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Economic Boom or Environmental Doom: E-waste Scavenging as a Livelihood Strategy among the Youth in Accra, Ghana.

Martin Oteng-Ababio (PhD)

Department of Geography and Resource Development University of Ghana

moababio@yahoo.com/moababio@ug.edu.gh

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Abstract

In a rapidly urbanizing Accra, as in most cities in the developing world, individuals, especially the youth, try to make a living by engaging in novel occupations such as e-waste scavenging. Although, today there is a body of knowledge about the emergence of e-waste scavenging as a source of livelihood for the urban poor, none comprehensively examines the merits and demerit of this new enterprise, leaving room for and encouraging its occasional sensational castigation by some media and environmental NGOs who discuss the electrical and electronic waste unidirectional, from production, consumption to disposal.

While the NGOs tend to overstretch the negative impacts, scholars interested in its socio-economic values also over-trumpet its potentials. Through qualitative and quantitative studies at the largest scrap yard in Ghana, this study fills this lacuna. It provides an invaluable insight into a complex gamut of management practices which can impact on poverty reduction. The findings reveal that an average e-waste collector at Agbogbloshie earns about \$3.50 a day which is above the national daily minimum wage of \$2.15. Despite this potentially huge livelihood opportunity, the findings also indicate that the process is fraught with health and environmental hazards. This perhaps signals that the ideal mix of skilled labour from the informal sector with appropriate technology can provide the necessary platform which will guarantee efficient exploitation of the economic value of e-waste and at the same time, minimize its health and environmental impact.

Key words: E-waste; Livelihood; Environmental hazards; Agbogbloshie; Ghana.

1. Introduction

Electronic and electrical waste (or e-waste) is generated from any equipment running on electricity or battery that is discarded by the original user, in a working or nonworking condition. Recent studies worldwide show that e-waste is increasing three times faster than all other domestic waste (UNEP, 2005). Africa is no exception. Kenya, Morocco and Senegal, for example, discarded approximately 17,500 tonnes in 2007; South Africa generates 100,000 tonnes and Ghana treats between 10,000 and 13,000 tonnes annually (Prakash and Manhart, 2010).

It is expected that the surging in e-waste generation should be accompanied by specific policy and legislation on its management which is currently, virtually non-existent. There is also a dearth of knowledge and training about management options. Thus, waste which could be safely disposed of or recycled now becomes a hazard, presenting manifold impacts on the environment, local communities and the economic system in general (Oteng-Ababio, 2010; Bridgen et al, 2008). At a forum in June 2010, the Mayor of Accra noted: "the hazard associated with e-waste has long-term effects such as cancers and chronic disease, and can result in a public health crisis which huge sums of money, which could be used for more profitable ventures such as construction of infrastructure, would be channeled to control" (Accra Mayor, 2010).

Despite such negative commentaries, some studies have also revealed that e-waste provides valuable jobs for people who cannot easily access formal employment. It is also known to contain valuable metals like copper, gold and silver that are inevitably lost if not recovered and that have to be compensated for by intensified mining activities, which lead to severe sustainability impacts in mining areas. A conundrum is created relating to whether e-waste (mis)management presents an "economic boom or environmental doom", especially in the face of recent media exposés (e.g. Frontline, 2009; New York Times, 2010) underscoring illegal dumping at the end of a commodity chain while some NGOs (Basel Action Network (BAN), Green peace International) have highlighted the local health and environmental consequences of e-waste toxicants wafting into the immediate atmosphere, leaching into soils, the lagoon and the nearby sea.

The nexus becomes more complex particularly at Agbogbloshie, the hub of e-waste activities, where there is nothing like "waste". Every object, component and material has 'value'. Computers and televisions are regularly bought and sold, assembled, disassembled, and reassembled. They disintegrate into their constituent materials – plastics, glass, metals. Plastic printer cases are smashed by hand and hammer. Indeed, a day's working experience with an executive of the Scrap Dealers Association was an eye opener. His wife sells "Koko" (a local name for porridge) at the scrap yard with four hired hands. We visited a police station where he negotiated a police enquiry bail for a member of the association who had been accused of "stealing plastic shards".

