

Benedicta Ideho Omokaro

Moving Forward Sustainably  
Material and Social Conditions of  
Electronic Waste Management in Nigeria



Benedicta Ideho Omokaro

## Moving Forward Sustainably

### Material and Social Conditions of Electronic Waste Management in Nigeria

Esitetään Jyväskylän yliopiston humanistis-yhteiskuntatieteellisen tiedekunnan suostumuksella  
julkisesti tarkastettavaksi yliopiston päärakennuksen salissa C4  
maaliskuun 24. päivänä 2018 kello 12.

Academic dissertation to be publicly discussed, by permission of  
the Faculty of Humanities and Social Sciences of the University of Jyväskylä,  
in the Main building, hall C4, on March 24, 2018 at 12 o'clock noon.



UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 2018

# Moving Forward Sustainably

Material and Social Conditions of  
Electronic Waste Management in Nigeria

JYVÄSKYLÄ STUDIES IN EDUCATION, PSYCHOLOGY AND SOCIAL RESEARCH 608

Benedicta Ideho Omokaro

# Moving Forward Sustainably

Material and Social Conditions of  
Electronic Waste Management in Nigeria



UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 2018

Editors

Olli-Pekka Moisio

Department of Social Sciences and Philosophy, University of Jyväskylä

Pekka Olsbo, Ville Korhonen

Publishing Unit, University Library of Jyväskylä

Permanent link to this publication: <http://urn.fi/URN:ISBN:978-951-39-7354-4>

URN:ISBN:978-951-39-7354-4

ISBN 978-951-39-7354-4 (PDF)

ISBN 978-951-39-7353-7 (nid.)

ISSN 0075-4625

Copyright © 2018, by University of Jyväskylä

Jyväskylä University Printing House, Jyväskylä 2018

## ABSTRACT

Omokaro, Benedicta Ideho

Moving Forward Sustainably: Material and Social Conditions of Electronic Waste Management in Nigeria

Jyväskylä: University of Jyväskylä, 2018, 73 p.

(Jyväskylä Studies in Education, Psychology and Social Research

ISSN 0075-4625; 608)

ISBN 978-951-39-7353-7 (nid.)

ISBN 978-951-39-7354-4 (PDF)

This dissertation focuses on understanding the social material interaction between e-waste and e-scrapppers for sustainable management of e-waste. Previous studies mainly concentrate on the detrimental environmental impact of e-scrapppers activities, the economic and political influences of e-waste on the e-scrapppers, the material flow of e-waste and the exportation of valuable e-waste extracts from highly industrialized countries to less industrialized countries. The aim of the dissertation is therefore to extend the scope of the previous studies by investigating the social material interaction between e-scrapppers and e-waste. To achieve this aim, this study examines the following research questions: 1) How has e-waste gained recognition and remained relevant in both government and private spheres? 2) Through what material and social mechanisms has e-scrapppers thrived despite the negative environmental perception of their activities? Environmental perception, as used in this dissertation, indicates the perceived impacts of the activities of e-scrapppers on their environment. Qualitative data sets attained via ethnographic video method from 29 e-scrapppers from two states in Nigeria are analyzed and used to meet the main objective of this dissertation. This dissertation consists of a summary and results presented in four separate articles. The results reveal that far from the notion that e-scrappping is carried out by illiterate, poor marginalized groups, e-scrapppers in Nigeria possess a certain level of formal institutional education and professionalism that becomes evident during the e-scrappping process. Additionally, the informal learning and organization achieved via models such as the apprenticeship system provide social recognition among members of society and relevant government institutions. It therefore implies that Nigerian e-scrapppers possess a level of intellectual engagement that could be recognized and actively utilized by local environmental agencies and other government institutions. The main policy implication of this dissertation is that in order to move forward sustainably in the management of e-waste in Nigeria, organized activities of e-scrapppers ought to be seen as formal activities. As such, standardization of proper basic infrastructure that limits negative environmental pollution and promotes acquired recycling skills should be engrained in environmental policies and provided for the e-scrapppers.

Keywords: e-scrapppers, e-waste, Nigeria, e-waste management, informal recycling.

<b>Author's address</b>	Benedicta Ideho Omokaro Department of Social Science and Philosophy Faculty of Humanities and Social Sciences University of Jyväskylä benedicta.ideho@jyu.fi
<b>Supervisors</b>	Dr. Sakari Taipale Department of Social Science and Philosophy Faculty of Humanities and Social Sciences University of Jyväskylä  Prof. Marja Järvelä Department of Social Science and Philosophy Faculty of Humanities and Social Sciences University of Jyväskylä
<b>Reviewers</b>	Dr. Marja Vehviläinen University of Tampere  Dr. Sarah A. Moore University of Wisconsin - Madison
<b>Opponent</b>	Dr. Jennie Olofsson Senior Lecturer University of Ljubljana Mid Sweden University

## ACKNOWLEDGEMENTS

*Limitations are abstract boundaries enhanced by our imaginations and immediate environment.*

These words rang constantly in my head as I embarked on this interesting journey of studying Nigerian e-scrapers in e-waste management. In the field, I encountered individuals, who despite the environmental, political and social challenges they encountered, rose above their limitations. Through their recycling activities, they have forced us to acknowledge the materiality of e-waste and our disposal habits. For this and many more reasons, I acknowledge the e-scrapers who shared their knowledge with me and granted me permission to tell their stories in a different light and bring a different insight into the world of e-waste management.

Discussing the activities of the Nigerian e-scrapers in the academic sphere required the expert supervision of my wonderful supervisors Dr. Sakari Taipale and Professor Marja Järvelä. Thanks for being the best supervisors and mentors I could have asked for. In more ways than one, you have made me a better academic writer and researcher. I appreciate you both beyond words. As it is often said in a Nigerian adage, it takes a village to accomplish a task worthy of praise. This doctoral journey has been greatly impacted by some spectacular persons. To mention only a few will be doing a disservice to others. Therefore, I say thanks to all my friends and colleagues, you know who you are. Specifically, thanks for listening to my ramblings about e-waste; for smiling even when it becomes boring and for encouraging me to put my ideas in ink.

To my family, you know how much you mean to me. Thank you for being a continuous pillar of support. To my husband, you are continuously a source of love and inspiration. Thanks for bringing out the best in me. Above all, my praise and gratitude to Jehovah the Almighty God. The giver of life and source of my strength. Through this journey, You have graced my footsteps and favoured me and my household immensely. Thank you.

Jyväskylä 31.01.2018  
Benedicta Ideho Omokaro



## LIST OF ORIGINAL PAPERS

1. Omokaro, Ideho, B. 2017. The Issuefication and Assemblage of Things in E-waste Management: A Methodological Approach. Submitted for publication and under review at the Journal of Sociological Forum
2. Omokaro Ideho, B. 2016. Building Capabilities among E-scrapppers in Informal Electronic Waste Management: The case of the Nigerian E-scrapppers.  
*Environmental Sociology Journal*, 2325-1042.  
<http://www.tandfonline.com/doi/full/10.1080/23251042.2016.1155791>  
doi:10.1080/23251042.2016.1155791
3. Omokaro I. B. & Taipale S. 2017. Into the World of E-Waste: Mobility among E-Scrapppers in Nigeria.  
*Journal of Applied Mobilities*,  
<http://www.tandfonline.com/doi/full/10.1080/23800127.2017.1329974>  
doi:10.1080/23800127.2017.1329974
4. Omokaro, Ideho, B. 2017. Revisiting Informal Recyclers: Understanding the Organizational and Operational Paradigm of Nigerian E-scrapppers. Submitted for publication and under review at Journal of Current Sociology

## FIGURES

Figure 1	Wilson’s four categories of informal recycling (Source: Wilson, 2001).....	21
Figure 2	Interplay of assemblage of things and issuefication of things. (Source: Omokaro 2017).....	25
Figure 3	Distribution of interviews by location (Source: Omokaro) .....	42
Figure 4	Coding footage in MAXQDA (Source: Omokaro).....	44
Figure 5	Snapshot of overall dissertation (Source: Omokaro).....	47
Figure 6	Social network of e-scrapppers in Nigeria (Source: Omokaro, 2016).....	50
Figure 7	Systematic extraction of motherboard from a DVD device (Source: Omokaro).....	51
Figure 8	Smashing extraction process (Source: Omokaro).....	51
Figure 9	A network model showing the organizational structure of e-scrapppers in Nigeria (Omokaro, 2017).....	54
Figure 10	Proposed operational framework (Omokaro, 2017) .....	56

## TABLES

Table 1	Data collection and analysis.....	39
---------	-----------------------------------	----

## CONTENTS

ABSTRACT

ACKNOWLEDGEMENTS

LIST OF ORIGINAL PAPERS

FIGURES AND TABLES

CONTENTS

LIST OF ACRONYMS

1	INTRODUCTION .....	13
1.1	The electronic industry and e-waste .....	14
1.2	Two sectors, one goal: formal and informal recycling .....	16
1.3	State of the informal recycling sector.....	18
1.4	Categorizing informal recyclers: the concept of e-scrappers in e-waste management.....	19
1.5	Purpose of the study.....	22
2	THEORETICAL FOUNDATIONS.....	23
2.1	New materialism theory: recognizing the liveliness of e-waste through the assemblage of things and issuefication of things .....	24
2.2	Capability approach .....	26
3	E-WASTE IN NIGERIA.....	30
3.1	International policies governing management of e-waste in Nigeria .....	31
3.2	Nigerian laws on e-waste management .....	33
4	DATA AND METHODS .....	37
4.1	Data collection.....	37
4.2	Ethical considerations .....	41
4.3	Research material.....	42
4.4	Methods of analysis.....	43
5	ARTICLE CONTRIBUTIONS.....	46
5.1	Article I: The issuefication and assemblage of things in e-waste management: a methodological approach.....	48
5.2	Article II: Building capabilities among e-scrappers in informal electronic waste management: the case of the Nigerian e- scrappers. ....	49
5.3	Article III: Into the world of e-waste: mobility among e-scrappers in Nigeria. ....	52
5.4	Article IV: Revisiting informal recyclers: understanding the organizational and operational paradigm of Nigerian e-scrappers.....	53

6	DISCUSSION AND CONCLUSIONS.....	57
6.1	Applicability and policy implications .....	59
6.2	Recommendation for further studies.....	60
	REFERENCES.....	62
	APPENDIX 1 .....	72
	ORIGINAL PAPERS	

## LIST OF ACRONYMS

AUC	African Union Commission
BAN	Basel Action Network
CMR	Cargo Movement Requirement
CPU	Central Processing Unit
EPR	Extended Producer's Responsibility
ESM	Environmentally Sound Management
IMPEL-TFS	The European Union Network for the Implementation and Enforcement of Environmental Law- Transfrontier Shipment of Waste
INECE	International Network for Environmental Compliance and Enforcement
INTERPOL	The International Criminal Police Organization
NCS	Nigeria Customs Service
NESREA	National Environmental Standards and Regulations Enforcement Agency
UEEE	Electrical and Electronic Equipment
USEPA	United States Environmental Protection Agency
WEEE	Waste Electrical and Electronic Equipment
SESN	Seaport Environmental Security Network

# 1 INTRODUCTION

Since the beginning of time, humans have been inventors, utilizing material elements within the environment to solve immediate and future problems: the invention of the wheel (Chaves, Engerman & Robinson, 2014), which propelled canyons into battle grounds, and the compass (William, 2007), which facilitated fairly accurate navigation on land and sea. Automobiles (Michael, 2001), steam engines (Davids, 2012), petrol (Kettering, 1947; Loeb, 1995), railways (King, 2010) and airplanes (de Barros, 2006; BBC News, 1999) revolutionized the travel industry. The telephone (Georg-August-Universität Göttingen, ND; Evenson, 2000) and the mobile phone (American Mensa, 2004) brought communication to our fingertips. The World Wide Web (McPherson, 2009), also known as the Internet, transformed how we communicate, how we live our daily lives. Even now, the Internet is also playing a significant role in technological advancements of the electronic industry. These inventions have been developed with earth's finite natural resources (Leonard & Conrad, 2010), a significant amount of which was devoted to these creations. Inventions like the wheel and steam engine, were chunky and bold. Finesse and design appeal was usually not a focal point. The sole concern was to solve a need and as a result, priority was placed on the functionality of these inventions. However, proper handling of the resultant waste was an afterthought (Zimring & Rathje, 2012). For example, the invention of leaded petrol was considered a novel creation until the resultant emission of lead into the atmosphere caused dangerous health hazards and an outcry from environmental activists and concerned persons resulted in environmental regulations targeted at eliminating the use of lead in petrol (Kettering, 1947; Loeb, 1995). This example is similar to the electronic industry where the use of lead has also been phased out (EU-Directive, 2011).

