggests that e-waste workers often have a poor, or downplayed understanding of the ways in which their health is adversely affected by proximity to the hazardous toxins in WEEE (Agyei-Mensah & Oteng-Ababio, 2012; Akormedi et al., 2013; Yu et al., 2017), the interviews demonstrated resoundingly that the majority of those involved in any facet of the e-waste trade are aware of the implied dangers. Mr. B remarked, "the workers themselves [understand] the health hazards involved, but it is a question of survival." Likewise, the representative from the environmental NGO GreenAd points out that even before results from blood work are returned, "they themselves are aware that they are exposed to some hazardous conditions." Substantiating these words, the young scrapyard worker Mr. G recounts that when scrap is being burned "you have to [protect] yourself from the smoke," but when asked why he continues to work despite the risk, he replies that he needs the money for his education and to support his family.

It is telling that even those not directly involved in the dismantling of WEEE are resoundingly aware of the problems it presents, which speaks further to the all-encompassing, community-wide, and pervasive impacts of the industry. The journalist Mr. C notes "it is a grave situation because of the very serious dangers that the poisonous chemicals contained in e-waste pose to both our environment and human health." One step closer to the recyclers, Mr. A reflects

on his occasional need to call on scrapyard workers to take away the electronics abandoned at his shop saying he is "not happy about the situation," but in many ways has no other choice but to employ them as he does not "have the means to recycle or dispose." Further expanding on his comment, Mr. A touches on the digital divide that was arguably the inception of the trade:

> "Africa is poor. We wanted to be abreast with the modern technology. How do we get it? The magnanimity of Europe: 'Let's give Africa this little product to see if they can train their children in modern technology.' Little did we know that Europe ha[d] found a dumping ground."

This small sampling of responses alone is enough to make it quite evident that those involved in the e-waste trade are undeniably aware of the safety risks associated with WEEE. Even Mr. G, the young scrapyard worker, was not so oblivious as to ignore the dangers of toxic fumes created by burning copper wire. Mr. A also identified the essential origins of North-South WEEE distribution patterns and expressed unhappiness with current systems that necessitate his reliance on scrap workers utilizing unhealthful techniques to break down the e-waste generated through the operation of his electronics storefront.

4.2 SOCIOECONOMIC BACKGROUND OF E-WASTE INDUSTRY PARTICIPANTS

Virtually all of the interviewees, save for one (journalist Mr. C), stressed the fiscal importance of the e-waste trade for a large number of individuals. In fact, monetary reliance on e-waste surfaced as a key theme across the interviews in response to open-ended questions either about the government response to e-waste, or thoughts about why the industry continues to operate in a harmful manner. A simple surficial examination of the e-waste industry is enough to recognize its potency. Although it boasts a relatively short history, two decades of e-waste with no end or resolution in sight warrants an investigation into its continued maintenance. Widely

cited as the driving force behind the e-waste industry is its establishment as a somewhat reliable means to make a living (Oteng-Ababio et al., 2020).

Mr. B mentions the cost-benefit analysis attached to the trade; in performing this mental transaction, workers must weigh their long-term physical health against the promise of immediate material gain for survival. Further elaborating, he notes "it's not something that is immediate –it's not like there's no electricity and everybody's panicking, there's no water, everybody's panicking –but, the danger[s] are as huge as any of those areas I've mentioned." The absence of immediately noticeable health defects leads to resigned acceptance of, or complacency with unhealthful working conditions. After all, something instantaneously impactful like electricity outages or lack of potable water would generally take precedence over the slow bioaccumulation of heavy metals in the body, which largely remains undetected until impacts are so harsh that they cannot go ignored. Mr. B also reasons that inaction regarding health impacts may be due in part to the fact that the community in Agbogbloshie is largely illiterate.

The GreenAd representative expounds on this adding that all workers "wanted to be part of [the health study] so that they would know what was happening to them. But you see they cannot...stop, because it's a matter of survival. That happens to be their source of livelihood. So though they know they are exposed to dangerous substances, they still continue." Thus, while they had no shortage of volunteers for their health study, the resultant alarming results did not dissuade workers who were still compelled to continue working in accordance with their livelihood realities. As the Head of Science and Technology in the Ministry of the Environment, Mr. D maintains that the position of the Ministry recognizes the importance of e-waste as many people's source of income sharing that "when well-handled, [e-waste] can create jobs, to some

extent." Mr. D also touches on the difficulties presented by the e-waste trade as a matter of international dependency structures, and inability to control international actors: "most [WEEE] at the end of the day become[s] [a problem] on the users, and so that is the main concern –the imported ones." With the inability to effectively control imports of WEEE, waste will continue to proliferate, and so long as that is the case, jobs will persist along with it.

Another avenue to consider is the lack of widespread public awareness. Communicating that he "presume[s]...that lack of knowledge in the media is accounting for the very little coverage of the problem in the country," Mr. C contends that lack of national media coverage is partially to blame for the gap in public knowledge which, coupled with the illiteracy of the community that Mr. B describes, could very well translate to lack of collective pressure for e-waste reform.

4.3 HOW E-WASTE IS PROCESSED AND THE POTENTIAL IMPACT

Generally, when mentioning the actual action of e-waste processing, interviewees overwhelmingly mentioned the burning of WEEE to extract copper wire. Much of the documentaries also focus on this aspect of e-waste processing (Frontline; Kanbi, 2019), perhaps because of the compelling visuals that fire and smoke provide. Speaking to this, Mr. B is sure to tie in the global magnitude of the issue and notes that the product of unhealthful e-waste processing is a bloated effect that impacts not only those in the immediate vicinity, but international waters after polluted waters exit Korle Lagoon: "[WEEE]'s being burned in Ghana, but we don't know where the wind will end. Some of this enters into...Korle Lagoon and it finds its way into the ocean. The ocean has no boundaries, and that is where it becomes a global issue." While alternate methods to burning copper wire exist, they are not exactly viable given the industry's emphasis on efficiency. Mr. G mentions that "in order to retrieve it without

burning it...you can use any sharp object to cut the rubber so you are able to absolve the copper, but the workers do not have time for cutting the rubber [instead of] burning it." After all, being able to process mass amounts of copper wire at once through burning is surely preferable to manually stripping out the copper, despite any potential for harm reduction.

Of course, burning for copper wire is only one element of WEEE processing. Mr. E, head of a small recycling company points out that much of the industry also relies on simple disassembled parts like motherboards, hard plastic shells, or components made of aluminum and steel that are acquired by physically dismantling by hand. That said, a widespread lack of personal protective equipment (PPE) like gloves, masks, goggles, and proper footwear in this hand-disassembly process opens the door to a multitude of potential health impacts. The young scrapyard worker mentions that inadequate PPE among scrapyard workers was quite common, as like others, his own wages were often spent on other fiscally-demanding things like family remittances, or funding a personal education, rather than protective gear: "there [are] a lot of sharp objects which can also hurt you so you have to also wear some boots or some slippers to protect yourself...for me now I don't have the money to get some shoes because of my education."

Also up for consideration when thinking about how e-waste is processed are the potential impacts it has on the intellectual vitality of the workforce. Arguably the longest-lasting result of the e-waste trade and unfortunate consequence of its persistence is the resultant endemic loss of skilled workers, almost like a localized version of the brain drain phenomena. Mr. A emphasizes that the workforce is taking an intellectual hit because of the proliferation of secondhand products exclaiming "it is not my hope that I would train apprentices who only [know] how to fix broken down, secondhand products." The way the e-waste trade is structured, skills are

developed around simple knowledge regarding reparation of secondhand electronics, rather than engagement with, or development of new technology. Furthermore, clunky policies make the disposal of WEEE surprisingly difficult for individuals, with Mr. A revealing that "the system is also such that you can't easily throw [WEEE] away," at least without the monetary means to do so –an issue that further perpetuates the need for informal e-waste dismantling.

4.4 TYPES OF E-WASTE PROCESSED AND THE POTENTIAL IMPACT

While a wide range of precious metals are extracted from WEEE, the specific appliances they are removed from lie within three main categories: computers, refrigerators, and televisions. During his interview, Mr. B points out "there are a lot of fridges that are no [longer] acceptable in western Europe and North America because they contain certain chemicals in them or certain pollutants, yet those computers can be bought and exported here." This statement highlights one of the more outright, sinister entanglements of the e-waste trade; the e-waste processed can often be attributed to simple old age, but on occasion, the waste is explicitly no longer allowed in the countries from which they have been exported due to the harmful toxins they contain. Mr. D speaks more on the types of e-waste most frequently encountered: "of late we can talk about microwaves, yeah, but computers, refrigerators, and televisions, these are the three main groups that come." Mr. A also makes mention of the energy inefficiency of many of the appliances:

> "We are always crying about our energy –scarce energy resource[s], but look at the volume of waste. There's been refrigerators, electronics, and all other energy-consuming products that they bring in. It [has a] very serious, damning effect on our energy."

In this sense, Ghana's newfound proliferation of energy inefficient electronics has the potential to manifest more stringent energy problems (Atiemo et al., 2016). Similar potential impacts include exposure to chemicals and pollutants contained in certain elements of electronics that

have already been deemed objectively detrimental to human health, which no doubt could cause future strain on the healthcare system due to resulting ailments, or even birth defects in future generations (Grant et al., 2013).

More specifically, exposure to lead seems to be a common and dire side-effect of working with almost any type of e-waste without proper personal protective equipment. Much of both the worker sample and control sample in the GreenAd health assessment displayed levels of lead and other heavy metals in blood and urine samples that were "very high and alarming." Speaking more on the potential health impacts, Mr. F notes "we know the situation is really critical in this area and the people are rather badly exposed," in reference to the dioxins that are breathed in during the waste incineration process, and heavy metal exposure from general unsanitary working conditions. Notably, dioxins are known carcinogens, as well as persistent environmental pollutants, which have the capacity to become long-term stressors (US EPA, 2018). Other materials and electrical elements mentioned in the interviews were copper, hard plastics, aluminum, wire casings, motherboards, steel, and cathode-ray tubes (CRTs). CRTs are particularly egregious in terms of their potential health impacts due to radiation emissions and their composition including leaded glass, so much so that even the United States Environmental Protection Agency regulates CRT exports in spite of the US not having ratified the Basel Convention, which would allow for more comprehensive regulation of e-waste flows (Daum et al., 2017).