We went to the ministries where he met "some friends" who alert him of impending public auctions, where he buys "obsolete e-products". We also visited a shipping agent at the Tema port who was processing his consignment of mother boards for export to Asia and later picked up his cheque at Tema Steel, a company which recycles metal scraps into iron rods for the local market. On reaching Blowplast limited (a plastics recycling company), he picked a local purchase order (LPO). Finally, we joined the inauguration of the executives of the KIA Truck Drivers (transporters of e-waste to and from Agbogbloshie), but not until after visiting the Ridge Hospital where a two and half year old son of another executive member, was on admission suffering from incessant convulsion.

After my experience, I became convinced that the oversimplified storyline outlined from 'origin' to 'final resting point' in some e-waste arguments without drawing out the more complex spatial realities cannot continue without questioning (see Leslie and Reimer, 1999; Huges, 2000). There seems to be a multifarious and iterative process of work rather than a linear unidirectional transformation (Lepawsky and McNabb, 2010). It is believed that adopting an open-ended approach provides a better opportunity to account for a wider 'gamut' of economic activity (Hudson, 2008, 422), including waste, its uneven dispersal and accumulation in people's bodies and environments, as well as its travels back into regimes of value (Gille, 2007).

This study, through qualitative (ethnographic) and quantitative studies at Agbogbloshie, shows how informal e-waste scavenging has emerged and become embedded in specific networked places within highly differentiated circuits that produce geographically uneven development. It shows how economic circuits are not readymade but change with advancement in knowledge and technology. The study is organized in four main parts. The subsequent section outlines the conceptual framing, which draws on the global value chain debate. It further highlights the fact that the element of linearity overshadows a more complex interaction in the value chain. The field methodologies receive critical consideration in the third sections while the final one uses the findings to provide an overview of the potential and vulnerability of "rubbish electronics".

2. An Overview of Linearity and the Global Value Chain Debate

The Global value chain describes the full range of activities that firms and workers perform to bring a product from its conception to its end and beyond. This includes activities such as design, production, marketing, distribution and support to the final consumer, and can be contained within a single geographical location or spread over wide swaths of geographic space. The concept has become much more prevalent and elaborate in the past 10 to 15 years (Gereffi et al, 2005) though with reference to its application to electronic waste, some writings tend to exhibit limited understanding of downstream activities as well as the smallest links within the chain. Puckett (2011) for example intimidates that there are questions lying strewn about the Agbogbloshie dump site.

It a place where the developed world's old techno-crash waste has been tossed up by the hidden currents of today's consumerism and commerce, and has found a strange resting place..... in these global waysides, questions beg for answers; They cry out from the bone yards where these fallen icons of our proud information age lie as rotting fruit the progeny of centuries of technological advancement. He further argued that machines which months ago could process a billion instructions per second have found their end as metal and plastic skeletons in the world's most sorrowfully poor communities, to be subjected to hammer and fire, emitting deadly smoke and fume. Such arguments are obviously unidirectional and mercies the realities on the ground.

Thus, a number of scholars have shown how the concept exhibits a variety of characteristics and impacts communities in a variety of ways, yet recent studies have questioned its viability as a framework for studying a globalizing economic activity due to its inherent element of linearity. Leslie and Reimer (1999, 403), for example, criticized the

framework for ignoring the 'multiple and shifting connections between sites'. They argued that linearity in the commodity chain analysis privileged certain groups with agency at the end of the chain, yet ignored the role of those at the beginning of the chain who may be both producers and consumers. They accordingly called for an approach that recognized the 'interconnected flows not only of materials but also of knowledge and discourses'.

Hughes (2000) also examined the Kenyan cut flower trade and argued that 'the often unidirectional linearity of commodity chain approaches imposes analytical constraints'. His study revealed 'complex webs of interdependence rather than fixed, vertical and unidirectional relationships' (2000, 178), and traced the 'multi-stranded connections forged between a variety of significant and interrelated actors' (2000, 179). He advocated for the introduction of 'circuits of culture' which can enrich understanding regarding commodities and their multidirectional journeys and offer us a thicker description of the attachment of meaning to goods.

Contributing to the debate, Lepawsky and Mather (2011) agree that commodity production and circulation is clearly not linear but networked, mesh worked and circuited, where goods are discarded only to be transformed based on the availability of knowledge and technology and then consumed again. They however argue that even most critics of linearity in the value chain have themselves failed to get to the underlying problem, intimating that linearity is not only a problem of simplifying economic activity as a linear low (Hudson, 2008); nor is it only a problem associated with removing economic activity from the spatial, social and embodied context in which it is embedded. Instead, it is a problem related to the architecture of "beginnings and endings"; contrary to the present arguments which remain wedded to an analysis of economic activity that has a defined "beginning" and "end point" (Lepawsky and Mather, 2011).