Waste has always been an essential part of society. It is a form of disclosure, revealing the manifestation of human presence, humans' political, economic, cultural and social activities and technological evolution (Zimring & Rathje, 2012). Importantly, waste exposes our perception of value placed on material objects - what is regarded as waste and what is not and our processes of dealing with waste. But at what point do we perceive *matter* as waste that

should be handled in a particular way? At what point does our perception of waste change? Douglas (2001) explored this question in her book 'Purity and Danger'. According to Douglas (2001, p. 2) "dirt offends order. Eliminating it is not a negative movement, but a positive effort to organize the environment." In this sense, waste is seen as a disorderliness; a deviation from the orderly environment and therefore needs to be dealt with.

There is a certain fascination with waste among environmental activists and academic scholars. It not only reveals the cultural, social, political and economic realities of a people, it also uncovers the creative and resourceful ability of humans and our freedom to decide what is valuable and what is not. The ability to recognize value in waste such that it is perceived as a resource for innovation shows the resourcefulness of people, for instance, creating a parking canopy out of used water bottles and constructing a beautiful mosaic out of bottle caps left by hurricane Sandy (Skirmanté 2015). Importantly, waste is capable of bestowing and defining certain social attributes on a particular group of people. This attribute of waste and the exemplification in the electronic industry is the inspiration for this dissertation. Specifically, the aim of this study is to investigate the social material interaction between e-scrapers and e-waste. Data gathered from Lagos and Edo states in Nigeria is used to examine this aim. The results are presented in section five.

## 1.1 The electronic industry and e-waste

Since the birth of the Internet, the electronic industry has experienced a significant growth in production of sophisticated devices (Woolard, Loerop, & Micheal, 2003). These devices are, however, designed to have a short life span and are often difficult to repair. Where repair is unavoidable, the availability of spare parts to fix them is inadequate when a failure occurs. This strategy is referred to as planned obsolescence (Bulow, 1986). Planned obsolescence is the practice of designing products with intentional, limited lifespan, which coerces consumers into early repurchases. In conjunction with planned obsolescence, the electronic industry also employs the strategy of perceived obsolescence (Saiz-Álvarez, 2016). It involves convincing consumers to replace a device even when the existing device is still fully functional. Perceived obsolescence and planned obsolescence have been driving forces in increasing the volume of electronic waste (Model & Model, 2010; Pope, 2017; Mahoney & Tang, 2017).

Electronic waste, hereto referred to as e-waste, constitute more than 2% of the global municipal waste of 1,636 million tonnes per year (Mallawarachchi & Karunasena, 2012) with a possible increase of 5% every year (Agamuthu, Kasapo & Nordin, 2015). In a study published by Robinson in 2009, it was estimated that a billion computer devices will be disposed of by 2014 (Robinson, 2009). In another study (Chi et. al., 2010), it was noticed that more than 60% of upgraded devices were still fully functional in 2012. The reason for this replacement is due to technology change, such as the switch from analogue to

digital devices (CRT TVs to LED TVs). This portrays the planned obsolescence and perceived obsolescence of the industry. With the production of newer and more sophisticated technology, older technologies get redundant and introduced into the waste stream.

Unlike other forms of solid waste, e-waste, one of the fastest growing waste in the world, houses more than 50 distinct metals including precious materials such as gold, copper, silver, aluminum and palladium (Baldé, Wang, Kuehr & Huisman, 2015; Puckett, Adesanya, Davis & Saidu, 2005). For instance, in mobile devices, copper, ceramics, glass and copper constitute approximately 15% of waste, while plastics represent 40% of the material makeup (Ylä-Mella et al., 2007). In 2014, the value of metals and other materials within e-waste was estimated to be around 48 billion Euros. 40% of this value is attributed to printed circuit boards which are considered the most valuable parts found in most electronic devices (Baldé, Wang, Kuehr & Huisman, 2015).

The world possesses limited natural resources such as the gold and silver used in the production of electronic products, yet the electronic industry is estimated to consume about 7500 tonnes of silver and 320 tonnes of gold each year (Golev & Corder, 2017). These resources deplete as we produce and consume each year. Manufacturers are becoming aware of this and as a consequence, the strategy of urban mining is employed to extract valuable materials from e-waste. Urban mining involves the manual extraction of valuable materials from e-waste (Cossu, Salieri & Bisinella, 2012; Nakamura & Halada, 2014). However, e-waste also houses very toxic materials, including cadmium, mercury, lead and beryllium. Studies have shown that long term exposure to certain materials results in specific illnesses; for example, exposure to mercury through inhalation or ingestion can adversely affect the kidney and central nervous system (Bhat & Patil, 2014). Constant exposure to lead results in brain damage, blood disorders and poor fetal development (Perkins, Drisse, Nxele & Sly, 2014), and contact with cadmium over a period of time results in damage to kidney and bone density (Puckett, Adesanya, Davis & Saidu, 2005). Studies carried out by Ongondo, Williams and Cherrett (2011) and Chi, Streicher-Porte, Wang and Reuter (2010) also show that these materials have very detrimental effects on animals and the entire environment. With so much resource encased in electronic devices and technological advancements in waste management, it can be assumed that the recycling industry would be able to effectively harvest these valuable materials back from e-waste. But as has been shown in previous studies (see Baldé, Wang, Kuehr & Huisman, 2015; Holmes, 2009), recycling has been very challenging.

E-waste is a challenging waste to manage. The production of electronic devices is complex and many valuable materials are embedded in the devices. Consequently, electronic devices vary in components and their manufacturing processes (Landers, Browne, Fant & Malstrom, 1994; Edwards, 2013). Also, the sophisticated combinations of hardware and software entail questions of privacy and security. For consumers, privacy and security issues are becoming paramount concerns and this has become a selling point for producers of electronic



devices, especially mobile phones. In e-waste management, these concerns are heightened because e-waste can be used as spare parts. Also, with the right software and knowledge, it is possible to retrieve data from certain e-waste devices even when considered non-functional. This indicates that data from spare parts obtained from e-waste can still be accessed, and in the wrong hands, this data can be dangerous. Therefore, the need to protect consumers' information has led to more complex manufacturing processes and the introduction of new technologies for electronic devices. For instance, manufacturers like Apple have progressively been producing electronic products in compact forms. This compactness is first aimed at discouraging easy repair and the introduction of counterfeit parts that may compromise the security and privacy functionalities of the electronic device. The second aim of compactness is to create unobtrusive functionality for consumers such that the electronic devices blend in seamlessly with the daily activities of the consumer. Unobtrusiveness in this sense means that consumers are increasingly unaware of the inner workings of an electronic device. More focus is placed on the user interface so that it fits in seamlessly into an individual's daily activities (Emerson, 2014). Therefore, more than recycling possibilities, user experience and intuitive functionality are paramount in product design.

Due to the competitive nature of the consumer market, manufacturers try to out-compete each other, pushing the boundaries of unobtrusiveness and deriving new ways to compartmentalize the hardware to suit the software such that it becomes more and more challenging to recycle without specialized knowledge and/or tools. An example of a specialized tool for recycling is Apple's Liam (Rujanavech et al., 2016), a specialized robot designed to systematically take apart the iPhone for reuse in the production of new electronic devices. Hence at the end of life (Step Initiative, 2014), e-waste poses a challenge in recycling (Hieronymi, Kahhat & Williams, 2013) and this recycling challenge couple with growing emphasis on stricter environmental laws on improper disposal of e-waste (BAN, 2011; EU Directive, 2012), has given rise to formal and informal recycling sectors.

## **1.2 Two sectors, one goal: formal and informal recycling**

Although it may not seem obvious from previous studies (Kahhat, Hieronymi & Williams, 2013), both the formal sector and the informal sector's activities share a goal; that is to manage e-waste in an efficient, profitable manner while preventing it from entering the main waste stream and into landfills.

The formal recycling sector is usually found in industrialized countries such as Finland, the United States, the United Kingdom, Germany and Sweden, who possess and implement stricter environmental laws and regulations (Ceballos & Dong, 2016). The formal sector is characterized by standardized, highly regulated operations, in which recycling is carried out in controlled environments where protective gear is utilized and sophisticated equipment and pro-

cesses are employed in extracting valuable materials from e-waste (Hieronymi, Kahhat & Williams, 2013). On the other hand, the informal recycling sector, which is the focus of this dissertation, is found in countries such as China, Pakistan, India, Nigeria and Ghana where less strident environmental laws and regulations exist. This informal sector is marked by the use of basic extraction tools such as screwdrivers, mallets, hammers, open burning and chemical leaching, the use of which are generally assumed to be less regulated and less standardized than in the formal recycling sector in highly industrialized countries. As revealed in the articles included in this dissertation (Omokaro Ideho, 2016; 2017) and validated by other studies (Puckett, Adesanya, Davis & Saidu, 2005; Puckett et. al., 2002), informal recycling is carried out in open, uncontrolled environments.

Literature review shows a link between the formal and informal recycling sector. The link is found in the flow of e-waste and export of valuable e-waste extracts between the formal recyclers and the informal recyclers. Loopholes in environmental regulations, ambiguous definitions of what constitutes e-waste, rapid production of devices in the electronic industry and the increase in consumption across the world has positioned the formal recycling sector as one of the major providers of e-waste to the informal recycling sector (Puckett, Adesanya, Davis & Saidu, 2005; Puckett et. al., 2002). Consumers who want to carry out their civic duty of properly recycling electronics, take them to designated formal recycling centers or collection points. However, by trying to circumvent environmental regulations and increase profits, some formal recycling centers export the e-waste to the informal recycling sector in less industrialized countries (Baldé, Wang, Kuehr & Huisman, 2015; Ibid). Transboundary movement of e-waste is carried out under the disguise of second-hand electronics or as charity donations to countries where informal recycling flourish (Puckett, Adesanya, Davis & Saidu, 2005). Thus, previous studies (Balde et. al., 2015) have suggested that the informal recycling sector manages half the world's e-waste.