4.5 GOVERNMENT RESPONSE

In agreement with much of the literature, many interview responses look to government response as key to impacting lasting change, but are also critical of governmental inaction and perceived complicitness in the e-waste industry. Government response was the largest category,

encompassing the largest number of coded meaning units. Mentions of government response were so prolific that highlights are listed here in a bulleted format to convey the wide range of criticisms interviewees held as well as suggestions they provided:

- "...the local government should also be working around on how to come up with a framework on how to dispose of computers because even without importation, we still buy new computers." – Mr. B
- "...no clearly cut policy or regulations in managing the importation of secondhand electronic electrical equipment and also in managing the waste that is generated and it was just [a] free for all…" – Mr. F
- "...the laws that would hopefully be passed [would] eliminate the indiscriminate use of scrapyards anywhere, and then also eliminate burning of electronics and electrical parts…" – Mr. F
- "...there are even government officials working in the Ministry of the Environment who have no idea what e-waste is about." – Mr. C
- "...if you see somebody carting a truckload of e-waste and the government thinks that will make the person comfortable, they will not come to put pressure on them –the government will go to sleep." – Mr. A
- "They are pretending they don't want to see because it is a political decision they have to take." – Mr. A

As a representative of the Ghanaian government itself, Mr. D's responses are listed here, separate from the other interviewees' remarks about government response:

- "...the ministry has observed that e-waste is becoming a menace and is creating some problems."

- "...train them to dismantle the computers and the televisions because we realized that apart from them being metallic, there are some radiations in some of them so they need to be very careful, they need to be trained, so that is the ministry's position on that."
- "...the government has put in place [the Ghana Atomic Energy Commission] to [expertly dismantle radiated e-waste], and there is also some discussions on a project in collaboration with the Environmental Protection Agency to develop a policy and guidelines on how to handle the management of e-waste in the country…"
- "...I don't think the government of Ghana has that intention, and [a total ban on the import of used electronics] is not being discussed anyway, for one reason because to some extent it creates jobs…"
- "We want to collaborate with the private sector to make sure that e-waste is effectively managed."
- "The e-waste that contain[s] radiations. Because the ordinary people who are handling them now are not good, and they are not experienced in it so ideally, the government wishes that these are submitted to the Ghana Atomic Energy Commission for them to expertly dismantle, and get rid of them."

The lack of adequate policies and regulations to meet the strain of the e-waste disposal problem is apparent. However, there appears to be some incongruence between what advocacy organizations like GreenAd want, and what workers themselves proclaim to want. Where GreenAd is calling for the elimination of WEEE burning, the reality is that this method remains the most effective and efficient way for workers to extract copper wire. It is quite likely that elimination by law would not curb the burning, rather it would make it untraceable to a single location; instead of burning in the scrapyard, workers would go elsewhere to burn to minimize

detection. From the Ministry of Environment's standpoint, it seems they are privy to the reliance on WEEE imports and have no plans to completely disrupt its flow. Mr. A concedes that this political position adopted by the government allows for the sustenance of many individuals, but is ultimately critical of their stance, voicing his unhappiness with having to call young scrapworkers to dismantle the WEEE that accumulates in his workshop.

CHAPTER 5

CONCLUSIONS AND FUTURE RESEARCH

Although well-studied in the academic community and subject to widespread international scrutiny, e-waste remains a major problem for Ghana. As there is already a deluge of comprehensive scholarship out there regarding this topic, it is worth noting what this particular research contributes to the discourse on the impact of e-waste in Ghana. One of the biggest aspirational outcomes of this research is a change in the single-story narrative surrounding Agbogbloshie. As it stands right now, much of the literature regarding Agbogbloshie, particularly writing that is not informed through a critical geography lens lends itself to the sort of "doom and gloom" mentality surrounding much of e-waste processing. It is no question that electronic waste processing produces a great deal of pollution, but the jobs this industry creates are a vital means of living for several Ghanaians, many of whom find the work they do at the site fulfilling. One of the missing pieces is also a critical understanding of ways in which the e-waste trade as seen today is an indirect result of Western hegemony. Much of the literature disregards this major player in the perpetuation of North-South e-waste flows, but the problems at Agbogbloshie are, in many ways, simply a symptom of the larger capitalistic order that demands profit and consumption at the expense of humans and the environment. All this to say, the environmental cost of continuous e-waste production is certainly a concern; however, the human cost must also be examined. This research examined the potential impacts of the e-waste trade primarily through the use of content analysis in the hopes that more comprehensive

recommendations could be made to minimize exposure to and production of human-environmental bads. Findings could also be applied to improvements in the current restoration efforts while also contextualizing the trade in a larger, global power struggle.

Current impacts of the e-waste trade in Ghana can be encapsulated in an understanding of the detriments it has on human health and the environment, although these are increasingly intertwined and inform one another as an environmental (in)justice issue. Although Agbogbloshie is mainly known for e-waste processing, the recycling grounds still constitute a neighborhood itself, indeed being home to over 40,000 people (Akortia et al., 2017). Identifying the demographic that is employed in the e-waste trade, it becomes difficult to parse out who is most impacted by its existence. Laborers can be as young as school-age children who are tasked with finding, collecting, and selling metal scraps. The most visible workers, however, are young men who perform a full range of functions within the processing of e-waste (Srigboh, 2016). Essentially, a legion of people are needed to process the massive volume of e-waste that finds its way to the scrapyard, and the human cost of this industry is undeniable. Multiple researchers have studied the environmental and human health impacts of e-waste processing in Agbogbloshie through soil analyses that assess certain metal concentrations like lead, copper, and arsenic, among other metal(loid)s (Cao et al., 2020). Their findings indicate that lead and copper in particular are the main extreme contaminants of topsoils in Agbogbloshie, with 72% and 57%, respectively (Ackah, 2019).

This is particularly concerning given the history of the land. Agbogbloshie was not always an e-waste dump. Before shipments of waste from the Global North arrived, the ground beneath today's dump was a wetland area. Although a National Wetlands Conservation Strategy for Ghana was outlined in 1999, there has been little effective implementation of protections

(Nsor & Alhassan, 2015). Of course, attempting to attach a price tag to ecosystems and their ecological services is problematic, and there is a stark incongruence reached when trying to weigh a priceless environment against a monetary scale, but it is difficult to say whether or not the presence of the e-waste industry generates enough capital to offset this "loss." Moreover, contaminants on the ground have the potential to leak into the groundwater, and contaminate the wider water supply, leading to adverse human health impacts (Kyere et al., 2017). Crucially, weaponizing this perceived human-environmental harm has already been used as a justification to forcibly evict residents from their homes in the slum adjacent to Agbogbloshie's scrapyard (Morrison, 2017). In a way, extensive critical foreign media coverage of the site manufactured consent for the Ghanaian government's use of destructive force (Oteng-Ababio et al., 2020). Refusal on behalf of international media outlets to tell the whole story may lead to easier storytelling that perhaps makes for a scoop that is more palatable to Western viewers' preconceived notions of Ghana (or anywhere on the African continent for that matter), but to sensationalize Agbogbloshie is to do an injustice to the complexities of the site as a part of the material reality for many trade workers.

Admittedly, the current literature surrounding Agbogbloshie is already quite robust as the site remains one of the world's largest e-waste scrapyards. In spite of this, stagnation in community improvements is a product of potentially the most damaging symptom of globalized capitalism: overconsumption. The notion that e-waste processing in Agbogbloshie impacts human health and the environment simultaneously because of the way in which capitalism seeks monetary gain without consideration to either is also worth exploring. While the majority of Agbogbloshie's e-waste has been found to originate domestically, these numbers are inclusive of secondhand electronics that were still originally owned by Western consumers (UNEP, 2011).

Regardless, a substantial amount of waste is imported from, or illegally dumped by developed countries in the Global North. In line with their hopes “to improve their business environments for foreign companies, [developing] countries have developed export processing and free trade zones in which companies can operate virtually free of any labour or environmental laws” (Alexander, 2010). Free trade zones like the one at Tema Harbour where shipments of secondhand electronics are unloaded encourage lax environmental care and open the door to e-waste proliferation (Yeung, 2019). The conflation of labor and environmental constraints as a blockade to profit has several implications that many countries looking to export their waste are well aware of, hence this trend of dumping digital detritus in developing nations. In any event, the basic root of capitalism is to maximize profit. Still, according to Marx, capitalism’s eventual demise is contained within its own structural shortcomings (Harvey, 2011). The impossibility of satisfying a never-ceasing need to increase profits and gain capital makes the excessive e-waste at Agbogbloshie particularly senseless, and the brunt of the harm falls upon workers and the environment.