This study at the Agbogbloshie e-waste recycling site is of a piece with this position and adds to the current intellectual thinking (see also Gregson et al., 2010; Lepawsky and Mather, 2011). It affirms how informalization and casualization of work looms large in most urbanizing cities (Dierwechter, 2004; Lindel 2010; Myers, 2010). It shows how casualization of work and other arrangements have connected formal forms with formal and informal agents in a circuitry that can stretch across the globe in embedded hierarchies, divisions and subdivisions. These specific contours exhibit how informal work is endlessly franchised within hidden the e-waste circuitry of "economic boom" (opportunities) and "environmental doom" (vulnerability). The study argues that these contours will be better appreciated by adopting a more holistic methodological and conceptual approach which Lepawsky and Mather (2011) describe as "boundaries and edges", as opposed to "beginnings and endings".

The research was carried out at the Agbogbloshie scrap yard which is geographically helmed within the triangulate of Abossey Okai Road, the Odaw River and the Agbogbloshie drain. It is the biggest e-waste recycling site in Ghana and its genesis dates back to 1980 when after a clash between two tribes from the north, (the Kokomba and Nanumba traders) at the Yam market in Accra, the government decided to temporary rehabilitate the Kokomba faction at Old Fadama (present day Agbogbloshie) while alternative place was being sought to resettle them. Later, a group of Nzema coconut oil and Kwahu Russia second-hand cloth sellers joined the Kokombas as temporary settlers. It was also gathered that on the eve of the 1992 Non-Aligned Movement (NAM) conference in Ghana, the then AMA boss asked street hawkers along the pavements of Accra to relocate to Agbogbloshie to give the city a beautiful facelift during the period of the conference. After persistent pressure, the hawkers moved in. Today, the area is about 31.3 hectares and less than a kilometer from the central business district (CBD), with an estimated population of 79,684 ("Housing the Masses", 2010: 2). It is engulfed by urban commercial development due to the rapid spatial expansion of Accra (see Figure 1).



Figure 1: Map of Ghana showing Accra Metropolitan assembly and the study area

Source: Authors' Own Construct, May 2010.

3. Data and Methods

The study examines both the potential and negative impact of e-waste scavenging as a livelihood strategy, especially for the unemployed youth, based on the case study from Agbogbloshie. It particularly examines what happens to EEE at its end-of-life and demonstrates that e-waste does not necessarily follow waste, recycling, pollution and final disposal (Coe et al, 2008) but consists of a multiplicity of 'waste' and 'value' depending on its geographical location, available technology and know-how. It also seeks to interrogate how the transformation of perceived waste into some form of value actually happens and presents a clearer picture than the apparent oversimplified storyline of "dumping of waste from the North to the South" delineated by some media and ENGOS (BAN, 2005; Greenpeace, 2008; Frontline, 2009; New York Times, 2010).

To achieve the set objectives, 80 e-waste scavengers at the Agbogbloshie scrap yard were interviewed between February and May 2010. Data collection involved multiple techniques: personal interviews, visual inspections, transect walks and stakeholder interviews. The questionnaires targeted 60 individuals engaged directly in e-waste recycling who were systematically sampled during the field work. Additionally, 20 others including those in e-waste related activities (refurbishers, scrap dealers) were selected through participants' observation. The later methodology allowed for greater insight into contexts, relationships and behaviour of participants though it appeared time consuming and documentation relied mainly on the memory, personal discipline and diligence of the researcher. The questionnaires probed into their socio-economic characteristics, roles in the process of recycling, wages and the profitability of their undertakings, among others. The selected socio-economic variables were in consonance with the guidelines for "Social Life Cycle Assessment" (S-LAC) postulated by UNEP (see UNEP, 2009). Participants were first contacted through a member of the association because recent 'negative' commentaries have made some very skeptical about strangers prying into their business. In order to obtain a more balanced perspective, in-depth interviews were further conducted with key stakeholders including the executives of the Scrap Dealers' Association, officials from the Accra Metropolitan Assembly (AMA), the Ministries of Health, Local Government and Environment, and the Environmental Protection Agency (EPA).