Despite this flow of e-waste between formal recyclers and informal recyclers, it is important to point out that recent studies (Chi, Streicher-Porte, Wang & Reuter, 2010) have also shown that there is a steady increase in locally generated e-waste among less industrialized counties where informal recycling operates. This increase in electronic consumption is attributed to increase in income among the middle class and rapid digitization of good and services (Borthakura & Govindb, 2016). In Nigeria, electronic consumption is motivated by convenience of use, and social and economic benefits. Also, the growth of the Internet and its adaptation to services such as mobile banking has encouraged the increased use of mobile phones. Moreover, the switch has led to the displacement of analogue phones and to the increase in consumption of smart phones. Besides the use for banking services, Nigerians also rely on mobile phones for access to information, social material interaction, entertainment, business transactions and networking. However, the implication of this increase in mobile consumption is that unused analogue phones are either stored by consumers in

their homes, given away as charity donations, abandoned and/or sold to electronic repairers, or worse, disposed in the main waste stream. The presence of the informal recycling sector thus provides the channel through which e-waste finds new purpose and meaning.

### 1.3 State of the informal recycling sector

Over the years, the negative and positive activities of the informal recycling sector have been the focus of many studies. Particular attention has been on the business aspects of e-waste recycling (Joe, 2012), international laws and regulatory bodies involved in e-waste management (Terazono & Yoshida, 2013), the chemical compound and valuable materials found in e-waste (Goosey, 2009) and the detrimental environmental activities of the informal recycling sector (Puckett et. al., 2002). Some of these studies (Puckett, Adesanya, Davis & Saidu, 2005) have approached the informal recycling sector as a sector that produces lots of negative environmental effects and therefore should be discouraged and phased out.

Thus, attempts have been made by countries such as China and Nigeria to abolish the informal recycling sector and establish formal recycling. However, these attempts have not been very successful because first, the consumption habits, economic, social, political and cultural context of the countries preserve the practice of informal recycling. According to Standaert (2015), China suspended informal recycling activities in a major informal recycling hub called Guiyu, while establishing formal recycling centers in a centralized industrial park where emissions from burning e-waste were controlled by smokestacks provided by the environmental protection agencies. Although this move was successful in cleaning up the deteriorated Guiyu environment, it created new destinations for informal recycling activities. Some of the informal recyclers either relocated their activities to their homes and immediate environment or moved to the industrial park. Others continued their activities around the Guiyu area.

There are many reasons why informal recyclers continue to survive and the development of formal recycling faces obstacles. In Nigeria, waste sorting at source is not ingrained in the culture, hence e-waste is often mixed with other waste. Additionally, electronic devices are often used as spare parts to repair other electronic devices, passed down to others for further use or taken to repair shops where, regardless of the cheap cost of repair, they are often abandoned if the device cannot be repaired with available spare parts. This consumption pattern and low incentive to engage in take-back programmes or sort e-waste at collection points makes it challenging for any established formal recycling center. Additionally, the transboundary movement of e-waste as second hand goods or charity donations and the disposal behavior of consumers ensures a steady supply and also, the formal recycling sector faces the challenge of specific volume recycling. Specific volume recycling means that machineries

used in formal recycling of e-waste function efficiently when the machines are fed a certain volume of e-waste (Kahhat, Hieronymi & Williams, 2013). This is therefore an operational constraint occasioned by the technology and processes employed for extracting valuable materials from e-waste. This constraint is absent in the informal recycling sector because only very basic tools are employed and e-waste is recycled in small quantities.

While it is evident that activities of informal recyclers are dangerous to the environment, it is also evident that inevitably, they play an important role in preventing e-waste from entering the main waste stream where they end up in landfills or incinerators. Thus, the mechanisms such as basic extraction tools and low barriers to entry into the informal recycling sector, by which informal recyclers remain relevant despite the environmentally unfriendly practices in e-waste management, has also received significant scholarly attention (Fei, Qu, Wen, Xue & Zhang, 2016; Kumar, Holuszko & Croce Romano Espinosa, 2017). However, the social material interaction between e-waste and the informal recyclers, specifically e-scrapers, and the underlying mechanisms that have retained their relevance for overall e-waste management have not received as much attention among these studies. By social material interaction, this study refers to the connections and exchanges between e-waste, informal recyclers, local environmental agencies, government institutions and their cultural contexts (Lejano & Stokols, 2013) that constitute the host environment of e-waste management.

#### **1.4 Categorizing informal recyclers: the concept of e-scrapers in e-waste management**

Among various studies (Baldé, Wang, Kuehr & Huisman, 2015; Chi, Streicher-Porte, Wang, & Reuter, 2010; Herat & Agamuthu, 2012), informal recyclers have been broadly perceived as individuals who engage in recycling activities – usually in dumpsites utilizing very basic tools. The recycling activities include scavenging for metal scraps, clothing, all forms of paper waste, plastics and e-waste, the sorting of these items and their resale to interested buyers such as manufacturers. The concept of informal recycling gained awareness from studies embedded within the context of the term ‘developing countries’ or as commonly used, ‘Third World countries’ (Hart, 1970). At the academic and institutional levels, these terms have raised concern and therefore there is no standardized definition (Khokhar & Serajuddin, 2015; Waugh, 2000). Recently, the World Bank reviewed the use of these terms in its reports and presented the data in terms of income rather than the categorizations of ‘developing’ or ‘developed’ (Fantom & Serajuddin, 2016). However, in this dissertation, the term ‘less industrialized’ will be used to refer to countries where informal recycling of e-waste thrives and ‘highly industrialized’ for countries where formal recycling of e-waste is prevalent. These terms best suit this dissertation because they

focus on the social and economic mechanisms through which countries are transformed (Bożyk, 2006).

Although there is no standard definition for the use of the term 'informal recycling', there is general consensus among scholars that the informal recycling sector is defined by the lack of regulation, process standardization, institutionalization and structure, by illegality and non-registration and that the sector falls outside the mechanisms of official governance (Guha-Khasnobis, Kanbur & Ostrom, 2006; Briassoulis, 1999). A prevalent notion is that informal recycling is performed by poor, illiterate and marginalized social groups who resort to waste picking and scavenging for survival and financial sustenance (Wilson et al., 2006). Additionally, informal recycling activities are said to be born out of the structural defects of formal political, socioeconomic and institutional organization that encourage the formation and growth of the informal recycling sector (Briassoulis, 1999).

According to Schneider and Enste (2003), informal recyclers can be categorized into two broad groups: those who engage in self-sufficient legal economic activities and those who engage in illegal activities or what is known as the shadow economy. It is important to note that this categorization has no strict boundaries, as individuals tend to cross between the two groups. The focus of this study is on the first group: those who engage in self-sufficient legal economic activities. This group was chosen for this study because first, their activities are more accessible for data gathering purposes and second, the security risks involved in interviewing this group are less than those of interviewing recyclers working the shadow economy. The shadow economy is further subdivided into informal recyclers who operate illegally but produce legal goods and services and those who operate illegally and produce illegal outputs such as counterfeit goods. Further studies, such as Gerxhani (2004), outline that among the characteristics of the informal recycling economy, the economic features that include income tax evasion, societal perception of e-scrapers' activities, registration and regulation evasion and size of the business, are aspects of the informal recycling sector often focused on.

The informal recycling sector includes individuals who scavenge for plastics, paper, e-waste, food and metal scraps at dumpsites, obtained from private consumers, businesses or organizations and government institutions. Studies carried out on the management of e-waste reflect this broad categorization of the informal recycling sector, thereby reflecting a perceived assumption that all informal recyclers are active in e-waste management (see Agamuthu, Kasapo & Nordin, 2015; Hieronymi, Kahhat & Williams, 2013). However, this is not entirely the case as the actors and their specific activities in the informal recycling sector vary from country to country. Wilson et. al., (2001) show this subdivision among informal recyclers in nine different countries in Figure 1, specifying the local names attributed to four professions.

Profession	India	China	Brazil	Colombia/Peru/Chile	Morocco, Senegal	South Africa
Waste pickers from dumps	Scavengers	Shi huang zhe/jian pol an/Jian la ji	Catador/Gandaieiro	Recicadores - /Recuperadores-/ Segregadores Informales de Materiales Reciclables (RIMR)	Recuperateurs	Informal reclaimers/waste pickers
Street waste pickers	Rag pickers	Shi huang zhe/Jian pol an/Jian la ji	Catadores da rua, Catadores de materiais recicláveis (itinerant)	Recicladores/recuperadores/segregadores formales	-	Street collectors/informal collectors/waste pickers
Itinerant or stationary waste buyers	Kabadiwallas	Fei pin hui shou zhe/Shou fei pin/Shou po lan	Sucateiro/ferro-velho (both stationary)	Cooperativas/intermedias/centros de acopio/chatarros (all stationary)	chiffoniers	Small recyclers (itinerant)/ scrap dealers/buy back centers (both stationary)
Municipal waste collection crew	-	Haun wei gong ren	Gari	Empresas de servicio publico/empresas de aseo publico	-	Municipal collectors/refuse removers

Key	
Informal	
Intermediate	
Formal	

Figure 1 Wilson's four categories of informal recycling (Source: Wilson, 2001).

Figure 1 also shows that certain professions possess characteristics of both the formal and the informal sectors. This suggests a cohabiting situation where each sector benefits from the other. Professions in this category are regarded as intermediate. Also evident is that informal recyclers vary in their specific choice of waste recycling activities in different countries. This differentiation can be attributed to the consumption habits and the cultural, economic and political factors of the countries involved. For instance, in India, unlike e-waste and metals or even plastics that possess immediate economic appeal, clothing is not easily thrown out as trash and is therefore not the primary target of scavengers (Norris, 2010). Used clothing has a deep social meaning and it is considered a valuable resource. Used clothing can be easily gifted, exchanged for something else that is valuable or used up until it literally falls apart (Norris, 2010). It is also noticeable that e-waste is not mentioned as a particular category in Wilson's model.

E-waste is a special form of waste because of the number of chemical compounds it houses and the extensive environmental damage it can inflict on its host environment (Widmer, Oswald-Krapf, Sinha-Khetriwal, Schnellmann & Böni, 2005; Puckett, Adesanya, Davis & Saidu, 2005). Furthermore, the availability of extractable valuable materials inherent in e-waste helps to decrease the volume of virgin materials that is needed for production of electronic devices (Ylä-Mella et. al., 2007). This study therefore stresses that *informal recyclers whose activities involve only e-waste should be categorized separately*, and hence the use of the term 'e-scrapppers'. E-scrappping is a local word used among e-scrapppers in Nigeria, and was encountered during my fieldwork carried out in 2014 and 2015 among 29 male e-scrapppers in Nigeria. E-scrappping involves sourcing, sorting, manual extraction of valuable materials and resale of valuable materials from e-waste. The activities of e-scrapppers have been discussed extensively in the four articles in this dissertation but a summary is presented in section five.