Findings from this study indicate that while participants are aware of the deleterious impacts on their personal health and the environment, the immediate monetary gain to be had through the work outweighs long-term detriments for many workers. It is also for this reason that the e-waste industry is able to persist. Perhaps one of the most damning potential impacts is the jeopardization of the future of skilled workers in Ghana. In many ways the country is cannibalizing its intellect and undergoing an internal "brain drain," a phenomenon normally involving the emigration of highly-trained workers to another country in search of better living and working conditions. In this instance, however, workers' potential is being squandered endemically from being coerced into fixing second-hand electronics instead of being trained as

actual technicians that are familiar with modern technology. Through the interviews alone, it is evident that there is discordance in understanding between the government, NGOs, and workers themselves, as well as vast differences in lived experiences between established recycling facilities and informal scrap workers —two critical realizations that both hinder restoration efforts. After all, GreenAd calling for a ban on burning certainly makes sense from a human and environmental health perspective, but banning without established alternatives will simply open a Pandora's box of shadow operations, dispersing burning from a centralized location to several undisclosed, untraceable places. Additionally, as exemplified by Mr. E, the managing director of a small-scale recycling company, there is a huge contrast between the clean facilities in which he operates, and the dumping ground that the young scrapyard worker, Mr. G, works in —an inequity that makes restoration efforts difficult to apply as there is no simple "one size fits all" when it comes to accommodating the interests of a multiplicity of e-waste workers. These crucial disconnects make it clear why the problem of e-waste is so difficult to solve, and highlights the need for policy measures that are explicitly aware of, and address the concerns of those in all corners of the e-waste trade.

Given the various limitations of this study, it is difficult to ascribe policy recommendations, especially given the context of North-South development structures. The problem of e-waste is a multiscalar issue, and as such, any policy recommendations should follow suit at local, national, and global scales; policy implementation cannot be the sole burden of Agbogbloshie to bear. That said, an undeniably necessary place to start is United States' ratification of the Basel Convention, even with the oft-exploited loophole in mind. With the US being one of the world's largest producers of e-waste, the inability to put a reign around a massive portion of the trade invites far too many unknowns. Having some form of greater

accountability could lead to progress in slowing the overwhelming flow of e-waste to sites like the one at Agbogbloshie, and encourage big tech companies to reevaluate their recycling schemes. Overall, change must come from a balance of a number of factors including worker support, big tech reform, and decreased patterns of consumption.

More research that weighs the harmful impacts as well as beneficial outcomes of e-waste while still being mindful of a critical geography perspective is warranted, and it is hoped that this exploratory study helps fill that void. Though, optimistically, another thesis like this one will not rely on video data that is ten years old, yet still relevant. Future research aimed more specifically at delving in-depth into any one of the objectives addressed in this thesis is much-needed, and particularly necessary for a more complete comprehension of how the e-waste industry persists across temporal space. For example, an understanding of e-waste processing and potential impacts in this study uncovered one of the trade's underlying workforce impacts —the potential loss of highly-skilled workers. Interestingly, the e-waste trade's impact on domestic intellectual vitality was not a topic encountered in the literature. Research that is able to ascertain e-waste's impact on technological innovation in Ghana would be interesting, and would elucidate some of the longer-lasting impacts that are perhaps not as easily observed as something like environmental degradation.

While the current state of affairs in Ghana leaves much to be desired from an e-waste processing standpoint, this also means there is plenty of room for creative problem-solving and innovation, and it is certainly exciting to think about the ways in which positive change will manifest, whether that is through the impending thirty-million-dollar project to streamline recycling efforts (Afful, 2018), or collective community organizing among scrapyard workers for better working conditions. The two do not have to be mutually exclusive despite the difficulty of

advocating for progressive community change through institutional routes. Regardless of the avenue that reform is accomplished through, this thesis makes abundantly evident that the e-waste industry, while it exists in response to the growing demand for electronics, is unsustainable, both in terms of the potential impacts it has on environmental and human health. Again, the relevance of ten-year-old interviews today should not encourage their continued relevance another ten years down the road. As the situation grows increasingly urgent, all members involved in the e-waste trade from international actors, to national public officials, and local stakeholders must take a measured, concentrated effort to ensure that its continuance is not predicated on the denigration of environmental or human health. While this was an exploratory study, more research is needed to fully understand the direct impacts of the continued e-waste trade in order to offer more definitive recommendations to the Ghanaian government, local organizations, and the workers themselves.

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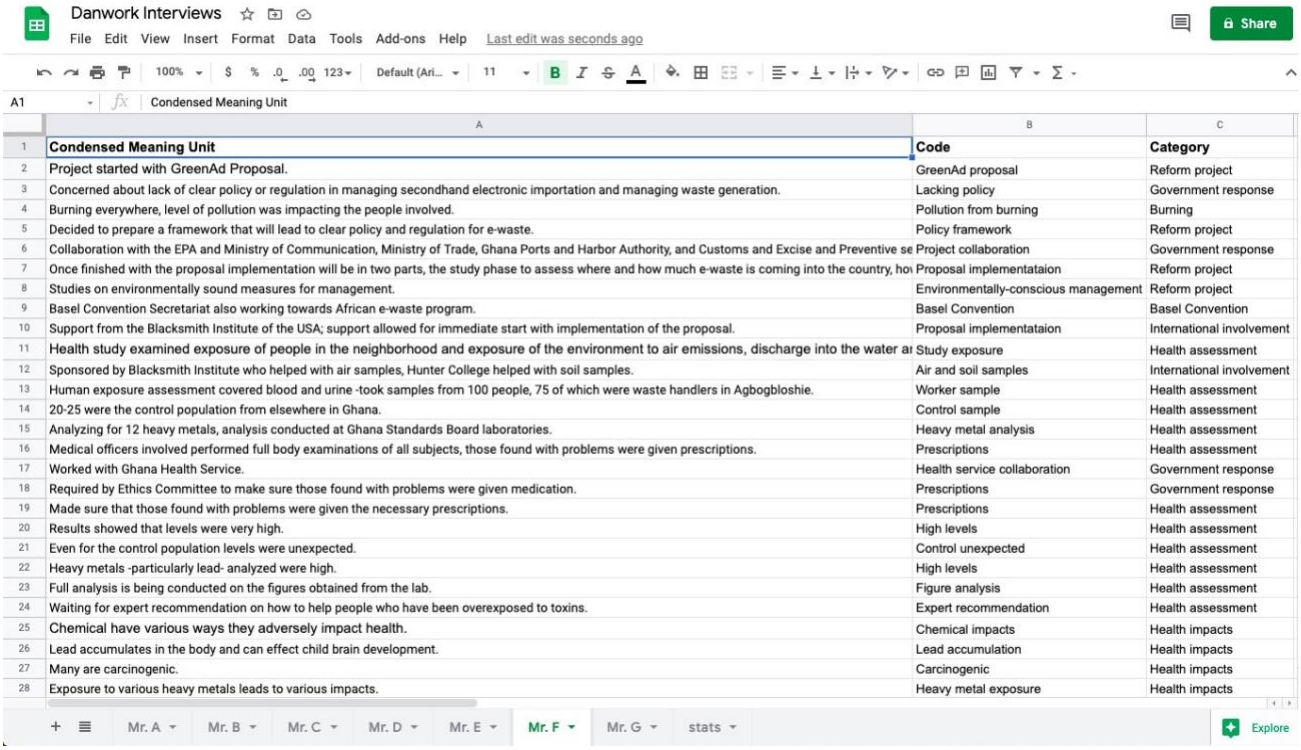
APPENDIX

Coding Process Example



	Condensed Meaning Unit	Code	Category
2	Project started with GreenAd Proposal.	GreenAd proposal	Reform project
3	Concerned about lack of clear policy or regulation in managing secondhand electronic importation and managing waste generation.	Lacking policy	Government response
4	Burning everywhere, level of pollution was impacting the people involved.	Pollution from burning	Burning
5	Decided to prepare a framework that will lead to clear policy and regulation for e-waste.	Policy framework	Reform project
6	Collaboration with the EPA and Ministry of Communication, Ministry of Trade, Ghana Ports and Harbor Authority, and Customs and Excise and Preventive se	Project collaboration	Government response
7	Once finished with the proposal implementation will be in two parts, the study phase to assess where and how much e-waste is coming into the country, hou	Proposal implementataion	Reform project
8	Studies on environmentally sound measures for management.	Environmentally-conscious management	Reform project
9	Basel Convention Secretariat also working towards African e-waste program.	Basel Convention	Basel Convention
10	Support from the Blacksmith Institute of the USA; support allowed for immediate start with implementation of the proposal.	Proposal implementataion	International involvement
11	Health study examined exposure of people in the neighborhood and exposure of the environment to air emissions, discharge into the water ar	Study exposure	Health assessment
12	Sponsored by Blacksmith Institute who helped with air samples, Hunter College helped with soil samples.	Air and soil samples	International involvement
13	Human exposure assessment covered blood and urine -took samples from 100 people, 75 of which were waste handlers in Agbogbloshie.	Worker sample	Health assessment
14	20-25 were the control population from elsewhere in Ghana.	Control sample	Health assessment
15	Analyzing for 12 heavy metals, analysis conducted at Ghana Standards Board laboratories.	Heavy metal analysis	Health assessment
16	Medical officers involved performed full body examinations of all subjects, those found with problems were given prescriptions.	Prescriptions	Health assessment
17	Worked with Ghana Health Service.	Health service collaboration	Government response
18	Required by Ethics Committee to make sure those found with problems were given medication.	Prescriptions	Government response
19	Made sure that those found with problems were given the necessary prescriptions.	Prescriptions	Health assessment
20	Results showed that levels were very high.	High levels	Health assessment
21	Even for the control population levels were unexpected.	Control unexpected	Health assessment
22	Heavy metals -particularly lead- analyzed were high.	High levels	Health assessment
23	Full analysis is being conducted on the figures obtained from the lab.	Figure analysis	Health assessment
24	Waiting for expert recommendation on how to help people who have been overexposed to toxins.	Expert recommendation	Health assessment
25	Chemical have various ways they adversely impact health.	Chemical impacts	Health impacts
26	Lead accumulates in the body and can effect child brain development.	Lead accumulation	Health impacts
27	Many are carcinogenic.	Carcinogenic	Health impacts
28	Exposure to various heavy metals leads to various impacts.	Heavy metal exposure	Health impacts

Figure 6 Example of the coding process in Google Sheets.