In general, the administration of the questionnaires typically lasted about two (2) hours and usually occurred at places of work, especially at Agbogbloshie, with buying, selling and processing of e-waste going on simultaneously. By the end of the fieldwork, over hundred hours of non-participant observation of various stages of e-waste processing had occurred. These helped fill missing links, validate and cross-check the primary data. The participatory observation particularly provided insights into labour intensities and recycling processes, including computer disassembling, retrieval of resalable and reusable parts, open incineration, and weighing and metal trading. These were supplemented by a comprehensive literature review and content analysis of data collected. The process facilitated the appreciation of, for example, the health implications of such practices as reported in the literature (see Pinto, 2008; Greenpeace, 2005). The primary data were computed and analyzed with the Statistical Package of Social Sciences (SPSS 17). Personal observations and responses to open-ended interviews were organized into themes and used to complement the survey research results. The analysis was based on the current available recycling technologies and management paths as against the socio-economic circumstances of those directly involved.

4. Results and Discussions

4.1. Agbogbloshie within the Urban Economy

The economic geography of Ghana has and continuous to be influenced by rapid urbanization and the position of Accra, the national capital, as a primate city (Yankson et al, 2004; Grant and Nijman 2002). The city's diverse economy is partly attributed to the operations of major parastatals and multinational cooperation (Grant, 2001). It contributes about 20%-30% of the national GDP and has an average per capita income of \$366.8 as against the national average of \$267.7, making it the highest in the country (GSS, 2008). Despite Accra's pivotal role and its relatively strong economic indicators, 11% of its population in 2006 subsisted on incomes below the World Bank absolute poverty threshold of \$47.2 a month (GSS, 2007). In terms of employment, only 20% of the active population is engaged in the formal sector (i.e. white color jobs provided by the private, government and parastatal organizations) (GSS, 2008). The vast majority are therefore, without the resources to obtain the requisite education and skills, often find themselves in much larger but more economically vulnerable informal sectors of the economy which are plagued with many challenges.

The e-waste scavenging at Agbogbloshie is one such 'survivalist enterprise' and is entirely private and informal. The sole motivation of participants is the possibility of making a living from the recovery of some "precious metals" including copper, aluminum and iron (steel) through the use of simple tools and rudimentary methods. Additionally, access to instant cash and the low level of skills required to carry out metal recovery operations, have made the enterprise an attractive "nouvelle trade" for those who cannot easily find a living in the formal sector. The main electronic wastes being processed are obsolete computers, monitors and televisions, which are manually dismantled at small workshops. Certain materials, including plastic coated wires and cables, are often taken to sites on the edge of the market where they are burned to retrieve copper (see Figure 2). **Figure 2: Burning of Plastic Coated Wires to Retrieve Copper**



Source: Survey Data, May 2010

The e-waste economy at Agbogbloshie is highly stratified and the study identified four main components: collection, recycling, repair and refurbishment, and trading of metals. These four activities are vertically integrated in a value chain that encompasses a wider space economy, but there is some degree of horizontal integration at the local site. The collectors, mostly aged between 15 and 29 years, constitute about 58% of the respondents and are the actors who execute door-to-door collections of used EEE from private homes, institutions and dump sites. Initially, collectors did not have to pay anything for items dumped at street corners, neighbourhoods or dump sites. However, with increasing competition occasioned by the entrance of more prospective scavengers, the "waste" has begun to attract a competitive price. During the fieldwork, it was learnt that a collector has to pay \$1-\$2.5 for an obsolete desktop computer. Some collectors also directly engage in the dismantling and recovery of metals, including the burning of cables and wires to liberate copper, but there are a few who "sell their booty" to middlemen, who also serve as the intermediaries between the collectors/recyclers and scrap dealers serving as the link to the 'processing units'. The industrial port of Tema is a particularly important recipient of scrap metals, used in the production of iron rods for both the local and international market.