## 1.5 Purpose of the study

This dissertation postulates that social material interaction between e-waste and informal recyclers enhances the relevance of the informal recycling sector in e-waste management. The focus is on how informal recyclers grasp the different constituents of e-waste, their ability to recognize valuable extracts in e-waste and navigate the complexities of e-waste management – all without access to formal institutional knowledge and resources.

To investigate and understand this phenomenon, this study proposes that a holistic understanding of the social material interaction between e-waste and informal recyclers, specifically e-scrapppers, is needed. Also, a new analytical perspective and an alternative theoretical approach to the social inquiry of e-waste management is required. Particularly, this thesis investigates the following questions: 1) How has e-waste gained recognition and remained relevant in both government and private spheres? 2) Through what material and social mechanisms have e-scrapppers thrived despite the negative environmental perception of their activities? In examining these questions, this dissertation utilizes Nigeria as a case study. Data gathered from Nigeria in 2014 and 2015 is discussed and presented in four independent but inter-related articles.

From here on, this study is structured as follows. Section two presents the main theoretical approaches employed and highlights the benefits of combining these theories and their relevance in e-waste management. Section three discusses the contextualization of e-waste in Nigeria. Section four presents the method of data collection, the analytical approach used and introduces the data. Section five reveals results and contributions presented in the four articles. The conclusions of the study are presented in section six.

## 2 THEORETICAL FOUNDATIONS

With the advent of the industrial revolution in the 18<sup>th</sup> century, political, economic and socially engineered consumption encouraged an unprecedented increase in the consumption of goods and services. For every consumer of electronic products, it is much easier to replace unwanted electronic devices with new ones instead of repairing the old. Thus, the understanding of e-waste is out of sight, out of mind. E-waste is perceived as rejected, trash, worthless and useless matter, unequivocally unimportant. This perception, aided by the strategy of planned and perceived obsolescence, propels the rapid disposal behaviour of consumers.

In the academic sphere and professional recycling industry, e-waste has been seen as matter possessing only physical and chemical properties with specific economic values (Robinson, 2009; Widmer, Oswald-Krapf, Sinha-Khetriwal, Schnellmann & Böni, 2005). This perspective has greatly influenced how e-scrapers are perceived among academic scholars, policy makers and government institutions. For example, academic narratives portray the activities of e-scrapers as derivative of economic and financial gains (Kahhat, Hieronymi & Williams, 2013), and thus reflect e-waste as a medium of parasitic gains by the e-scrapers.

But e-waste is matter made up of active chemical and material constituents that becomes vibrant under conducive conditions. It possesses the ability to give and receive responses and hence create a symbiotic relationship between itself and e-scrapers. Therefore, this study postulates that the vibrant nature of e-waste felt and understood by e-scrapers creates a symbiotic relationship that results in mutual beneficial results. To understand and examine this relationship between e-scrapers and e-waste, this study adopts the combined theoretical perspective of the assemblage of things (Deleuze & Guattari, 1993; DeLanda, 2006; Bennet, 2010) and the issuefication of things (Marres, 2014; Marres & Rogers, 2005) in new materialism theory. These are discussed in the following subchapter.



## 2.1 New materialism theory: recognizing the liveliness of e-waste through the assemblage of things and issuefication of things

New materialism is a generic approach to the study of matter, focusing on present and emerging development in the diverse field of materialism studies. New materialism examines how people interact with matter within and outside the host environment. It acknowledges the agency, organic and inorganic ontology of matter (Bennet, 2010; Coole & Frost, 2010; Dolphijn & van der Tuin, 2012). It argues that matter is not passive and irresponsive to its environment. Rather matter is always active, waiting to exhibit itself and elicit responses when a conducive environment presents itself (Mellström, 2004; Thomas, 1991; Coole & Frost, 2010; Dolphijn & van der Tuin, 2012; Sansi-Roca, 2005). Hence, while consumers consider e-waste as unimportant and trash, e-scrapppers encounter e-waste as valuable resources capable of eliciting specific responses. These responses include mobility during e-waste acquisition, skills acquisition, social mobility, policy formulation and implementation, sale of extracted valuable materials, workspace and professionalism (see Articles II, III, and IV). However, matter such as e-waste cannot exhibit its recognizable vibrant abilities by itself. It requires the collective response of other elements in its host environment. These collective elements are known as *assemblage of things* (Deleuze & Guattari, 1993).

Assemblage of things is a combination of self-organizing elements within the environment. They interact with each other to produce outcomes (Deleuze & Guattari, 1993; Mulcahy, 2012; DeLanda, 2006). Assemblage of things can also be regarded as sub systems within a larger system, presenting a scenario of layers of groups within the same system (Bennet, 2010). In e-waste management, the layers of group forming two or more contrasting assemblage of things can occur in the form of operational methods in a single system producing different blends of organizations but presenting the same outputs. Depending on the influence of the assemblage of things, the outcome can be easily recognizable by individuals in the environment such that immediate action is needed. In the case of e-waste, the negative outcomes such as environmental pollution produced by the activities of e-scrapppers, makes it an issue, hence the utilization of the issuefication of things theory (Marres & Rogers, 2005; Marres, 2014).

Issuefication of things refers to the ability of matter to attain a 'charged status' (Marres, 2014). This approach argues that matter has the capacity to exclude influences on other elements in its environment and in the process, obtain new meanings. The impact of the influence and newly acquired meanings can be measured in relation to the issues and sequential reactions that are evoked within the environment (Oudshoorn & Pinch, 2005). Once matter has attained an issuefied status, it has the ability to provoke new reactions from other elements in the environment; thus, redefining itself and creating new characteristics, and eliciting new approaches and actions (Latour & Weibel, 2005).

Combining the theory of assemblage of things and issuefication of things in new materialism addresses the vibrant characteristics of e-waste and the symbiotic relationship that arises between organic and inorganic elements within its host environment. It is argued in this dissertation (Article I) that when e-waste as matter is issuefied, it has the ability to move from the assemblage of things to the issuefication of things and back. This movement is shown in Figure 2, presented and discussed more systematically in one of the articles included in this dissertation (Article I).

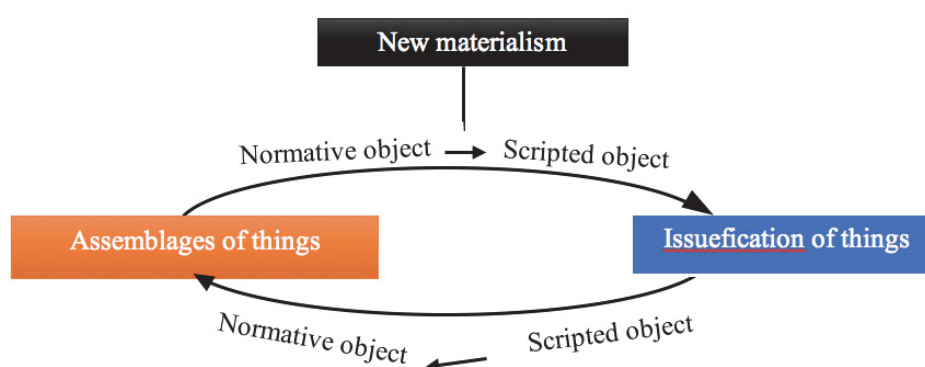


Figure 2 Interplay of assemblage of things and issuefication of things. (Source: Omokaro 2017)

Figure 2 shows the interplay of matter between the assemblage of things and the issuefication of things. Once matter, in this case e-waste in its normative form<sup>1</sup>, interacts with other elements in the assemblage of things and gains issuefication status, it becomes what Akrich (1992) and Marres (2014) refer to as a scripted object. Matter in its scripted form has attained a new identity such that it is able to exude influences strong enough to warrant significant responses from other elements in the assemblage of things. Thus, because the scripted object is not outside of the assemblage of things, it can reintegrate into the assemblage of things while retaining its acquired scripted ability as its new normative form within the environment.

This complex interaction is exemplified in the way e-waste attains issuefied status via the negative extraction practices employed by e-scrapppers and the environmental hazards generated. In Nigeria, until e-waste finds itself in the hands of e-scrapppers or in the main waste stream, it mostly goes unnoticed. E-waste assumes a quiet state where nobody bothers about it. In this state, even

<sup>1</sup> Normative form refers to the existing state of an element within the assemblage of things before it becomes issuefied.

though chemical reactions are active, e-waste does not attain the issuefication status. The reactions between the e-waste and its immediate environment are not enough to cause significant concern. However, once e-scrapers gain access to e-waste, it becomes issuefied through, for example, the processes employed during the extraction of valuable materials. The process of extracting valuable materials from e-waste also exposes harmful chemicals into the environment. Since most e-scraping activities in Nigeria also occur among residential buildings, the release of harmful chemicals from e-waste into the environment prompts public discourse resulting in the formulation of regulations to be enforced by governmental institutions such as environmental agencies. At this stage, the social material interactions of e-waste and the e-scrapers has caused a significant change in other elements within the environment.

Therefore, by combining assemblage of things and issuefication of things approaches, it is possible to reveal the materiality of e-waste and social material interaction between e-waste and e-scrapers, thereby presenting e-scrapers in a new perspective. Besides the significant role e-scrapers play in e-waste management, this new perspective is reflected in the continuous participation of e-scraping activities, which is highly dependent on the adherence to environmental and institutional regulations. While the combination of these theories addresses the active ability of e-waste, it does not provide for the capabilities that issuefied e-waste generates among e-scrapers. Therefore, a suitable theoretical approach is needed in addition to the assemblage of things and the issuefication of things. The study utilizes the capability approach.

## 2.2 Capability approach

Although the capability approach can be traced back to Karl Marx, Aristotle and Adam Smith (Nussbaum, 1988; Sen, 1993), it is Amartya Sen, an economist philosopher who popularized the approach, while Martha Nussbaum and several other scholars in the social sciences and humanities significantly developed it. Generally, the capability approach is perceived more as a multi-purpose framework than a theory of well-being (Sen, 1992; Robeyns, 2005; Qizilbash, 2008). This could explain why philosophical literature use the 'capacity approach' term instead of 'capability theory'. The attributed flexibility of the capability approach makes its applicability possible in the study of e-waste management. The capability approach is used, in this study, to understand the skills acquired by e-scrapers and the influence of these skills in the social material interaction with e-waste.

As in all professional endeavors, e-scrapers rely heavily on updated information, in this case about the electronic industry. However, how this information is acted upon depends on the freedoms and opportunities available to the e-scrapers. Sen (2010) refers to the capability approach in terms of the combination of the availability of information, opportunities and freedom. The capability approach is defined as

“...a person’s capability to do things he or she has reason to value. A person’s advantage in terms of opportunities is judged lower than that of another if she has less capability – less real opportunity – to achieve those things that she has reason to value.” (2010, p.231).