Transcribed Interviews

Interview with electronics shop owner
(https://www.youtube.com/watch?v=ASIUHlqqQJA&list=PLCA02A105CC83B8ED&index=3&ab_channel=Danwatch)

"There's also the question of energy."

"Fantastic question, fantastic question. You know, when I think about energy, if you're not very careful you are likely to sound a bit political. You are likely to sound a bit political because I wonder why the authorities sit down and consent for all these products to be brought in. Now the effect of e-waste and these other secondhand products on our little energy resources is that when the gadget is old, it consumes a lot of energy. Now ask yourself, why is Europe, or the developed countries producing less consuming gadgets and equipments, and they are pushing those old gadgets on us. It's because they realize how much those gadgets is consuming, especially in terms of the energy –the effects of those gadgets on their energy consumption. So the effect of

these secondhand products on our energy is so serious, and I want our aspects to one day to sit down and analyze the effect of these secondhand products on our energy consumption. We are always crying about our energy– scarce energy resource, but look at the volume of waste. There's been refrigerators, electronics, and all other energy consuming products that they bring in. It is very serious, damning effect on our energy."

"As for the people in Ghana, especially young people, what effect does this easy way to get a TV or computer, what effect does it have on them?"

"Every young person, you know it is the hope, the aspiration of every young person to have television or electronic gadgets in their homes. That is what everybody aspires to have. I mean, the comfort of having a television in your home, and then to also have a computer in your home. But then, if the little that you have earned, you are earning, will buy you a secondhand product when you have not taken into consideration the lifespan of the product you are buying. You see, what we fail to forget is that we tend to believe that because the secondhand products are cheaper, that is what our moneys can afford to buy, but it turns out to rather be more expensive than when one had decided to buy a new one. You understand?"

"Yes."

"Yeah, so that's the effects. Then the other effects is that now I am a trainer, I train apprentices – it is not my hope that I would train apprentices who only knows how to fix broken down, secondhand products. I believe that the boys we train or we are training at the workshops should be abreast with the new technology –the modern gadgets and equipment. Here is a situation where people cannot afford to buy these new gadgets, so when we train them what are they going to use? The training they have acquired, the skill they have acquired to do. To just go and fix secondhand products which is remove and fix? No. So the effect is that the manpower base is going to be affected. Very soon you will have boys going to the workshops to be trained as electronic technicians because they will find an easy way out –the easy option is that somebody wants a television to use at a low cost, the cheapest source of acquisition is the junk that has been brought from Europe, and so that is what they go and buy for the person– and that is the easy option out. Instead of seeing at the workshops to be trained to acquire skills over time, they want the easy way out, so that is also one of the effects on our youth."

"And what is your take on the local authorities' way of handling the e-waste situation?"

"I told you about the politics. Look, every politician will want the easy way out. Once the people are not complaining of lack of jobs. Now, if you see somebody carting a truckload of e-waste and the government thinks that will make the person comfortable, they will not come to put pressure on them –the government will go to sleep. You see, and it is a bit political, it takes the government –let me put it this way, the government must have the willpower to say no, to the importation of e-waste. If the government is very serious at tackling the health situation that will be caused by this e-waste –I told you about how these things are disposed of. Are you saying that our government are not aware of the dangers that these products have on our environment and our health? They are aware, but they pretend that they don't see because that is the easy option they have taken. You see it is a source of employment for some people. Because if you decide to

place a total ban on it, those who are importing it are going to put pressure on you because you are taking their daily bread away from them. You see, so the government will set consent down for these harms and pretend that they don't see. You see, but they know. They know the effects. Both health, environment, and the energy. Our government are aware –they can't pretend they aren't aware, they are aware. They are pretending they don't want to see because it is a political decision they have to take."

"Do you have anything else you would like to say? Oh, yeah, one more: would you have something that is not viable to fix, or something that the customers don't want anymore –what do you do with your electronic waste?"

"Personally, I don't have the means to recycle or dispose. So the only thing is to call those boys to come and pick it, and as for how they dispose of it –I've told you already– they break and burn, because I don't have the means– I don't recycle."

"And how do you feel when you then cause somebody getting, doing a non-healthy job, when you deliver?"

"I believe if I am happy about the situation, I would not be complaining. I am not happy. Yes, I am not happy about the situation. You see, I believe that nobody –now, if there is an outbreak of an epidemic, I am a citizen, I am likely to be affected. Directly, or indirectly. If I am not affected health-wise, financially, I will be affected. If the government will have to put some money which otherwise would have gone into education, it means it will have to be channeled into health, you see. So I also feel bad. Now if you look around –I will give you the opportunity to look around my workshop- and see the waste that I have generated. Not personally, it is not my intention to generate, but this is waste. Because let me tell you something. In the past, televisions would not stay at the workshop for long. There was pressure on us as technicians. There was pressure on us as technicians, to fix. Now, the pressure is not as it used to be just because if somebody brought a gadget for me to fix, as soon as he took the set out of his house, there is a second thought. There is a shop which sells a cheaper product which he can easily replace. And so, he doesn't care how long the gadget stays at your workshop. Now, the system is also such that you can't easily throw it away. You can't throw it away. You want to give the person the opportunity, you're probably thinking that the person is not coming because he hasn't got the money or he is not ready to fix, so you will give him some time. Before you realize, your workshop is full. You see, your workshop is already full with gadgets. Some are other people's waste. Now, I can't dispose of it. So I will want to make some little money out of it by calling those young boys to come and take it away. Yeah, maybe that is also how they earn their living. Yes. But that is an easy approach that our government have adopted. Let me put it politically, bluntly: that is a easy way our politicians have adopted. Now, let's move a little away from electronics into some areas. For a long time, until recently where one of our foremost health experts took up the campaign against importation of turkey tail. You know turkey tail?"

"No."

"It is a waste product from turkey. You people will eat the best part of it, and give us the fatty, worst one that you were otherwise going to throw away. You understand? Yes. Until recently

where one of our foremost health experts took up that campaign. We are consuming this hazardous product into our system. And, jokingly, I always tell people that I believe when Europe first starting bringing those turkey tails, they were not meant for our consumption. We probably want to tell them, we told them that we wanted it for, to feed our zoos. You see? Before we realized, we were consuming it. And we are consuming it at a very alarming rate. And I believe that that is how this e-waste also came about. Africa is poor. We wanted to be abreast with the modern technology. How do we get it? The magnanimity of Europe –let's give Africa this little product to see if they can train their children in modern technology. Little did we know that Europe has found a dumping ground. Just as they found a dumping ground for the turkey tails."

"Do you believe that people in general, is aware of the seriousness of this e-waste issue?"

"Lack of education, my people perish. I believe that they are not aware. So that calls for intensive campaign, which I have started. It calls for intensive campaign against e-wastes. And we must intensify the campaign. We much launch a multi-faceted approach to tackle e-waste. Yes. We should involve everybody including our government, and our educational institutions. I believe our citizens are not aware of these things, or the health implications of the e-wastes."

"Thank you very much, if you have anything to add please do so."

"The only thing I have to add is that if Africa is sick, Europe will not go to sleep. So Europe, help Africa to cut down or to curb the waste you bring down to us. If you don't need the waste, I believe Africa also do not need the waste. We don't deserve your wastes. We don't deserve the things that you have thrown away. So, Africa deserves the best. That is all I want to say, thank you very much."

Interview with educator & e-waste researcher (part 1 and 2)
(https://www.youtube.com/watch?v=ljv_3OxSrvA&list=PLCA02A105CC83B8ED&index=5&ab_channel=Danwatch +
https://www.youtube.com/watch?v=UO3lZ7ZeZ_o&list=PLCA02A105CC83B8ED&index=4&ab_channel=Danwatch)

"My name is [REDACTED]. I teach Development Studies and African Studies at the University of Calgary, Canada. And I have been involved in e-waste research in the past couple of years. Our work is multi-dimensional. We are looking basically at the political economy of e-waste. We are looking at what kind of contribution e-waste is making to the economy. At the same time, we are also looking at the dangers involved –the environmental dangers, hazards, and so forth involved in e-waste. And that takes us to look at e-waste on different levels –who are the people involved? Who are the actors? And so forth. So basically we are looking –I have currently students who are looking specifically at the environmental aspect, I have students who are also looking at how –who the actors involved, the people if you were there, you would see that most of them are young boys who are about 80% to 90% are from Northern Ghana. So we are trying to track them down –what is pulling them, what is the push factor pushing them from the north to come and do this kind of work and what is the benefit of this work for them? What can be done

to make their operation more safe in terms of personal safety as well as health safety, and as well as environmental issues?"

"Yeah, one of the things we've been focusing on today is the burning of copper wires to extract the copper, and I know that GreenAd has done this health survey in order to find out how serious –how dangerous it is exactly. What do you think the workers would say and do if they were told that the levels of toxins in their bodies were alarmingly high –do you think that would change their approach to the work?"

"It may, it may not. I've always mentioned at conferences and symposiums that the workers themselves understands the health hazards involved, but it is a question of survival. So if there are alternatives for them to do it more friendly with the report coming from the organization talking about the levels of toxins in their body that will help them to change towards something. But the toxic in them is not immediate –it's gradual. It durates and by the time they know it becomes serious they say well, they might have died of something else, and not the toxics. Remember, it's also an illiterate community, so that can easily be associated with something else. So yes, that's why I said yes, they may in a sense that if there's something, but if there's no way, it's a question of survival. People have no choice to burn those things. They know that it's difficult to burn, they know that it's more hard work burning them, but if there is something –it's cost-benefit analysis. If they have a way of extracting the copper easily, they'll easily go for it, but if there's no way by which they can do it and that's the only way they can survive –they'll do it, right. And I normally refer –use this question to talk of another story. People know that it's dangerous, right, to walk from here to become –illiterate and enter into Europe walking through Nigeria, Chad to that place, and people die in the desert, but that doesn't stop people from going, okay? Because it's for survival. So it's cost-benefit analysis. If they're able to come up with a strategy that can help them to you know, do the work better, I think the guys would do it, you know. They are very reasonable, looking at them they are very reasonable and easy to learn, right. They are fast learners, no doubt about that."