The study also revealed repairing and refurbishing as an important segment of ewaste (mis)management at Agbogbloshie. Refurbishers transform old/non-functioning products by replacing defective components. They engage in cleaning and repairing activities in order to make the refurbished product more appealing and affordable to the majority of the populace who, thanks to the Ghanaian economy which consigns 28.5% of the population below the poverty line¹ (GSS, 2008; UNDP, 2009), have little to spend on such items. During the study, a second-hand desktop computer at Agbogbloshie cost between \$60 and \$100. The area is also seen as having extensive inventories of accumulated parts to service the reuse cluster while the city refurbishers travel the area to source parts. Local reusers capitalize on available stocks and so have "earned" reputations as the most rapid installers of reused components in the country. As a result, reuse traders, shopkeepers and "individuals in the know" send devices from all over the country to be repaired in Agbogbloshie. Figure 3 shows some refurbishers of computer system units at the study area.

¹ In Ghana, poverty profile as the measure of the standard of living is based on household consumption expenditure, covering food and non-food (including housing). Hence, a lower poverty line focuses on what is needed to meet the nutritional requirements of household members. Individuals whose total expenditure fall below this line are considered to be in an extreme poverty position, since even if they allocated their entire budgets to food, they would not be able to meet their minimum nutritional requirements. Thus, there are two lines: a lower line of GH \pm 70 (\$47.20) per adult equivalent per month and an upper line of GH \pm 90 (\$60.68) per adult equivalent per month (GSS, 2008).

Figure 3: Refurbishers of Computer System Units at Agbogbloshie



Source: Survey Data, May 2010

4.2. Remuneration

The study captured four categories of workers involved in the e-waste management: the Waste Collectors, the Middlemen, Refurbishers and the Scrap Dealers. The lowest barrier of entry for most collectors is collection points at dump sites and around houses and companies. Unfortunately, these scavengers do not keep any records on quantities of collected commodities or financial revenues that accrue from their transactions. The findings reveal that e-waste collectors earn on the average \$3.5 a day (see figure 4), representing about two and a half times the average income of most informal economic workers in Ghana (Grant and Oteng-Ababio, 2010). Collectors engaged in dismantling and metal recovery earn even more (\$8 a day) while the youth under 15 (who formed about 23% of the sample) earn approximately \$20 a month. Most middlemen and scrap dealers were reluctant to disclose their incomes either for fear of taxation or due to the increasing attacks by environmental NGOs or the media. The few who obliged reported earning \$20 a day, while some scrap dealers mentioned netting \$50 daily but indicated that the incomes vary significantly. Some middlemen, for example, mentioned making \$80 "on a good day" but added that such earnings are really exceptional. Refurbishment appears to be a steadier income stream, recording an average earning of between \$7 and \$10.





Source: Survey Data, May 2010

Admittedly, one has to treat figures and expenditure generated from operators in the informal economy with caution due to the significant fluctuation in their fortunes and their "non-accounting" tendencies. They also tend to mix business with personal accounts. Be that as it may, view against the local economic realities, the reasons for the "supposed economic viability" and the upsurge/vibrancy in the e-business becomes apparent. For example, public servants in Ghana earn an average basic monthly salary of GH¢137.28 (\$92.6) or GH¢0.78 (\$0.52) per hour (i.e. \$4.16 a day) (GSS, 2008). Similarly farming, which employs about 60% of the population, also pays poorly attracting the lowest basic hourly earnings of GH¢0.41 (\$0.27) or \$2.16 a day (GSS, 2008).

Comparing these earnings to that of e-waste collectors (\$3.5), who are the least paid in the chain then gives some justification for the burgeoning significance of the e-business among the urban poor (see Figure 5). The situation becomes more apparent in the three northern Regions (constituting 63% of respondents) where individuals' labour is normally commandeered onto family farm lands and proceeds are normally controlled and expended by the "Father", and where they people face chronic food insecurities (FAO, 2010).





Source: Field Survey, May 2011.

In terms of the poverty head count ratio regarding purchasing power parity, in 2005 about 30% of the population lived on less than \$1.25 per day whilst 54% survived with less than \$2 a day (GSS, 2005). This coupled with the fact that about 11% of the 48% urban population in Ghana lives below the poverty line might partly explain why the e-waste chain of activities remains the second largest employment category for the 79,684 residents of Agbogbloshie after retailing (Armah, 2008, p 8). For example, the repair circuit appears disorganized, though approximately 30 repair facilities were counted during the transect walks while there was evidence of some collectors moving from scavenging into

retailing refurbished electronic products and providing other services for collectors. In particular, renting trucks and carts to the waste collectors has been a fast cash business that has blossomed, while branching into motor bike and bicycle repair by others has been profitable. Similarly, the sale of collectors' tools (e.g. hammer, chisel, spanners) has also become a crowded activity at Agbogbloshie.