The capability approach focuses on two fundamental assertions: 1) that the freedom to attain goals and abilities is of primary moral importance to individuals; and 2) that the freedom to attain goals and abilities is dependent on the availability of opportunities and the values placed on the opportunities. Collectively, the approach focuses on *how certain goals or abilities are attained in relation to the availability of opportunities and freedoms* (Robeyns, 2005; Nussbaum, 1995). The attainment of capabilities is also influenced by the freedom to access diversified opportunities and dependent on cultural habits, environmental policies and agencies and economic factors of the environment. In the Nigerian context, e-scrapppers investigated in this research possess the freedom to either remain in their previous professions or educational endeavors, or to engage in e-scrappping activities. Once their choice is made, e-scrapppers attain capability sets, which range from self-efficacy, self-conviction, self-esteem, knowledge skills, societal acceptance and recognition (intrinsic benefits) to financial stability, demand and supply, recycling methods, organizational skills and professional skills (extrinsic benefits) (Article II; Omokaro Ideho, 2016) during the e-scrappping process. These benefits are informed by the current trend in the e-waste industry and the implementation of environmental regulations by relevant government agencies.

Therefore, the capability approach does not only address the attainment of abilities and freedoms and the utilization of opportunities – it also highlights the complexities involved in the interaction of economic, political and social factors influencing the decisions, and the choices available to individuals in an environment (Nussbaum, 2013).

Although engaging in e-scrappping activities may initially stem from financial reasons, the involvement of individuals from all spheres of society, including those in white collar jobs and from formal educational and vocational institutions, working in the sector is still a conscious decision e-scrapppers in Nigeria have to make. However, once this decision is made, the information available to the individual e-scrapper and the opportunities and freedoms that arise from such information provide either a positive or negative experience. For the e-scrapper, *freedoms, information and opportunities* are three important factors influencing the extrinsic and intrinsic benefits that are experienced. This dissertation therefore, argues that e-scrappping activities have evolved from the focus on financial sustenance and extraction of only gold and silver (Puckett, Adesanya, Davis & Saidu, 2005) to all other aspects of e-waste recycling. It has evolved to include the recognition and acknowledgement of e-waste as matter capable of eliciting active responses and providing capabilities to e-scrapppers. Additionally, the evolution process experienced by e-waste and the e-scrapppers enhances the presence of an active social network facilitating knowledge on technological

advancements, information acquisition and dissemination, the presence of importers of e-waste, cultural habits of consumers and environmental and economic policies and buyers of valuable extracts.

In carrying out their activities and developing capabilities, e-scrapppers require a substantial amount of physical and virtual mobility. Although the availability of mobile devices provides a high level of virtual mobility for information acquisition among e-scrapppers in Nigeria, their capability to move physically from place to place is a pivotal part of their daily work. To examine this aspect of e-waste management in relation to capabilities approach, this dissertation (Article III) employs 'mobilities paradigm theory'.

Physical movement involves long distance walks and drives to acquire e-waste. For most of the e-scrapppers, this movement is not done without first utilizing virtual mobility channels such as making calls to verify availability of e-waste and oftentimes, coordinating the acquisition of e-waste such to avoid physical visitation. This scenario falls in line with the perspective on new mobilities paradigm provided by Freudendal-Pedersen, Hannam, & Kesselring (2016), Sheller & Urry (2006), Sheller & Urry (2016), Cresswell (2006) and Kellerman (2012). Mobilities paradigm posits that social life in relation to physical movement of human and non-human organisms is not restricted to intense physical relations and movement alone but rather, includes virtual mobility as well (Jensena, Lannga & Winda, 2016). Additionally, it acknowledges the interdependence of physical and virtual mobility (Taipale, 2016) and the means of communication that enhance the social relationships arising from the complex system of assemblage of things and the activities that emerge from such an assemblage (Fortunati & Taipale, 2017). This interdependency is evident in the assemblage of things and the issuefication of things according to the new materialism theory and the capability approach.

As shown in Article 1, e-waste has a self-organizing ability that is indicative of the assemblage of things in new materialism. The self-organizing ability of e-waste is reflected in the collective reactions of different elements within an environment such as the formation of unions, employment of specific extraction methods by the e-scrapppers and the presence or absence of middle men during the sale of valuable extracted materials. Hence, a closer look at the complex system of the assemblage of things in Article IV, shows the presence of smaller independent but interrelated organizations derived from the self-organizing ability of e-waste. Although these organizations can co-exist within a common system, they also produce different outcomes which have significant effects on the environment. Hence the use of the open system theory as a supporting theoretical lens in exploring the social material relationship of e-scrapppers and e-waste.

In open systems theory, change occurs in an organization when enough key resources are acquired to cause significant change in the activities of members of the organization (Scott, 2002, Bastedo, 2006). Open systems theory posits that organizations are not entirely independent of their environment. Rather, their survival depends on the changes that occur between the organizations and the environment. Attributing this to e-scrapppers, understanding the social-material relationship between the presence of e-waste and the subsequent activ-

ities of e-scrapppers requires an understanding of the social, economic and political factors affecting e-waste management.

Therefore, this study reveals that combining the seemingly disparate theories of issuefication of things, assemblage of things, open system theory, mobility paradigm and capability approach helps to address important aspects of e-waste management that have not gained much attention in previous studies. While the capability approach helps to highlight the skills and abilities that e-waste can enhance and provide in e-scrapppers, open system theory shows the presence of smaller organizations formed between e-scrapppers, e-waste and the environment; the mobilities paradigm reveals that intense mobility and social relationships do not rely solely on proximity but rather, can be attained via physical or virtual mobility, or a combination of both.

### 3 E-WASTE IN NIGERIA

Over the years, Nigeria has experienced an upshoot in technological consumption, especially with the growth of the internet and the transition from analogue devices to digital devices. According to Durkin (2010), internet penetration in Nigeria increased from 3.5% in 2005 to 38% in 2014 with a corresponding GDP increase of 804 USD to 3005 USD. The significance of this is in the consequent increase in consumption and affordability of technological devices like smartphones and smart TVs.

Nigeria, known as Africa's most populous country, is situated on the western coast of the African continent. It has a population of over 182 million (National Population Commission, Nigeria, 2017) with a land mass of about 923,769 km<sup>2</sup>. Nigeria shares its international border with the Atlantic Ocean's Gulf of Guinea and four Francophone nations Chad, Niger, Benin and Cameroon. Nigeria is composed of 36 states and a Federal Capital Territory (FCT), amongst them Lagos and Edo States, where the data for this dissertation was acquired. These states serve as major industrialized hubs for companies, thus they are attractive destinations for majority of the Nigerian populace. For example, major international companies such as Coca Cola, Samsung and Panasonic have their Nigerian head offices in Lagos State. Known as one of West Africa's mega cities and housing over 18 million people (Lagos State Government, 2016), the presence of such major companies and the prospect of job availability has facilitated the increase in urbanization of the state.

With a large population such as this and the presence of a thriving IT sector, accompanied by increasing technology consumption, Nigeria experiences significant challenges in e-waste management (Schluep et. al., 2012). Although there are electronics assembling companies, Nigeria currently lacks indigenous electronic manufacturers. This shows that majority of the electronic goods are imported from industrialized countries either as second hand devices or as new devices. Private consumption of small and large household electronics was estimated to be the highest, while the consumption of IT and telecommunications equipment by corporate and institutional organizations was estimated at 400,000 tonnes. Additionally, about 1.1 million tonnes of electronic devices are

discarded by consumers each year in Nigeria (Schluep et al. 2012). Also, there is a high reuse and repair rate of electronic devices like TV sets and mobile phones. This helps to increase the life span of the electronic devices beyond its planned obsolescence (Osibanjo & Nnorom 2008). Yet according to Schluep (2012), illegally imported e-waste in Nigeria, which usually comprises of broken or non-functional electronic devices, was estimated at 100,000 tonnes in 2010. Thus, the irregular consumption pattern of discarding electronic devices at repairers' shops when they are beyond repair, the reuse of functioning devices when repair is possible and the inclusion of e-waste in the main waste stream makes it a significant challenge to ascertain the amount of electronic devices consumed, e-waste that is locally generated and how much gathers dust at the repairers shop or ends up in the possession of the e-scrapers.

Although the lack of centralized and coordinated data gathering of discarded and recycled e-waste makes it challenging to ascertain the specific amount of e-waste that is recycled by e-scrapers, it is estimated that 540,000 tonnes of e-waste was recycled by Nigerian e-scrapers in 2010 (Ogungbuyi; Nnorom; Osibanjo; & Schluep, 2012). This implies that Nigerian e-scrapers are active players in the management of e-waste.

### **3.1 International policies governing management of e-waste in Nigeria**

Studying e-scraping in Nigeria is significant not only because it is the largest populated country in West Africa with a healthy appetite for consuming technology, but because Nigeria is a party to the Basel Convention and the Bamako Convention.

The Basel convention is an international treaty created in 1989 and that came into force in 1992. It is aimed at reducing the transboundary movement of hazardous waste, including e-waste from industrialized countries to less industrialized countries. In 1995 it was, however, amended to prohibit the export of hazardous waste from countries listed in an annex of the convention to other parties of the Convention. As at 2011, The Convention had 53 signatories and 186 Parties (Basel Convention, 2011). At the second conference meeting of the Convention in 1994, it was agreed that the stipulations in the Convention created a loophole for the legitimization of transboundary movement of hazardous waste, instead of criminalizing it. Hence, despite strong oppositions from Parties like the United Kingdom, Australia, the United States, Canada, Japan, and Germany, other members in collaboration with Green Peace organization, reached a consensus and created the Basel Ban (Basel Action Network, 2011). The Basel Ban requires all parties of the Basel Convention to fully implement the stipulations of The Convention including prohibiting exports of hazardous waste for recovery, recycling and final disposal.



The Basel Convention focuses on establishing a cohesive international framework for monitoring, regulating, reducing and restricting the transboundary movement of hazardous waste. Its goal is to encourage 'environmentally sound management' (ESM) practices that protect the environment and human health by curtailing the production of hazardous waste. Specifically, the Convention stipulates that each Party shall:

“...ensure that persons involved in the management of hazardous wastes or other wastes within it take such steps as are necessary to prevent pollution due to hazardous wastes and other wastes arising from such management and, if such pollution occurs, to minimize the consequences thereof for human health and the environment (Basel Convention, 1989, p.15)”

The Basel Convention not only restricts the movement of hazardous waste between countries, it also addresses environmentally friendly management of internationally generated waste in member countries. But the Basel Convention has a number of flaws such as lack of collaborative monitoring that is essential in preventing the transboundary movement of e-waste. The lack of mechanisms in the Basel Convention for criminalizing trade of prohibited hazardous waste to less industrialized countries was the motivation for the creation of the Bamako Convention.