"So if some local authority or something would teach them to do it more environmentally friendly and some method better for their health, they would go for it?"

"They would go for it, as long as it is cost-effective. You see people have talked of business model on how to turn this around, but you looking for a business model that is not going to make the thousands and thousands of people who rely on this as livelihood, unemployed, right. It should be a model that will still allow them to operate in that way that they can extract. For instance, if they have a central machine, or a huge place where you collect your copper, you bring it, you pay a fee which is minimal, and then it's a structure that you take your copper and go and sell it and still make profit, you don't want to go and stand there and burn fire all day in that hot sun. No, you wouldn't, and I think it would take a while for the government to do that, because of the environmental hazards. Pollution knows no boundaries. It's being burned in Ghana, but we don't know where the wind will end. Some of this enters into that lagoon there, the Korle Lagoon and it finds its way into the ocean. The ocean has no boundaries, and that is where it becomes a global issue. So it's cost-benefit analysis. People have a way to do it more environmentally friendly and cheaper and cost effective, they will. Yeah."

"There's been talking a little –I know there's been talk about a total ban on burning of copper wires. What do you think that would mean to the workers? If a ban comes before a solution to extracting the copper as fast and effective as burning does?"

"That is a political approach, and knowing the system in the third world, it's not that we don't have laws. Like you talk of women's rights here, you talk of child's rights, and so forth. They are all enshrined in the Ghanaian constitution, and I think in many other countries, and Ghana has one of the most you know, viable constitutions –the constitution is well-crafted, right. But there is a difference between the law and enforcement. If you ban it at Agbogbloshie they are going to relocate somewhere else and start burning it over there. It's the same effect, you might only change the dynamics, and even, you might even make it so complex that you not know –they don't even burn at a central location, but they hide and burn in different places, and I'll tell you a story: some of my work is on conservation, and one of the approach to conservation was the policing aspect. 'Oh, we make laws and enforce the laws.' And national parks you have a number of laws there, so the people all with guns walking around, you can't enter and poach. So people will sneak in now with traps and catch the animals. Whether they are pregnant or not, whether they are small or not, which is even worse than trying, so I think the solution must come from the people working side by side with NGOs like yours, with the government, with all consensus to see how best they can do it. The banning yes is a first approach, but it might not be necessarily a solution. Computer will still come, people will remove wire, so if they have no other technology or no other ways of removing the wires, they will resort to burning. They may not be burned at Agbogbloshie, or Sodom and Gomorrah, but they are going to burn somewhere else which you will not see, I will not see, and we cannot even track. That is where my fears come in. So I very much doubt how effective it would be."

"In your opinion, what should the local authorities do to reduce the issue –the problems of e-waste, or solve them if possible?"

"As I said, it's multi-dimensional. At one level they may have to come out with laws that regulate what type of computers enter the country. But even then, Ghanaians even buy new computers and use, so what happens to the new computers when they are old? So the local authority may have to come out with a law on how to dispose of e-waste properly. For instance, in Western Europe and I guess in Denmark, there is a percentage of disposal as the cost of a computer, so that when the computer is old, you send it back to them, they give you a rebate or maybe they give you $100 and add that on top of a new computer you buy, and they will have to find a way to dispose it of. Right, so they could set up a fund by which they can organize themselves, come up with equipment, come up with the technology. The technology is already there, it's not that it's not there, on how they can dispose of e-waste. If you look at the collection, it's excellent. Those boys are doing fantastic job. They collect everything –from computer, to battery, to everything their collection is about 50% –as excellent as Europe, North America and so forth. Now how to extract is the problem, and that is where I think the local authorities will have to work with NGOs, scientists, researchers, and so forth to see how best they can come up with a solution with the people themselves –the stakeholders. There is a proverb in the Ghanaian language that is: it is the person who lives in the house who knows where the leakage is coming from. So you cannot find solutions to those problems without getting the people involved."

"Without the workers?"

"Without the workers (nodding). They must get involved. Even if their contribution is marginal, you are going to work with them."

"You need their acceptance as well."

"Yeah, exactly. You need to talk with them. You need to have "okay what is the best way you can do this?" even though you may have the solution. And, you try gradually to sell ideas to them –that is the best way. And maybe you can start with a power project. The power project is working where many of the workers –may will buy, or may buy into it. And I think that is where the local authorities will have to. But as I told you from the beginning, it's not immediate trait. People don't see that I'm sick because some toxins from e-waste have entered the water and I've drank, or animals have eaten grass grown on e-waste and I bought the meat and eat. They can't trace it, so it's not something that is immediate –it's not like there's no electricity and everybody's panicking, there's no water, everybody's panicking –but, the dangers are as huge as any of those areas I've mentioned."

"There are also the problem of the exporting countries. What measures do you think they could take in order to reduce the problems of e-waste in Africa?"

"I think some of the countries like Holland has taken the lead. There are laws on the age of computers you can export, but the other problem as I said the levels are different, right. I don't know the percentage off my head, but a large number of computers come in the name of aid. An institution is donating computers to a school –the school has no electricity. The computers come there, they stay there for one or two years, and they become redundant –they are no more useful. They have to be dumped anyway. You can tell them it's a donation. So, that one is more difficult –the official one where maybe a company collects computers that well, we know how to dispose of computers and because the cost of disposal is huge there, they decided to bring them here. That is where the exporting countries can do much, but if it is organization donating –it's good will, so, and you know, you have to find a balance between that and the official. There are some company which may be due to that Africa is the place where they can dump these things, so that is where your governments can do a lot. And you have to link with the recipient countries so that they understand and monitor this problem very well."

"Do you have anything else you would like to add?"

"Yes, what I would like to add is basically at the smaller level of exportation of computers, institutions like hospitals, universities –they should look at their policies carefully. That if you are going to export computers to an institution here, to make sure that they have a very good use for them, and you make sure that you are not sending computers which are outmoded, or any electronics and equipment that are outmoded, right. We still have a lot of –just not computers- we are concentrating on computers –but if you look at fridges, there are a lot of fridges that are no more acceptable in western Europe and North America because they contain certain chemicals in them, or certain pollutants, yet those computers can be bought and exported here, so those countries can also -the same kind of law should apply, that because they could use them

here we must dispose them of here and not just send them where we don't care really about, yeah. And lastly, I want you to spread the message –people are not aware of the harm that the exportation of e-waste is doing to other peoples' life. Somebody needs a computer, I'm only doing you help by giving you a computer, so people should understand it, and I think that if the information gets out there, people will take a second look and people begin to question authority, and people begin to put pressure on their governments, right. It's good, you know, to come here and do development work, but it's also good to put pressure on your governments to do some things that will improve the lives here. Because the action or inaction of the developed countries –their governments have the tendency to cause more problems for people here. So you keep quiet, you think that "oh, it doesn't matter" it's going to affect them. Or, you produce a lot of computers, you don't know how to dispose them of, and therefore your action is to dump them here, it's still –that's why I'm saying that the action or inaction of European and North American governments, not to exclude the Chinese and Japanese and so forth, of course, you go there you have all the computers coming from everywhere. At the same time I also think that the government –the local government should also be working around on how to come up with a framework on how to dispose of computers because even without importation, we still buy new computers. When they're old what do we do with them?"

Interview with multimedia journalist
(https://www.youtube.com/watch?v=NkN0Buy3CRQ&list=PLCA02A105CC83B8ED&index=8&ab_channel=Danwatch)

"I am [REDACTED]. I worked as a journalist for twenty years. I own and manage Ghana's #1 business news website called GhanaBusinessNews.com. I also write a blog which I do at my spare time because I'm extremely busy, which of course you have seen before. So I've been working as a journalist for twenty years now."

"Okay, and our main focus is of course on e-waste. How long have you been focusing on the issue e-waste?"

"I started writing about e-waste for the past three years, but I've been writing about the environment for about the past ten, twelve years in my twenty-year career but I focused –I started focusing specifically on e-waste in 2007 when I first wrote an article for the national daily called The Daily Graphic in which I did an educational piece informing the people about the possible dangers inherent in e-waste. That was I think in June 2007. That was the very first time I did it."

"In your view, how much focus is there in the media on e-waste in Ghana?"

"If you talk about the media generally, there is no focus at all. There have been work you might call intermittent show of interest occasionally when there is something huge. I remember the last time in the media in Ghana focused on e-waste was about over a year ago, and that was after I think there was an international event. Somebody somewhere issued a statement about e-waste and then one radio station picked it and I remember because I was interviewed on that show. And since then, there hasn't been any serious focus in terms of generally the Ghanaian media on the

problem of e-waste. I probably am the only Ghanaian journalist who has been writing consistently about e-waste in this country."

"Okay, that's interesting. Is e-waste believed to be a problem by the Ghanaian people in general? How do they perceive it?"

"So far my articles have opened the eyes of the people. A couple of people now know about the dangers inherent in e-waste. But, there is a general lack of knowledge, you know, to the death or the danger that people are exposed to and the environment as well. And you would be surprised to know that there are even government officials working in the Ministry of the Environment who have no idea what e-waste is about. So that should tell you of the very limited, you know, knowledge of the people about the dangers of e-waste. And I presume probably that lack of knowledge in the media is accounting for the very little coverage of the problem in the country."

"From your point of view, how big is the problem of e-waste in Ghana?"

"It's a big problem. If you ask me, I would say we have reached crisis point. It is a grave situation because of the very serious dangers that the poisonous chemicals contained in e-waste pose to both our environment and human health, and more importantly for a country like Ghana where about 90% of our health budget is expended on malaria, right? And then you don't have anything left for any other disease. And then we have e-waste being added in this country, it means that we are going to expose our people to much greater health dangers which you don't have the money and the capacity to handle. So it is a very, very serious incident and it must be, you know, tackled with the urgency it requires."