The study further revealed that an influx of well-financed and better-connected middlemen from the West African region (18% of the respondents), specifically from Nigeria and Liberia, has internationalized the e-waste economy in new ways. These entrants are adding another dimension to the enterprise by pre-financing the activities of waste collectors and changing the oligarchic position of local scrap dealers. Collectors are currently extending their orbit beyond the Accra frontier, traveling farther and staying longer for the scramble for the most profitable hardware.

This internationalizing trend disadvantages local participants who appear to be losing market shares to their international well resourced compatriots, some of whom are also perceived to be vertically integrated into larger markets in Lagos, Abidjan, and Johannesburg. This newer waste frontier in Africa introduces a new source of rivalry and tension which, if not ameliorated, could trigger urban conflict.

4.3. Job Satisfaction and Viability

During the fieldwork, participants emphasized that the current e-waste economy is very lucrative, supporting many workers and their dependents. It is estimated that between 4,500 and 6000 collectors operate in Accra (Grant and Oteng-Ababio, 2010). This corroborates the findings of Prakash and Manhart (2010) who note that the e-waste recycling generates about \$100,000 to \$200,000 annually with about 30,000 people engaged in collecting, refurbishing and recycling e-waste, adding that overall, the sector sustains (including dependents) up to 200,000 people in the country. However, considerable skepticism was expressed about future prospects in the industry given the many uncertainties (e.g., the future of international shipments, local collection transport and travel costs, declining profits at the base, changing economies of scale and scope of operation for larger players). Still, there was unanimous agreement that the diversity of subsidiary enterprises that have sprung up at Agbogbloshie, thanks to the rubbish electronics, is a very positive development for the local community.

By implication, e-scrap participation not only revalued electronics and made it possible to make money in the process, but most importantly, it represents an alley to reconfigure and reassemble urban livelihoods. The estimates of income derived from the sale of items underscored the financial contribution of scavenging to the household economy. Almost all participants saw e-waste scavenging as a good venture. This was usually couched in terms of whether the 'industry' was providing them with decent livelihood in a country where the official daily minimum wage is GH¢3.11² (\$2.15).

4.4. Freedom of Association

The study reveals that the scrap dealers have led the way in institutionalizing a professional association by establishing the Greater Accra Scrap Dealers Association. Membership is open to all workers but not compulsory and vetting is not necessary. New entrants obtain association membership at a cost of GH¢ 6.00 (\$ 4.1) and are supposed to pay monthly dues of GH¢1.00(\$0.67). For the youthful, vulnerable and inexperienced workers, membership offers "temporary shelter" and solidarity, providing a bulwark of

² As at December 2010, 1 Ghanaian New Cedi (GHS) = 0.67425 US Dollar (USD)accessed on 26th Dec, 2010 http://www.oanda.com/convert/classic

sorts against intimidation, physical abuse and exploitation. In addition, the association operates a "susu scheme" (micro-finance) to which members contribute voluntarily and can borrow against their contributions (without interest) in times of need. This scheme functions much like a formal credit institution but is for informal workers in need of quick cash for covering emergencies and/or for expanding their businesses by paying in advance for e-waste consignments.

5. Counting the Cost of E-waste Management Practices

The study reviews these potential livelihood opportunities and finds that they are not without challenges. Earlier studies had highlighted the health and environmental consequences of e-waste toxicants wafting into the immediate atmosphere, leaching into soils, the lagoon and the sea nearby (BAN, 2005; Greenpeace, 2005; Brigden et al, 2008). These are corroborated by studies elsewhere which exhibit similar informal e-waste (mis)management (Keirsten and Michael, 1999; Ching-Hwa et al 2000; Schmidt, 2002; Roman & Puckett, 2002; Hicks *et al.* 2005; Widmer et al; 2005). Table 1 presents some of the known hazards associated with poor e-waste recycling reported in the literature.

e-waste component	Processes	Potential Occupational Hazard	Potential Environmental Hazard
Cathode ray tubes	Breaking, removal of copper yoke and dumping	 Silicosis Cuts from CRT glass Inhalation or contact with phosphor containing cadmium or other metals 	Lead, barium and other heavy metals leaching into ground and release of toxic phosphor
Printed circuit boards	Desoldering and removing computer chips	 Tin and lead inhalation Possible brominated dioxin, beryium, cadmium and mercury inhalation 	Air emission of the same substances