The Bamako Convention is an African initiative adopted on January 30, 1991 (The African Union Commission, 1991). Its enforcement began on April 22, 1998. The Bamako Convention was enacted to ban the import and transboundary movement of hazardous waste into African countries, and also addresses the management of hazardous waste within Africa. Unlike the Basel Convention, the Bamako Convention has strict regulations concerning the generators of hazardous waste and the damages they can cause. Also, the stipulations do not make exceptions to certain hazardous waste such as radioactive materials which are not covered in the Basel Convention. For instance, concerning the detection of illegal presence of hazardous waste such as e-waste, all parties of the Bamako Convention should:

...forward as soon as possible, all information relating to such illegal hazardous waste import activity to the Secretariat who shall distribute the information to all Contracting Parties;  
 ...co-operate to ensure that no imports of hazardous wastes from a non-Party enter a Party to this Convention. To this end, the Parties shall, at the Conference of the Contracting Parties, consider other enforcement mechanisms. (The African Union Commission, 1991, p.6)

This regulation offers a collaborative framework for all Parties of the Bamako Convention to work with to ensure that monitoring of hazardous waste becomes the prerogative of all Parties involved. Therefore, the Bamako Conven-

tion provides for a more comprehensive management and restrictive framework for regulating hazardous waste while the Basel Convention is lacking in this.

### 3.2 Nigerian laws on e-waste management

At the national level, the National Environmental Standards and Regulations Enforcement Agency (NESREA), an Agency of the Federal Ministry of Environment is tasked with the responsibility of enforcing all environmental laws in Nigeria. The duty of NESREA is to ensure a healthier, cleaner environment while also inspiring collective and personal responsibility in encouraging an environmentally conscious society (NESREA, 2016). Among other duties, NESREA functions as the police of the environment. It has the ability to prohibit the use of technology and processes that can impair environmental quality. NESREA has the mandate for reviewing existing national environmental laws and regulations and developing new ones where appropriate.

Where Nigeria is a signatory, the mandate includes implementing all multi-lateral Environmental agreements, Conventions, Protocols and Treaties such as the Basel Convention and the Bamako Convention. Regulations actively implemented by NESREA include the Harmful Waste Act Cap HI, 2004 (Special Criminal Provisions). This Act prohibits the deposition, dumping and carrying of harmful waste on any territorial waters and land of Nigeria. Where offenders are caught, the stiff penalty of life imprisonment and forfeiture of the medium of transportation such as containers, aircrafts or ships is implemented. Additionally, where the offence is committed by an organization or a cooperate entity, the personnel responsible for authorization of the waste and the cooperate entity are penalized respectively.

Expanding its reach, NESREA also collaborates with members of the National Toxic Waste Dump Watch committee on the illegal shipment of Waste Electrical and Electronic Equipment (WEEE) and the Nigeria Customs Service (NCS). This has helped increase monitoring on illegal importation of prohibited hazardous waste especially at the seaports. Beyond the Nigerian border, NESREA networks with governments such as Germany, United Kingdom and international organizations such as The European Union Network for the Implementation and Enforcement of Environmental Law - Transfrontier Shipment of Waste (IMPEL TFS), International Network for Environmental Compliance and Enforcement (INECE), Seaport Environmental Security Network (SESN) and United States Environmental Protection Agency (US EPA). The International Criminal Police Organization (INTERPOL) is not left out in this collaboration. Criminalizing offenders require the diligent participation of the international police force.

Nationally, NESREA carries out its functions on e-waste management based on a number of regulations. These include:

- **The National Environmental (Electrical Electronic Sector) Regulations SI No 23 of 2011**

The Regulation is based on the life cycle approach and includes all aspects of the electronic sector. The tenets of the regulations operate from the 5Rs - Reduce, Repair, Re-use, Recycle and Recover as the primary drivers of the sector. The regulation also adopts the Polluter Pays Principle which places waste management responsibilities on the producers of electronic devices. Stakeholders' responsibilities and roles are outlined as is the provision to ensure the practice of Environmentally Sound Management (ESM) of waste products.

- **Guide for Importers of UEEE into Nigeria** based on the Harmful Waste Act CAP H1 LFN 2004 (Special Criminal Provisions, ETC), which is still in force in Nigeria (NESREA, 2013).

This guideline came into being as a measure of organizing data on e-waste generation and its management. The main provisions include:

1. The exporting countries are expected to enforce their national laws and relevant regional and international conventions on trans-boundary movement of hazardous waste;
2. Every importer of Used Electrical and Electronic Equipment (UEEE) should register with NESREA;
3. The Nigerian government allows the importation of new and functional UEEE;
4. Nigeria bans the importation of WEEE and near-end-of-life electric/electronic equipment including CRT;
5. Any WEEE imported into Nigeria shall be sent back to the port of origin;
6. Any vessel used to import UEEE mixed with WEEE, shall be forfeited to the Nigerian Government;
7. Administrative punitive fine shall be imposed on the carrier of WEEE or UEEE mixed with WEEE;
8. Every carrier of UEEE shall be accompanied by:
  - a. Cargo Movement Requirement (CMR) document;
  - b. Proof of evaluation/testing and certificate containing testing information on each item;
  - c. Declaration of the liability by the importer (Letter of Indemnity); and copy of permit to import.
9. All UEEE imported into Nigeria shall comply with the following provisions:
 

The item(s) shall be of comparative models of equipment in use;

  - a. It shall be fit for the purpose it was originally designed for;
  - b. It shall be fully functional as originally intended;
  - c. The outward/external appearance of the item shall not show any waste characteristics;
  - d. It shall not be scrap; and

e. The item(s) shall be properly packaged for protection during transport, loading and unloading.

- **The National Environmental (Sanitation and Waste Control) Regulation 2009:**

This act lays out laws on the generation and handling of hazardous waste. Specifically, it states that:

1. A producer of waste shall ensure a secure means of storing such waste.
2. Every person who generates hazardous waste shall cause such waste to be treated using standard methods.
3. Any person who fails to conform with the above obligations shall be guilty of an offence punishable with a penalty of 5,000,000 Naira (Nigerian currency) or imprisonment for five years, or both.
4. No person shall export or transit hazardous waste without permit by the Agency (NESREA).
5. No person is to involve in any activity likely to generate hazardous waste without permit by the Agency (NESREA).
6. No person shall transit toxic waste intended for another country through the territory of Nigeria without prior informed consent of such movement by the Agency (NESREA).

In addition to the regulations, NESREA is also tasked with enforcing extended producer responsibility. All exporters, manufacturers, importers, distributors, retailers and assemblers are required to facilitate an Extended Producer's Responsibility (EPR) program. Producers, manufacturers, distributors, retailers and importers of electronics should return e-waste to designated collection points. Simultaneously, they are to ensure environmentally sound management of e-waste right from the collection points. Consumers are also required to return e-waste to the collection points for easy management.

Reflecting on the functions of NESREA and the stipulations of the regulations, it can be deduced that Nigeria has very strong policies for effectively managing e-waste. However, implementation of these laws has been a challenge. For instance, effective management of hazardous waste such as e-waste starts with collection. Nigeria does not practice sorting of waste at source. Waste is often mixed together. Additionally, most consumers are not aware of these regulations or even where collection points for waste are located. This significantly affects the way waste is stored, disposed and handled. At the household level, waste is stored in open cans and open air before the waste disposal unit and/companies come to remove them. At the consumer level, electronic devices are consumed and handled differently. The multifaceted channel - such as repair, resale or charity - through which e-waste can be discarded makes efficient collection a challenge.

Drawing on the new materialism theory, except for e-scrapppers, waste in Nigeria is generally seen as just that - waste. It is not perceived as valuable resources capable of positively transforming itself into valuable products. Hence,

the provision of infrastructure is not geared towards treating waste as a valuable resource but as trash to be discarded. The documentary published by the Basel Convention in 2005 brought significant attention to the presence of e-waste and the e-scrapppers (Puckett et al., 2005). The documentary not only exposed the true nature of e-waste management in Nigeria; it also revealed the environmental and human cost involved in the electronic life cycle (Leonard & Conrad, 2010). Besides inadequate infrastructure and implementation of the regulatory laws on e-waste, Nigeria also faces the challenge of political will, particularly to provide standard infrastructure and funds for the implementation of the regulations and the political will to abstain from corrupt practices that could undermine the effective management of e-waste (Osibanjo & Nnorom Chidi, 2008). Hence, e-scrappping of e-waste continues to flourish.

## 4 DATA AND METHODS

### 4.1 Data collection

The e-scraping process involves the extraction of valuable materials from e-waste using basic tools including screwdrivers and hammers. It also requires broad knowledge of components within electronic devices, how they work and their market value. In order to capture this visual process, qualitative research methods, specifically video-ethnography, was used. As a qualitative research method (Miles, Huberman & Saldana, 2014; Flick, 2014), video ethnography allows the e-scrapers, processes of e-scraping and the environment in which the activity is carried out to be actively documented (Schaeffer, 1995; Pink, 2013). In this study, the intention of employing video ethnography was not to quantify the overall e-waste phenomenon but rather, the aim was to understand the material and social conditions of e-scrapers in e-waste management.

Conversely, this method of research raises epistemological concerns. The concerns point to the legitimacy and ethics of video ethnography as a valid social science research method. Methodology in the social sciences is mostly based on three tenets - distinctly identified assumptions about the body of knowledge, a group of tested and tried procedures, and appropriate theoretical foundation (Flor 2002). Are these rules applicable to video ethnography? Can the purpose of social research be achieved via audio-visual data? Under what circumstances can this audio-visual data present epistemological conflicts? What ethical issues arise in the documentation process, analysis and scientific presentation of data? These questions came to the fore during data collection in Nigeria and are addressed in the preceding paragraph.

Video ethnography involves the use of audio-visual devices for recording and documenting interactions of people, events, social problems, processes, and places. Using video ethnography to study e-waste management in Nigeria required a comprehensive knowledge of prevailing management practices and stakeholders. Also important was possessing knowledge of the locations of e-scraping and the environmental agencies and regulations involved. Acquiring

this knowledge helped to create a procedure for carrying out the interviews. Informing the respondents on the intents of the research and the interviews, obtaining consent for utilizing a camcorder, an audio recorder or paper for documentation during the interview and asking a set of semi structured questions. To avoid epistemological conflicts, the set of semi structured questions was expanded to include issues that were raised by the respondents during the course of the interview. The following major themes were covered during the interview.

**Broad themes**

- Collection process
- Recycling process
- Qualifications/requirements
- Laws
- Collaboration/networking
- Social and economic impact
- Knowledge

The themes were gleaned from the data analysis. A list of the questions asked can be found in Appendix 1.

To resolve the ethical issues that may arise and ensure trustworthiness of the video ethnography process, certain techniques such as log book utilization, cataloguing, location, distinct environmental features and review of videos with subject and site investigation, are recommended by Knoblauch, Tuma & Schnettler (2015) from the researcher. These techniques produce sets of documentation and categorizations and that can be verified by the subjects and compared to other interview scenarios (Guerrero 1992). Video ethnography produces knowledge through observations of social and material interactions between people, places and non-human objects. The data occurs in images and sounds, that is, audio-visual records. Audio-visual records are not merely symbols in themselves or shots capturing a moment, they are also recordings of reality as it is at the given time. To resolve epistemological conflicts in presentation of data, the acquired data was reviewed and discussed together with the respondents. Consent on what can be revealed and anonymity of sensitive information were also addressed. In addressing validity and transparency of the documentation process, this dissertation utilized the following procedures in three phases: pre-videography process, videography process and post-videography process.