"In your view what needs to be done in order to reduce or solve the problems of e-waste?"

"A lot of things can be done, but it requires political will. Government must be involved. Civil society must be involved, the media must be involved. We need to do education, we need policy, we need laws, and of course, Ghana is a member of the Basel Convention, because Ghana has ratified the Basel Convention on the transboundary movement of hazardous waste, which also includes e-waste. So we need a localized legislation to be able to enforce the laws to make sure you don't get people bringing e-waste into Ghana, you know, under the pretense of supplying Ghanaians with used computers and used electronic items, but eventually, they get into this country and you can't use them. So they end up being e-waste, and nobody wants e-waste in this country. I don't think Denmark wants it."

Interview with Assistant Director & Head of the Science and Technology Department of the Ministry of the Environment
(https://www.youtube.com/watch?v=fLBcvyoQc50&list=PLCA02A105CC83B8ED&index=9&ab_channel=Danwatch)

"My name is [REDACTED]. Yeah, I'm an Assistant Director, and I'm the head of the Science and Technology Department of this Ministry. Basically, I'm an environmental scientist and I

handle the UN Convention on Biological Diversity. So I work on biodiversity and then biosafety. I also do science and technology issues, and I also handle environmental events in this ministry."

"As you know our main focus is on e-waste. We want to ask you: what is the Ministry of the Environment's view of the e-waste situation in Ghana?"

"Yeah, I must say that as of late the Ministry has observed that e-waste is becoming a menace and is creating some problems. In this capacity as waste, you know, in the country, we see them in two ways: e-waste that are imported into the country, and then e-waste that are generated in the country. And these have become –the handling and management of these have of late become a menace, a problem. And the Ministry sees that as a concern, in general."

"Which is the biggest issue? The imported electronics or the locally generated?"

"No, the issue is the imported, it's the imported. Because one, it's a big business and then most of them are not all that good even though some are good, people use them, and they help. But most of them at the end of the day become problems on the users, and so that is the main concern –the imported ones."

"How long do you estimate that e-waste has been an issue in Ghana? For how long time?"

"It's very difficult to get a very accurate estimation of the time, but to the best of my knowledge it started coming in from the year 2000, yeah 2000, and the bulk of the waste has been computers. Yeah, and then fridges, and televisions –refrigerators and televisions. Of late we can talk about microwaves, yeah, but computers, refrigerators, and televisions, these are the three main groups that come."

"What does the Ministry of Environment's position on what has to be done to reduce or solve the problems concerning e-waste?"

"Yeah, the Ministry of Environment as I said before sees the waste as a concern, and because of that what we want to do is to get a solution to that in the collection, and the disposal. Our main concern on the management of e-waste is basically to recycle –basically to recycle. And that sector again is a business to some citizens, so we are looking at the best way to collect and the best way to recycle. And in the recycling in fact I remember holding a meeting which discussed how best to train the people who collect –the scrap collectors, how to train them to dismantle the computers and the televisions because we realized that apart from them being metallic, there are some radiations in some of them so they need to be very careful, they need to be trained, so that is the Ministry's position on that."

"To follow up on this, what is being done right now and what has been tried earlier in the period?"

"Yeah what is being done officially, and let me say this because many people don't know: the government of Ghana has this commission: Ghana Atomic Energy Commision. It is expected that they will handle basically the dismantling and disposal of e-waste. The e-waste that contain

radiations. Because the ordinary people who are handling them now are not good, and they are not experienced in it so ideally the government wishes that these are submitted to the Ghana Atomic Energy Commission for them to expertly dismantle, and get rid of them. But that's not what is happening now, and what has been done is that one the government has put in place that commission to do that, and there is also some discussions on a project in collaboration with the Environmental Protection Agency to develop a policy and guidelines on how to handle the management of e-waste in the country, so that is what is happening now, yes."

"Are you setting up some form of education programs for the dealers and the collectors?"

"Yes, and when I looked at it –I had the opportunity to look briefly at the document they are developing and I realized they have in place some educational program. Together –and in addition, they also have training programs, so these are the two. There is going to be training for them, and there is going to be education. And in fact there is also the proposal for creating centers of collection where people will, you know, submit their unwanted waste and then these people who have been trained will work on them, yes."

"Ghana isn't the only country to have issues with e-waste. Has there been any collaboration and exchange of knowledge with all of the e-waste importing countries like Nigeria, for example?"

"Not that I know of. As far as I'm concerned there hasn't been any collaboration, but if the honorable Minister of Environment now because of health concern for the e-waste traveled to the Netherlands –I was fortunate to be on that delegation, and we had opportunity to go to Rotterdam –the port in Rotterdam– where we were sent to the customs office which handles these things, and there the Minister told them that yeah, some of the wastes are good because they are not too old, they are useful to Ghanaians so when they come it helps people, but some of them are very, very old, so at the port when these guys are coming into Ghana, I mean the customs should try to look at them and then prevent those that are very, very old, and of course that also sent to a center in Netherlands where these things are collected –they took us there and we looked at that. So there's that collaboration between Ghana and Netherlands, because bulk of the goods that come in from Europe pass through the port at Rotterdam."

"Just have one more question, actually. In connection with what you just said and that is: what do you think the e-waste exporting countries can do to help?"

"Yeah, I think the best way they can do to help is to sort the consignment very, very well you know, and then separate the very, very used ones from the relatively new ones and then they have better recycling facilities. Submit the very used ones let me say the useless ones, recycle them, and then allow the better ones to come in so that after some use, after the people who purchased them have used them for some time, Ghana will take care of its end disposal, so that it will reduce the pressure on management of e-waste in their country –I think that is the best way to handle that."

"Uganda has introduced a total ban of import of used electronics. Would that be a way to go for Ghana?"

“I will not say yes, I will not say yes. Because to some extent –when well-handled, it can create jobs, to some extent. I wouldn’t advise –I don't think the government of Ghana has that intention, and it’s not being discussed anyway, for one reason because to some extent it creates jobs, but as I said before, it shouldn’t be the items that have almost outlived their usefulness, yeah their usefulness. So if it should not be too old and if it can be slightly useful, the government of Ghana can permit it so that somebody will remain in business. How we see to handling them properly when they are –I mean at the end of their lifespan, yes.”

“Do you have anything else to elaborate on?”

“Not much, not much. The only thing is that it’s an area that is of interest to the Ministry. It’s an area that the Ministry would want to collaborate, you know, to find solutions to them. Helpful solutions, you know. Solutions that can benefit the exporting countries, and solutions that can benefit Ghana. I think that is the Ministry’s position, and we are looking forward to collaborate with any organization. Already I think [inaudible] NGO came to see the Chief Director, myself, and the Minister and we are discussing –that is the kind of collaboration we want. We want to collaborate with the private sector to make sure that e-waste is effectively managed.”

Interview with managing director of e-waste scrap company (https://www.youtube.com/watch?v=XsElRhLRVMs&list=PLCA02A105CC83B8ED&index=2&ab_channel=Danwatch)

“[REDACTED]. I’m the managing director of this company here. At the moment we are about 3 people working here due to first and foremost infrastructure and logistic problems, so we are just a small company at the moment. We started somewhere in February and you can see that our warehouse is very small and we wanted to use this first and by our action plan by next year we should be in a better position for a place where the South [inaudible] they’ve given us a six acre land to put up all this -the plastic recycling and the electronic recycling in place, and we hope the bank -our bankers will allow us to get the construction going on so that we will be able to put all our branches under one roof instead. Now these are the things -the motherboards, for instance- we are going to export, these are going to be exported to our partner Encross in Germany, and they are in the position to recover a lot of the chemicals on the motherboard, up to about 98% -that’s what we believe we shall be able to do. Here we have, we put the condensers. Okay that does it, the aluminum parts which we find it difficult to sell at the moment -get a buyer in Ghana. We wish so much to have sold to aluminum companies, but nobody is around. And here we have the condensers -they are put here, which we are going to export we are -here we have the plastics. This we hope the Nigerian cement works will finally give us a wire so that we send the plastics to them for their firing of cement production. In this container we have -we understand that these can be shredded- yeah they can be shredded to very nice and reuse; we don’t know any company in Ghana that can make it, so that will also be an export commodity. And here we finally come here to one of our best products; the copper wires which are burnt very fast in Agbogbloshie, but we don’t want it to be burnt in order to get the copper. And this, this iron plates from the computer we give it to the aluminum -not [inaudible]. Well, at the moment we are getting them from the Catholic relief agency who were the first to help us with over 70 computers, and then the customs. Otherwise some other organizations private like banks they try

to give us some of their old computers all along. And we are now appealing to most of -we have written to all the embassies– UN agencies in Accra that their old computers –that they should give it to us, and one interesting thing is that the Netherlands has been one of the countries that has supported EPA to see to this recycling to go on, and other stakeholders meeting. The last stakeholder meeting we told a representative of the Netherland embassy that we find it a little bit contradictory when they support our studies, but on the other hand their embassy, we've written to the embassy to give us some of their computer. We are not, but luckily the following day I had a call to come and collect some computers from the Netherland embassy, so I think with that, the next one was the Danish embassy and we hope that they will also follow up and give us their old computers instead of selling it to agents. We think we can do a better thing to help our mother earth. The German embassy has been very, very, very supportive. Of all these work benches they helped us to acquire all these – six workbenches; they are given to us by the German embassy and even with the washing machines that you saw there, they gave us some of their old washing machines, so we are very, very grateful to the German embassy and the German country as a whole. So we are waiting for you people, and then you come over. I think we should go to the other place. These are some of the work benches. The other two work benches we had, but these machines –cutting machines– this one was acquired by recycling the plastic branch, they brought them because he had found that we need cutting so that one is actually used for cutting. This is for sharpening, that is part of what the German embassy helped us to acquire, so. But otherwise these ones are for the owner of the house here."