Table 1: Health hazards associated with poor e-waste management practices

Dismantled printed circuit board processing	Open burning of waste boards	Toxicity of workers and nearby residents from tin, lead, brominated dioxin, beryllium, cadmium and mercury inhalation	Tin and lead contamination of immediate environment, including surface and ground waters, brominated toxins, beryllium, cadmium and mercury inhalation
Chips and other gold plated compounds	Chemical stripping using nitric and hydrochloric acid along river banks	 Acid contact with eyes, skin may result in permanent injury Inhalation if mists and fumes of acids, chlorine and sulfur dioxide gases can cause respiratory irritation to severe effects, including pulmonary edema, circulatory failure and death 	 Hydrocarbons, heavy metals, brominated substances etc. discharged directly into river and banks. Acidifies the river destroying fish and flora
Plastics from the computer and peripherals	Shredding and low- temperature melting	Probably hydrocarbon, brominatd dioxin and PAH exposure to workers living in the burning works area	Emission of brominated dioxins and heavy metals and hydrocarbons
Secondary steel or copper and precious metal smelting	Furnace recovers steel or copper from waste	Exposure to dioxins and heavy metals	Emission of dioxins and heavy metals
Wires	Open burning to recover copper	Brominated and chlorinated dioxin and PAH exposure to workers living in the burning area	Hydrocarbon and ashes, including PAHS discharged into air, water and soil

Source: Pinto, 2008.

During the study, most participants admitted that the current practices have some negative impact on their health and the environment, albeit to different degrees and in varying dimensions. The most perceived impact revolved around the horrendous pollution through the emission of smoke and incessant noise, which recorded the highest of 87% of respondents. This was not surprising because as already alluded to, most youth engage in the burning of plastic wires to liberate copper. A comment by an opinion leader who is also a merchant of e-waste by-products is a reflection of the general sentiments expressed:

"The burning of electronic cables and other electrical components in order to melt off the plastic and reclaim the copper wires may affect our health; I am not very sure. However, I am very certain that it negatively affects the environment as toxic chemicals are constantly released into the atmosphere."

Some shop owners, who are at a distance from the burning sites however see the open burning of cables on hitherto derelict swampy and waterlogged land as an activity that can help control mosquito breeding which has been the bane of most residents. In the main, participants were divided on whether that was enough justification for the continuation of the current practice. Those who did not see anything wrong with the practice contrasted it with the indiscriminate open dumping of domestic waste and "freefor-all" defecating in the area which they see as more polluting and environmentally disastrous. On the specific hazards confronting participants, they gave a plethora of daily hazards they suffer. Figure 6 presents respondents' self-identified health related problems.





Judged against the health hazard outlined in Table 1, respondents seem to oversimplify the health problems, possibly due to their limited medical knowledge. Thus 42% of respondents alluded to coughing. Be that as it may, there were obvious variations in claims

Source: Field Survey, May 2010

by respondents from the different work categories. For example, the collectors involved in the recycling and metal recovery process pointed to accident-induced health impacts like burns, cuts, and other body injuries as their major health concerns. Those whose activities involved rigorous hours of pulling of handcarts (made of wawa boards and old car axles) in transporting EEE from different parts of the city to the scrap yard complained of body and back pains which can be attributed to the lifting and transporting of heavy appliances.

The refurbishers, who use simple tools to replace defective parts, also complain of respiratory problems (catarrh) which they attribute to the inhalation of fumes from soldering activities. It must be added that this display of uncertainty or ignorance is not unique to the workers at the Agbogbloshie site, as studies which identified positive relationships between crude e-waste management and health implications also established participants' gross ignorance (Bush et al., 2001). A medical health officer with the Ghana Health Service, who was contacted during the study, reiterated the negative health impact of the practice. She opined;

"Mobile phones, old pen drives, outdated TVs, refrigerators, music systems - name any electronic devices and you will find that the hazardous substances they contain find their way back in your system. Ghana may also face rising environmental damage and health problems from the e-waste sector. Worse still, most of these workers are kids and women who are exposed to deadly toxins".