Table 1 Data collection and analysis

Data gathering phase	Time	Activity
<b>Pre-videography process</b>	<p>2014 – April, Lagos            2015 – January, Benin city            2015 – May, Benin city            2015 – May, Lagos</p>	<p>7 days of field exploration.</p> <ul style="list-style-type: none"> <li>• Identified potential interviewees at the chosen locations</li> <li>• Identified key stakeholders and establishing intentions and data collection process</li> <li>• Familiarization between target community and researcher</li> <li>• Built rapport with the community</li> <li>• Discussed calendar of activities with the key stakeholders and documentation plan</li> <li>• Journal writing</li> </ul>
<b>Videography process</b>	<p>2014 – April, Lagos            2015 – January, Benin city            2015 – May, Lagos            2015 – May, Benin city</p> <p>19 e-scrappers interviewed in 2014            10 e-scrappers interviewed in 2015            (see Fig. 3)</p>	<ul style="list-style-type: none"> <li>- Interviews conducted with a hand-held camcorder supported by an audio recorder when anonymity was needed.</li> <li>• Interviews with e-scrappers: on-camera, off camera with note taking only, and off camera with audio device only</li> <li>• Video footage preview and discussion on issues raised, mode of presentation and anonymity of the interviewees</li> <li>• Indexing in journal at the end of every recording session. Indexing helped to tag location of specific footage. Segments within the footage via real time stamps produced by the camcorder, doing this on paper in the field reduced conflict of information during the post-videography phase.</li> </ul>
<b>Post-videography process</b>	<p>September, 2015</p>	<ul style="list-style-type: none"> <li>- Identification of good shots and editing points</li> <li>- Updated journal</li> <li>- Used MAXQDA software for footage analysis</li> <li>• Catalogued and categorized in logical structure and themes</li> <li>• * Coded according to themes, structured according to location and themes, attached memo notes where needed</li> <li>- Utilized F5 transcript software for transcribing audio and visual footage (F5</li> </ul>



		<p>transcription acquired first by the researcher before MAXQDA). – Transcription imported into MAXQDA for proper documentation; audio text and video images synchronized.</p> <ul style="list-style-type: none"> <li>• Digitalization and Pre-editing <ul style="list-style-type: none"> <li>◦ Noted segments of footage where anonymity was identified during preview with interviewees</li> </ul> </li> <li>• Abstraction for presentation and storage <ul style="list-style-type: none"> <li>◦ Transfer of catalogued and categorized footage to Adobe Premier Pro for file collation and size reduction.</li> <li>◦ Suitable footage chosen for corresponding journals</li> <li>◦ Raw Data stored in CD and DVD ROMs for future use.</li> </ul> </li> </ul>
<p><b>Presentation of Data in Articles</b></p>	<p>2015, 2016, 2017</p>	<p>Vignettes and short video clips</p> <ul style="list-style-type: none"> <li>• Vignettes of transcribed interviews used to present the data in the four articles</li> <li>• Short video clips used as supplementary data for the vignettes</li> </ul> <p>Interview excerpts chosen based on the catalogued themes and relevance to the subject matter of the articles.</p>

### *\*Coding*

Coding was done by reviewing the list of semi structured questions alongside the video clips in MAXQDA after which the videos were grouped according to location. MAXQDA is a qualitative and quantitative software that is well suited for videography analysis. Besides in-depth analysis of videos and text, the aim of using MAXQDA was to also provide proper cataloguing and logging. Each video clip was attached to the transcript produced in F5 transcription software. Combining the transcript and the videos in MAXQDA made it easy to quickly code different segments based on the emerging terms used by the e-scrapppers. The derived terms were then categorized into broad themes from which the four articles presented in this dissertation is derived (See Table 1 and Appendix 1).

## **4.2 Ethical considerations**

Given the sensitive nature of e-scrappping activities and the place of e-scrapppers in e-waste management, this dissertation studied the group of e-scrapppers whose activities were legal. They were chosen based on the visibility and accessibility of their activities. Importantly, gaining access to information from the e-scrapppers was more feasible than the group of e-scrapppers operating in the shadows. In addition, information from the study group could be cross verified among the e-scrapppers.

Although video ethnography provides a comprehensive platform for capturing both audio and visual records of the e-scrapppers activities, there is the possibility that participants who do not wish to be featured in the video may be captured. Also, the environment portrayed in the video may consist of identifiable features that can be captured in the video as well. This raises ethical concerns pertaining to security and anonymity. To address this, identifiable features are either zoomed out or totally avoided if possible. Where it is unavoidable, these features are blurred out when in use for data presentation. Consent to record e-scrappping activities on and off camera as well full time engagement in e-waste management were also the main criterions for choosing respondents.

It was also observed that e-scrapppers in the locations were mainly men between the ages of 18 - 65, and thus underage children, generally considered a vulnerable group in e-waste management, were not captured. It is important to note that even though the e-scrapppers were adults as at the time of the interviews, some of them began e-scrappping as kids. This raises the question of child labor, its prevalence in the informal recycling sector and existing policies concerning child labor in this sector. The absence of female e-scrapppers also raises the question of gender issues. This dissertation does not address these questions but they are interesting topics for further studies.

### 4.3 Research material

The primary data used for this dissertation was carried out in four locations in Lagos State and two locations in Edo State between 2014 and 2015. Edo State is known as the heartbeat of Nigeria as it has a good road network, which facilitates the transit of people and goods between states. Lagos State is known as the commercial hub in Nigeria. It is bordered by the Atlantic Ocean and has many sea ports that enable the movement of people and the importation of goods, including electronics, between Nigeria and other countries.

Among the 36 states in Nigeria, the interview sites were specifically chosen based on their activities in e-waste, geographical locations and level of security. Figure 3 shows this distribution of interviews by location.

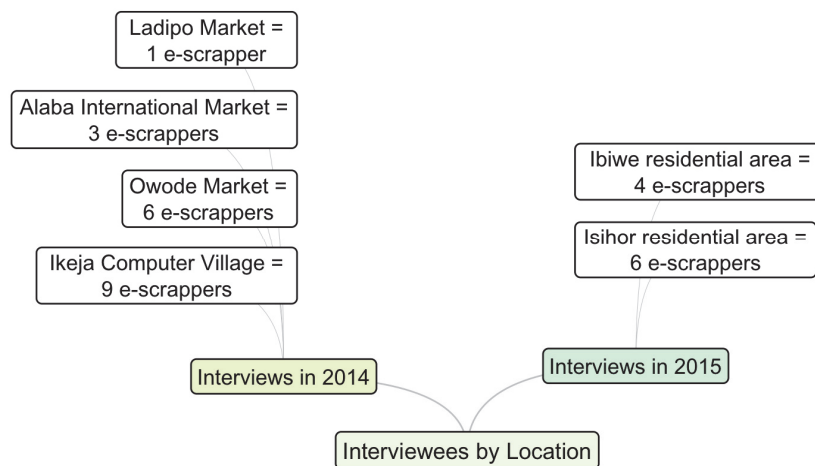


Figure 3 Distribution of interviews by location (Source: Omokaro)

Given the visual nature of e-scraping activities and the real-life factors such as difference in volume of e-waste and population associated with it, it was decided to investigate multiple locations within the e-scraping community (Stake 2005).

Methodological triangulation was used as a means to strengthen the validity and reliability of the research (Rothbauer, 2008, Denzin, 2006). While the camera was pointed at the interviewees' activities, capturing the e-scrapers' voices and movements, the interviewer asked semi-structured questions and observed the surroundings and the nuances that emerged while the camera rolled. Having the camera on at all times ensured that important aspects of their activities, both spoken and physical, were visually documented. In situations where sensitive e-scraping activity was ongoing, the camera was pointed to the ground or turned off. This was done to prevent visual documentation of the activity while recording audio only. Also, where the interviewee was uncomfortable providing sensitive information on camera, notes were taken instead

and afterwards, shown to the interviewee for clarification. The interviews were conducted using the local dialect, *Pidgin English*. This helped to create an easy-going atmosphere and rapport between the interviewer and the interviewee so that the presence of the camera was not perceived as an intrusion. Interview questions were based on the answers provided by the interviewees. Having an open mind when carrying out the first interview ensured that relevant issues were revealed by the interviewees. These issues became leading questions for subsequent interviewees. The questions asked during the interview are provided in Appendix 1.

Understanding that not all informal recyclers engage in e-waste management, the snow ball method was employed to ensure that only e-scrapppers were interviewed. Taking into consideration that qualitative research provides for undefined sample sizes when carrying out a qualitative study as long as a saturation point is reached (Creswell, 2013; Creswell, 1998; Morse, 1994), I decided to stop the interviews at 29 respondents, when interviews were no longer producing new insights into the studied research questions.

#### **4.4 Methods of analysis**

Data analysis was carried out by utilizing the process outlined by Knoblauch, Tuma & Schnettler, (2014); Heath, Hindmarsh & Luff (2010); Miles, Huberman & Saldana, (2014). Initial interpretation of data while on field was relayed back to the respondents to check for validity of interpretation. Using MAXQDA qualitative software and F5 transcription software, data was transcribed and coded. In accordance with the recommended practice, the coded data was descriptive in nature and derived from terminology used by the respondents in the field. Figure 4 shows a snapshot of the coded segments from a video clip obtained at Ibiwe, Benin city, Edo state, Nigeria in 2015.

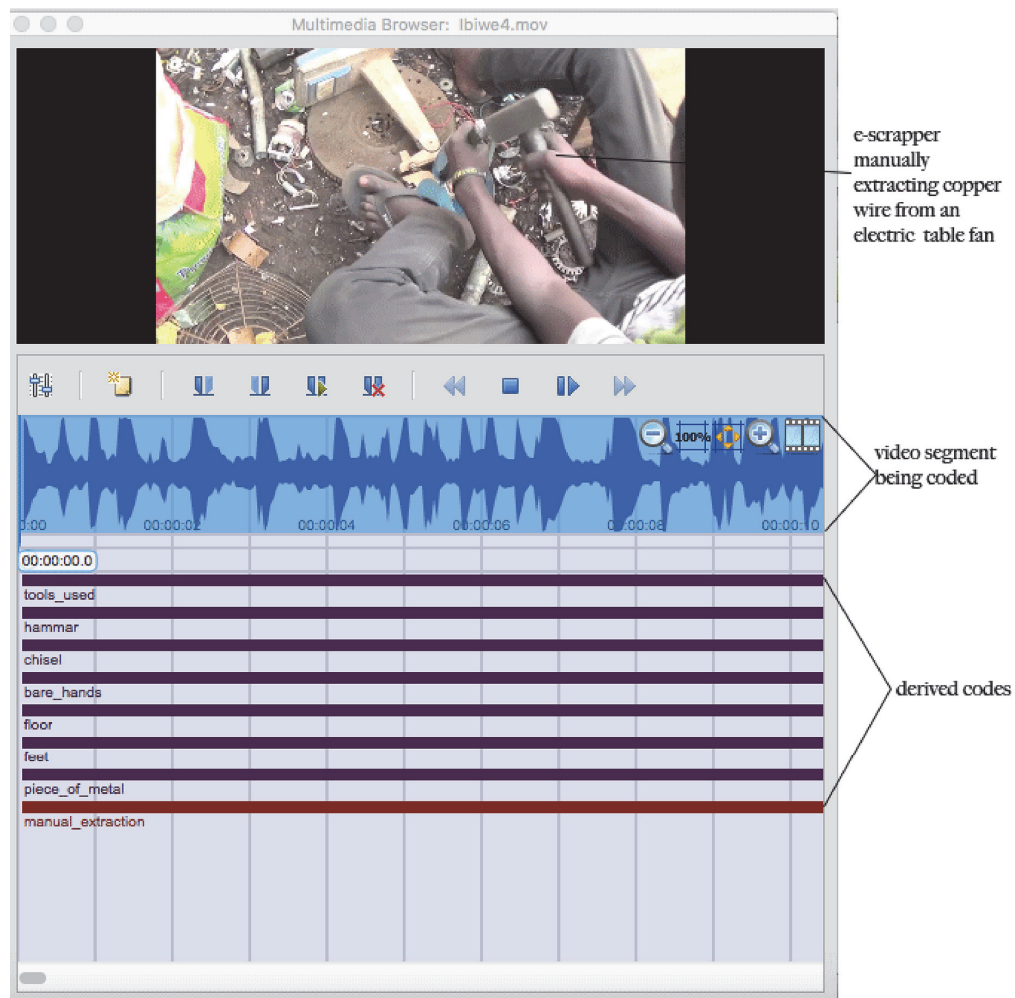


Figure 4 Coding footage in MAXQDA (Source: Omokaro)