"And city waste recycling –it was started by a German guy?"

"[Inaudible] has been in this country for about 20 years. He worked with the AMA waste management, and during one of our trying to get rid of plastic waste I came in contact with him and then he suggested that we should think about recycling computers. And then taking out some of the nice elements which we can export to Europe for money, we don't have to do it all. And then on my retirement we joined together and we started a business."

"How is the competition with the informal collectors of computers? Are you able to compete with them for the computers?"

"No, we are not in a position to compete with them right now for the mere fact that they have got a better start, but we hope with our machinery, our technology, we should be able to catch up with them. We cannot compete because they are at the moment dictating the prices of all computers where they go and collect them and where they buy them. We are not in the position at the moment to buy them at the rate or at the prices they are buying them, so we will work very slowly and we hope commitment when Encross visits us we will be able to tell and we should also be in a position to pay, to buy the computers, but even at a much competitive price. We are not fighting with them –we do not want to quarrel with them, we just want –they will see it and then they will try, and with their hard plastic what they have they will collect some of them and try to ship it for them if Nigeria cement works agree to take it. Let's go over and I'll show you – Peter, open the container and let me– okay. No, at least you can see that the environment here is neat. At Agbogbloshie you had it. We try to keep this place as nice as possible. Even our neighbors don't know what is being done here. You come and see. So you see some of the motherboards all are here."

"These are the things ready to be exported?"

"They are ready to be exported. But we want them in big sacks. They have some jumbo sacks which they put them in. That's even a satellite dish which the German embassy couldn't make use of, and they give it to us and we plan to work on it, so that is the dish. These are some of the things that we have there. This is what is going to the local steel furnaces. So these are all the boards for them. Yeah, you see that these are things from the CRTs. It's tied around the CRT and then you take it, so it's all copper. So this is why nobody will be able to make use of it here so definitely we are going to export that one. My appeal is just that I just want to say like what the speaker wrote about the poor man. The poor man says the Europeans –they are making everything and we are suffering it here. We don't want that to happen so we are appealing that not for assistance, or that they should give us any peanuts. But the point is that we want to 'Ah! The problem we have is there are some parts we don't know them. In fact, we can't identify them –what is this, what is that, what is this' and we've been trying to, in case our people want to study material science especially in the area of computers, and washing machines, air conditioners, they should please allow them to know some of the parts very well –that is my appeal. Education. And we also want to educate our brothers and sisters here to understand the dangers of modern technology –it's not all that easy; we say it's very easy, but it's not all that easy."

Interview with GreenAd representative (part 1 and 2)
(https://www.youtube.com/watch?v=zUtXELak5ro&list=PLCA02A105CC83B8ED&index=7&ab_channel=Danwatch + https://www.youtube.com/watch?v=AH-s0aCoa1c&list=PLCA02A105CC83B8ED&index=6&ab_channel=Danwatch)

"The e-waste project started with the proposal that GreenAd developed. We were concerned that there was no clearly cut policy or regulations in managing the importation of secondhand electronic electrical equipment and also in managing the waste that is generated and it was just free for all –people were just doing things their own way. Burning everywhere, and the level of pollution and also the effects this was having on the people involved themselves, in the general population. So we decided to prepare a framework that we will develop as that will lead to clear policy and regulation in the importation and the management of the waste. We did this in collaboration with the EPA and other relevant institutions such as the Ministry of Communications, Ministry of Trade, the Ghana Ports and Harbor Authority, and the Customs and Excise and Preventive service. When we are finished with the proposal and we are looking for, you know, funding to start the implementation and this were in two parts; the study phase, the inventory phase, where we wanted to know what the real situation is; how much of this is coming into the country? How it's used? Where the stocks –the end of life stocks are held? What options are the waste dumps where they are burnt and dismantled, and then studies on how to environmentally –what environmentally sound measures can be introduced in their management? So this was the scoop of the study: and as we were looking for sponsorship we were surprised to find out that the Basel Convention Secretariat was also working towards an African e-waste program so it sort of fitted quite well. And then we had other support from the Blacksmith

Institute of the USA and so with all this support coming we were able to immediately start with the implementation of the proposal we had developed."

"Part of the project was a health survey that you undertook at Agbogbloshie –can you tell us about that?"

"Yes, the part of the study relating to health was the exposure of humans –especially the e-waste handlers and then so the surrounding people who live in the neighborhood, and also the exposure of the environment –the emissions into air, discharges or releases into the water, into the soil, and things like that. This was sponsored by the Blacksmith Institute, and we were helped in doing the sampling especially the air, and then the soil by the Hunter College, also of New York. Yeah, so the human exposure assessment covered mainly blood and urine. We took blood and urine samples from about 100 subjects, and there was I think 75 of the people who handled and electronic waste all work in the Agbogbloshie environment and then we brought a control population of about 20-25 from elsewhere in Accra to take the samples. We were analyzing for 12 heavy metals, and the analysis was conducted at the Ghana Standards Board Laboratories. As part of the sampling, the team of medical officers involved did full body examination of all the subjects that were sampled, so those who were found to have certain problems on their bodies were given prescriptions as part of the requirements by GreenAd, and I must say that we work jointly with the Ghana Health Service. We were required by the ethics committee of the Ghana Health Service to, you know, make sure that people were found to have any problems from the work that we're doing coming out of the analysis. We provided medication, and we made sure that we helped them. This was part of our requirements. So we made sure that those who had body problems from the full body examination, we give the necessary prescriptions and that will help them to get over those problems. We have the results out now from the Ghana Standards Board. The levels, as expected, in most cases were very, very high and alarming. Strangely, even for the control population, we still had levels that we did not expect. For most of the metals, heavy metals analyzed, particularly lead, was just too high for our liking. Now the full analysis is being conducted –analysis of the figures that were obtained from the lab. It's being worked on by the experts, and we're still waiting on them to give us what the real picture is, and then recommendations on how to help people who have been overexposed to some of these rather toxic elements."

"How does it affect the human body to have these heightened levels of –for example, lead– in the body?"

"Well we know these chemicals have various ways that they manifest in terms of ill health. Lead, for instance, we know accumulates in the body, and as you take it continues to accumulate and we know lead has very serious effects on brain development of children. As the levels accumulate you can imagine anything can happen –a lot of these are known to be carcinogenic –that's cancer-causing. So this is a situation they are exposed to, and you know the various heavy metals, you know, have the various pathways they follow in the human body and you can imagine what is happening with all these wide range of heavy metals have been accumulated in the body. Apart from what people breathe in, like the dioxins and all that they breathe in, so you can tell for yourself, you know, taking in all this from all angles. Both through their hands -we know the conditions in which they work and eat. The insanitary situation, and the polluted air

that they breathe in. So we know the situation is really critical in this area and the people are rather badly exposed."

"What impact do you think the survey will have?"

"We think perhaps this is the empirical –this is going to give us the empirical evidence of the seriousness of the situation, that will get everybody to sit up. We think if the policy decision-makers become aware of the situation from the analysis –if the parliamentarians become aware of the seriousness of the situation, then what we are calling for: regulations of importation of secondhand goods so that we can eliminate those ones that come and never work, and they just come and designated as waste, and then those that we also generate locally, we will have a better way -a proper management system for electronic and electrical goods. That is what eventually we are looking forward to by this proposal that we made in the first place: controlling importation so that we eliminate the obsolete, unworkable and waste -electrical electronics that enter the country, and also how to manage the waste that we generate locally in a more formal, organized way that will protect the health of people who work with them. This is what we are looking forward to and we think the studies is going to emphasize the need for these measurements to be implemented even quicker than we anticipated."

"Do you think when the workers are told about the results of the survey, do you think it will have an effect on how they work?"

"Yeah, we think so -it would certainly have effect on them once they are told of the results. And of course, even before the story is told, they themselves are aware that they are exposed to some hazardous conditions. But as early how, they may not know, but they know that they are affected. That's why when we went in to do the analysis, they were just tripping. Everybody wanted to be involved, but we could take not more than 100, that was how far our resources could go. But they all wanted to be part of it so that they would know what was happening to them. But you see they cannot also stop, because it's a matter of survival. That happens to be their source of livelihood. So though they know they are exposed to dangerous substances, they still continue."

"What would you like the exporting countries of used electronics to do to secure that waste isn't entering into the country?"

"Well, so far the proposals we are making and the recommendations we are making with respect to regulations is to have the exporting countries conduct the necessary tests, and certify all electrical and electronic equipments coming as secondhand -that they can take power, that they are functional -that is what we are recommending. Anything arriving as secondhand we shall have the evidence -certification- that it's functional, it's working. And then we can also test here at a port of entry that these are working. And if they are working, then that's it -then they are not waste. But if they are not working, after our tests, then it means that it is waste, and then we have to find -we are recommending that this be repatriated, re-exported at the expense of the importer. This is part of the regulations that we are drafting for consideration by the relevant authorities."

"And if there is anything else you would like to add please do so."

"Well, what I would want to add is: at this point, what we need is also support because we have finished the inventory phase, the studies phase, and we are moving on to the piloting of the implementation phase, and the piloting phase we are looking from our proposal -we are looking at constructing working areas, and helping these handlers to form the necessary groups, and been given simple implements. For instance, as one of the first measures that we want to take is to eliminate burning: burning of plastics, burning of casings, some of these with all the flame retardants -you know casings, are being burnt- and we think that is perhaps the major source of the problem. So we are looking forward to eliminating burning, but it means that we have to have a substitute for removing the plastics from the copper wires and that kind of thing, you see. A means of granulating these casings, and then you know reducing, compacting them for either landfill or whatever measures that we would decide on them where we cannot find a means of reusing them. See so the construction of such structures, working tables, simple implements to de-wire -to remove the plastics from them- and we are also looking at some simple cleaning structures close by. Sanitary facilities where they can wash their hands, and they can go to you know, properly organize if you like, restaurant for them to eat when they have to. Giving training, awareness, building some minimum capacity for them to operate in a sound -environmentally sound manner. You know, clinic with [inaudible] to provide the necessary first aid you know, support to them so that the whole system would become formal, rather than what we have now, which is regulated by law, and then with the laws that would hopefully be passed this will eliminate the indiscriminate use of scrap yards anywhere, and then also eliminate burning of electronic and electrical parts. And what we need is support -we need the financial support to be able to set up such systems, and then depending on how successful they are, this can be replicated through other countries."