Explaining the assertion, she intimated that:

"Lead widely used in lead-acid batteries, cable sheathing, the glass of CRTs, printed circuit boards, can cause diarrhea, coma and appetite loss in the short term. Long term exposure can affect the kidneys, damage nerves and cause blood and brain and liver damage".

Discussions with some participants and executives of the association revealed that the workers might be wholly ignorant or uncertain about the health risk. However, for economic reasons, they appear challenged to choose between "poverty and poison"; a choice of working in such an informal environment and being exposed to the hazards but making a living, or remaining unemployed and poor. All participants display very limited ambiguity about this dilemma but take solace in the economic gain.

6. E-waste (mis)management at Agbogbloshie- an Unjustifiable Risk?

In the main, the study shows that, the absence of a formal recycling infrastructure has enabled and increased the capacity of unemployed youth to take the lead in e-waste scavenging as a source of livelihood in a turbulent urban economy. The sector relies on low technology and low investments without government oversight and sometimes works under some health- and environmentally-threatening conditions. This tends to put the industry under suspicion of directly generating unjustifiable risks for society. Yet, the industry undoubtedly provides work and livelihood for thousands of the unemployed youth in particular and incorporates them into an urban economy that provides few alternative work opportunities. This underscores the interlocking and overlapping chain of the e-waste enterprise rather than the end-point of a linear chain of production, consumption and disposal (e.g. BAN, 2005; Brigden et al, 2008; Frontline, 2009; Afrol News, 2010).

The findings suggest some important implications for conceptualizing the end-of-life management of waste electronics in general. First, it adds credence to the argument that the processing of e-waste occurs at sites (both domestically and abroad) where significant rounds of human labour engage in sorting material into domains of waste and value (Cetina and Bruegger 2002; Lepawsky and McNabb, 2010) that differ significantly from those domains as they are defined and practiced at the sites of initial disposal. It also goes beyond the dominant storyline of most ENGOs (see Greenpeace, 2005) that informal e-waste activities put people and places at high risk of economic insecurity and toxic contamination. Indeed, the findings complicate but do not contradict the position of ENGOs and those of the media which tend to highlight the health and environmental impact of waste electronics on poor countries of Africa and Asia. The findings also show that e-waste materials and their effects move and persist in ways that belie models of e-waste flows that conceptualize a linear chain of production-consumption-disposal. Such a linear model suggests a 'final resting place' (Clapp, 2002), yet waste rarely, if ever, settles in one place. It flows elsewhere, it returns, not only as toxicity, but also as feedstock of new rounds of commodity production.

These findings amplify the need for caution in ordering actual human engagement with rubbish electronics into dichotomies like 'positives' or 'negatives' if man is not to become a victim of his own global information communication technology which seems inevitable for socio-economic development and sustainability. This creates a dilemma regarding the need for EEE to develop and the need to sustainably manage its end-of-life. Such findings do not, however, support a counsel of despair. Rather, the analysis raises a cautionary signal, suggests a variety of guidelines, and supports a broad-based framework for examining waste electronics. This is particularly important because, the existence of trade and traffic networks for e-waste means that by definition, some form(s) of value exist or are created after disposal takes place (Lepawsky and McNabb, 2010).

Even as waste, the harmful health and environmental effects of e-waste processing are neither evenly distributed nor remain contained in a single locale, as earlier presentations tend to suggest (Brigden et al, 2008; BAN, 2005; Frontline, 2009; Afrol News, 2010). Moreover, the materials disposed of as e-waste in one place not only provide sources of employment and livelihood for thousands of the urban poor, especially the youth, but more importantly, become sources of value elsewhere when they are reused, repurposed and/or broken down as feed-stock of primary inputs to subsequent rounds of the production of new commodities, not all or even most of which may be in the electronics sector.

In this regard, the waste electronics saga should necessarily be conceptualized as a series of open-ended and contingent processes and practices of "wasting and valuing that rely on geographic difference and mobility for the exchanges between the domains of waste and value to occur" (Lepawsky and McNabb, 2010). In short, to the extent that waste electronics provide livelihood to thousands of the unemployed youth, based on geographical knowledge and technology, the present analysis is a good news story. The bad news is that most parts of the world, especially the less developed countries, seem already inundated as never before with the supposed ills of the waste electronics, and this situation has an overarching influence on national policies and frameworks, thus reducing such nations' inherent economic potential for poverty reduction and national development.

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