"Thank you very much."

"Thank you."

Interview with scrapyard worker
(https://www.youtube.com/watch?v=iX5vikgX9QY&list=PLCA02A105CC83B8ED&index=1)

"My introduction starts by saying that my name is [REDACTED]. I am from Nigeria, my age is sixteen years old, I am sixteen years old. The question, please."

"Okay, how long have you been working here at Agbogbloshie?"

"I've been working here for about 2 months because I came from Nigeria so I had to get close to the workers so I would be able to do the perfect job at the perfect time. So that's why I have been two months working here."

"How long have you been in Ghana?"

"I have been in Ghana for two years."

"And you go to school?"

"Yeah, I go to school here in Ghana. I attend school here in Ghana at [inaudible] Electronic Institute [inaudible]."

"What kind of work do you do here?"

"I pick copper, and I also burn some if I have the ones that haven't been burned."

"Who do you burn for, do you burn for yourself or does somebody employ you to burn?"

"No no no, I burn for myself, because these people there are some friendly, close together, they speak the language and I don't even hear them, so if I try to ask for help they are like okay let me help you to burn that and I said no even if that person speaks it in their language they accept it but because the little that I have is the one I burn."

"Where did you get that cable from?"

"We found it on the floor. We are walking around, many people are doing work, they got it from any kind of element. Like the components there are some little wires. When they are walking some fell down, so we saw them and we took it to burn."

"Are you aware of the health risks connected to burning copper?"

"About the health risks...The health risks only depend on you, by protecting yourself. When they are doing the smoke over there you have to protect yourself from the smoke. Pass somewhere else that there is no smoke so that you will be able save your throat, everything about your safety. To talk more about it, the floor also there is a lot of sharp objects which can also hurt you so you have to also wear some boots or some slippers to protect yourself. Even though the slippers also doesn't work a lot because while you are burning it there are many people watching with you so their slippers also burn with the light on the floor, so you have to get some shoes. For me now I don't have the money to get some shoes because of my education."

"Ah okay, you spent your money on your education."

"Yeah."

"Have you ever tried retrieving the copper in another way than burning it? The copper wires?"

"In order to retrieve it without burning it is when the copper has a rubber covering it so you can use any sharp object to cut the rubber so you are able to absolve the copper, but the workers do not have time for cutting the rubber rather than burning it."

"So it's faster to burn."

"Yeah, than to retrieve it by pulling it out."

"So that's why people burn."

"Burn, most of them burn. But most of them say that 'Oh, I do not have time today, I don't want get stained.' So they get in their house and they relax and do it themself."

"There are people who strip it instead of burning it."

"Like those copper over there, the one blue over there. Those are the ones you can be able to strip out."

"Why?"

"Because those are made with strong ones so when they cut it they will be able to pull it because the tiny, tiny ones you will never be able to pull it. Like this, example [moves off camera]. Oh, okay, don't follow, don't follow. Like some example, little ones when you try to pull it-"

"What is it let me find for you."

"It's around there, well over there (motions to scrap)."

"Okay. So there are other ways of doing it, so this next question may seem a little off. But still, if somebody came to you with a safe method-"

"Uh huh, like this one (shows scrap) because when you try to pull it over here, you get some injury over here because when you place your hand on this you're supposed to pull it. This sharp object shoots you inside. Then little by little - you may think oh, they're small things, it can affect your body. Because why you put your hand in it and it shoots you, you can think oh it's a small thing that it only shocked me and everything every dirty things absorb from it and you feel some pain, through your hands."

"I was trying to ask a question but, if you would be willing to use another method than burning if somebody came up with an idea to do it safely, and if someday that burning of the copper wires were banned by law?"

"Please could you say the question again?"

"Yeah, if it was possible to retrieve the copper in a safe way, not by burning -and if burning became illegal- would people still be burning or would they use a new method? A new way of retrieving it?"

"Them over here they believe in something, because why you try to be pulling it? It takes a lot of time, and they doesn't have a lot of time. They just work, take everything and sell. Because while you try to be pulling there are some that remain in it and you may think, oh don't let me leave any more to it, and you think you may have pulled everything, but you don't know that.

Time is not by your back. Time moves faster, and you are sitting there slow. That is why they all burn together. And even if there is a method and I don't believe they would be interested in it."

"What if somebody came up with a faster method, a method that was as fast as burning?"

"That's when you have many people to organize. If somebody came up with a faster method, then this burning, and these problems or diseases, you may ask some people that you may be able to talk to, and little by little some will come forward to you and you will have some idea of it, and you all go in together. It can establish itself."

"Okay, yeah, so they have to start in small groups and then develop."

"Uh huh, yeah it goes and develops."

"How long do you think you will be working at this dump site?"

"How long I will be working here, as long as I get a job. I finish my school, I get my report. Many people say I am too short to get a job, but by my aspiration, by my work, by my brain, I could be able to get a job because if I get a job my parents couldn't be able to afford my student for my youngest brother. I will be able to be doing it. I may be short, but I know what I can do. You have to believe in yourself. Not about height, not about short, not about anything in you but your brain and what you're feeling, and be proud of yourself."

"So you're saying until you get a better job you will still be working here."

"Yeah, working here so that I will also be able to be helping my mom. At least if I get a job and everything was changed I wouldn't be able to be coming here anymore. I would be able to be getting myself, I would be neat, I would be gentle, and something like that."

"I'm sure you'll do fine."

"Oh, I will."

"If you were told that it was very bad for your health to work here -I know you're aware of that- but if you were told that it was worse than you thought it was, would you then stop working here?"

"Many people have also been telling me that it's very bad for me to be working here, about the smoke is the best. The smoke is the dangerous one isn't it. So they are saying that many people do things to raise money. You can even say 'Oh because I will get disease from this, the money I have I will even spend it on the disease so….' It's likewise the same thing. I live, or I stay. It's the choice of the man."

"So what would be your lesson?"

"Some people says that I have the disease before I run from it. Oh, do you understand what I just said? If something happens to me before I know that I am injured. Assuming you get it when you are working, you don't know yet, you just rub your hand on it, it has gone, but not until you feeling the pain before you stop it."

"What if one of your friends got seriously ill or-"

"That's his problem, not mine."

"It wouldn't stop you?"

"No, not when you are uncareful. If you see….you have to be more careful to yourself."

Understanding Global E-waste Flows

In order to contextualize Agbogbloshie's e-waste trade, global e-waste flows were examined using quantitative data from the Global E-Waste Monitor 2017. Using these figures the volume of domestic e-waste production by country as related to that country's GDP was discerned. The Global E-Waste Monitor 2017 generated in part by the United Nations University has a relatively comprehensive list of domestic e-waste generated by country for six e-waste categories: Temperature Exchange Equipment, Screens, Monitors, Lamps, Large equipment, Small IT and telecommunication equipment (Baldé et al., 2017). This data is based on 2016 collections. Also taking into account the GDP figures published by the World Bank for the given countries, some hypotheses can be made (DataBank). Based on the literature and global e-waste trends, the initial hypothesis was: the higher the GDP, the more e-waste is produced. Assuming the narrative that wealthy nations produce the majority of e-waste holds true, there should be a positive correlation between the volume of e-waste and GDP. In other words, with this data, the claim that more wealthy countries (presumably in the Global North) produce greater amounts of e-waste can be substantiated.

Results of quantitative analysis of e-waste data and GDP figures yielded findings consistent with the initial hypothesis that the higher the GDP, the more e-waste would be produced (Table 2).

Table 2 Summary descriptive statistics of e-waste generated in kilotons from the Global E-Waste Monitor Report 2017 and GDP figures from the World Bank.

E-waste generated in 2016 (kt)		*GDP ($)*	
Mean	252.84	Mean	$426,094,302,858.09
Standard Error	59.65	Standard Error	$130,781,237,898.29
Median	33.00	Median	$36,054,281,572.40
Standard Deviation	793.57	Standard Deviation	$1,730,073,158,160.21
Sample Variance	629746.74	Sample Variance	$2,993,153,132,586,450,000,000,000.00
Kurtosis	52.06	Kurtosis	$80.23
Skewness	6.70	Skewness	$8.41
Minimum	0.01	Minimum	$36,547,419.87
Maximum	7211.00	Maximum	$18,707,188,235,000.00
Sum	44752.21	Sum	$74,566,503,000,165.20
Count	177.00	Count	175.00

The difference in data counts is accounted for by the fact that two countries (Eritrea and Venezuela) did not have GDP data reported by the World Bank. Perhaps this could be remedied by using data from other sources, but there is a possibility that the data would not be as reliable. Further statistical analysis to see the correlation between GDP and e-waste production yielded the following confusion matrix:

Table 3 Confusion matrix for the parameters of e-waste generated in 2016 in kilotons and GDP in USD.

	E-waste generated in 2016 (kt)	*GDP ($)*
E-waste generated in 2016 (kt)	1	
GDP ($)	0.938	1

Based on Table 3 the correlation coefficient between e-waste generated in 2016 and GDP is about .94, which is a very high value. This indicates that there is a strong positive correlation between the two. In other words, as e-waste generated increases, GDP is expected to be high and vice versa.