In Figure 4 above, the purple colored codes feature the variety of tools used by the e-scrapers in his e-scraping activities. A uniform color code was used for the variety of tools because the aim was not to capture frequency of tools used. Rather it is intended to show the basic equipment that is employed by the e-scrapers on the field. The red color coded term (*manual\_extraction*) represents the extraction methods employed during the e-scraping process. The color red is used to differentiate between tools used and processes employed.

To present data in the four articles, this dissertation utilized short video clips as supplementary data and vignettes (Jarzabkowski & Kaplan, 2014; Michaud, 2014). Vignettes were used because they allow for reflective analysis, vivid representation of activities carried out during fieldwork, enhances clarity of data and presentation of interview excerpts in an organized format. Anonymity in data presentation was achieved by blurring the faces of the respond-

ents or through total removal where necessary. Additionally, pseudonyms are used when presenting excerpts of the interviews.

A major constraint in using video ethnography is that when writing articles for journal publications, utilization of video data is limited to only images, vignettes and short supplementary video clips that usually last for a maximum of 2 minutes. What then is the purpose of obtaining so much rich data only to present a limited summary of it? In the process of this dissertation, I realized that though I may not be able to use full length video clips for journal publications, the narratives present in the rich data enhanced the writing process and provided me with a wealth of insight into the activities of the e-scrappers. Also, the rich data can be compiled into a documentary. Furthermore, there is the possibility to publish longer clips in ethnography journals dedicated to video alone (Gopakumar, 2016).

Despite these constraints, the use of videography for this dissertation was an educated choice. Besides revealing the practical daily activities of the e-scrappers through the video recordings, the videos also revealed the different layers of relationships between e-scrappers, government institutions and the environment where they operate. The different layers of relationships exposed through the use of videography speak to research questions 1 and 2:

1) How has e-waste gained recognition and remained relevant in both government and private spheres? and 2) Through what material and social mechanisms has e-scrappers thrived despite the negative environmental perception of their activities? The answers to these questions are uncovered in sections 5 of this dissertation.

## 5 ARTICLE CONTRIBUTIONS

The contributions of the four original articles that make up this dissertation are presented in this section. The first article provides for the use of assemblage of things in new materialism theory, in conjunction with the issuefication of things, as a theoretical foundation that runs through the other articles. Additionally, it focuses on the processes by which e-waste becomes issuefied, gains recognition in society and transforms itself from a state of trash to valuable social and economic material. Thus, Article I provides answers to research question 1: how has e-waste gained recognition and remained relevant in both government and private spheres?

The second and third articles investigate in detail, the medium through which the e-scrappers acquire capabilities from interacting with e-waste and the mobility behavior e-scrappers engage in in the day to day activities of e-scraping. Hence, Articles II and III provide answers to research questions 1 and 2, particularly: through what material and social mechanisms have e-scrappers thrived despite the negative environmental perception of their activities? The fourth article also answers to research questions 1 and 2 but from a different aspect. It examines the materiality of e-waste, focusing on the mechanisms that influence the organizational and operational activities of e-scrappers. Figure 5 shows a snapshot of the connectivity between the articles and how they fit into the overall dissertation. Summaries of each article follow the figure below.

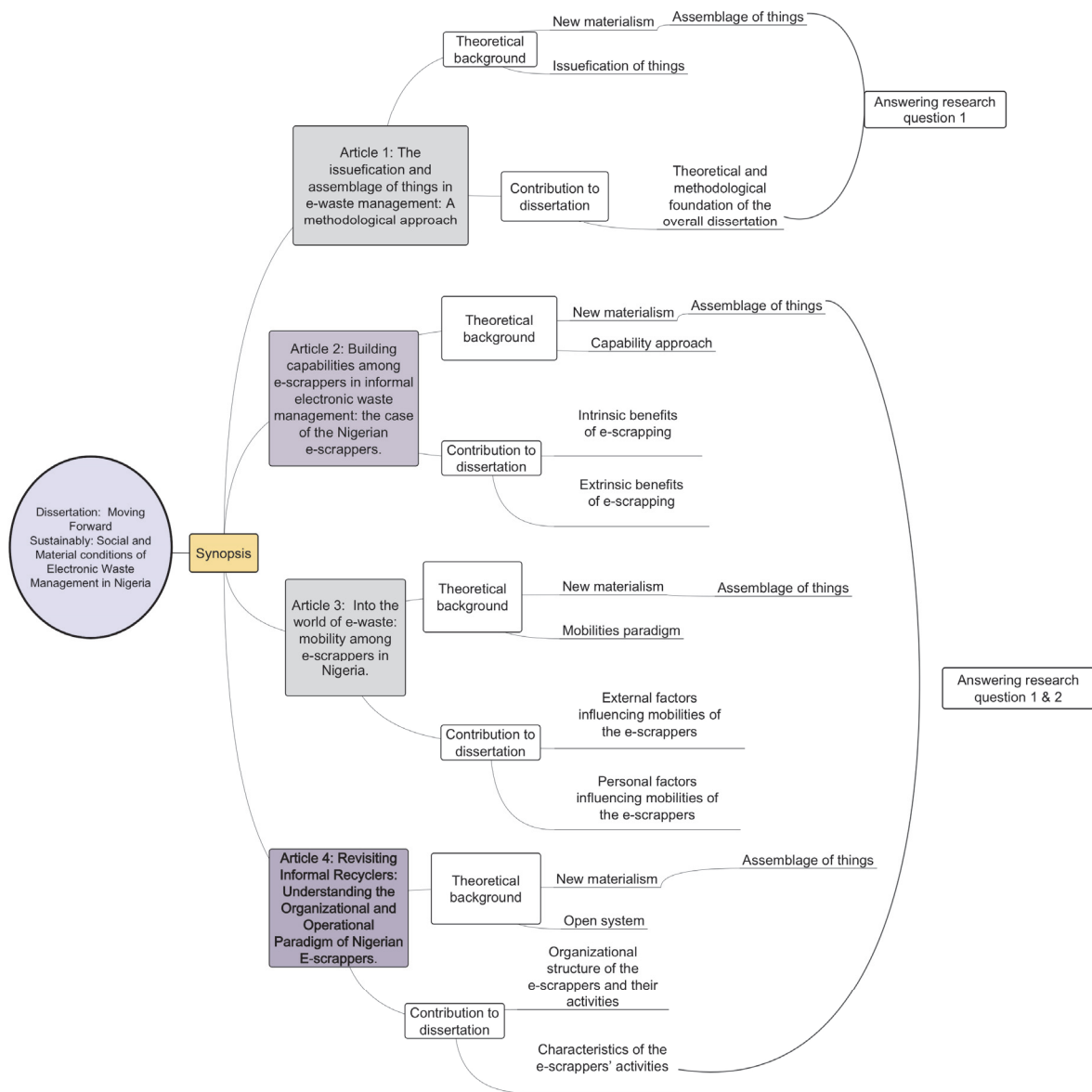


Figure 5 Snapshot of overall dissertation (Source: Omokaro)



### **5.1 Article I: The issuefication and assemblage of things in e-waste management: a methodological approach.**

This article investigates the combination of issuefication of things (Marres, 2014) and assemblage of things (Deleuze & Guattari, 1993; Bennet, 2010) as a theoretical and methodological approach to studying the activities of e-scrapppers in e-waste management. The article contributes to the dissertation by considering the issuefication of things as a process through which e-waste, as matter, gains recognition in an assemblage. It gives an in-depth analysis of the applicability of the theories of assemblage of things and issuefication of things in understanding the social and material interaction between e-waste, the e-scrapppers and their host environment.

The article argues that e-waste as matter cannot be studied only in terms of its chemical properties and environmental impact on organic and inorganic materials. Rather, because e-waste is matter, it possesses other abilities such as acting as a conduit for linking divergent issues within an assemblage, creating beneficial capabilities, facilitating mobility patterns for e-scrapppers and enabling the presence of an organizational structure. This article thus provides an answer to the research question 1: 'how the vibrant nature of e-waste has gained recognition and remained relevant in both government and private sphere of discuss'. By becoming vibrant and interacting with other elements such as e-scrapppers within the assemblage of things, e-waste gains recognition enough to become issuefied; hence eliciting responses in form of environmental policies, specific recycling practices and collaborative social relationship between all elements in the assemblages of things.

Although other theories such as the capability approach, mobilities paradigm and open systems theory have been applied in the other three articles, the combination of the assemblages of things, new materialism theory and the issuefication of things as discussed in this article serves as background through which the other articles examine the activities of the e-scrapppers. However, what the assemblage of things and the issuefication of things lack in understanding the other aspects of the e-scrapppers' social and material interaction with e-waste, the application of the capability theory, mobilities paradigm and the open systems theory as supporting theories provides. For instance, the capability approach investigates the capabilities that e-scrapppers acquire as a result of their interaction with the vibrant nature of e-waste.

The results of this article show that e-waste within an assemblage elicits reactions from the e-scrapppers. These reactions manifest themselves in forms of recognizing value in e-waste, e-waste acquisition and certain recycling practices such as e-scrappping on bare floors and leaving leftover e-waste exposed in the working area. Due to the fact that e-scrapppers' working areas are usually situated amongst residential buildings or marketplaces, the reactions from the residents and the local environmental agencies cause the e-scrapppers to adhere to environmental regulations, develop new e-scrappping practices or move from

their workspace. In this position, e-waste becomes issuefied enough to cause policy changes, especially in terms of importation and handling of e-waste, and changes in social relationships between the e-scrappers and the locations of e-scrapping.

## **5.2 Article II: Building capabilities among e-scrappers in informal electronic waste management: the case of the Nigerian e-scrappers.**

The focal point in most scholarly work around e-waste are on the negative chemical and environmental impacts of the activities of informal recyclers in e-waste management. This article presents a new perspective on the activities of informal recyclers by revealing the sub-category of e-scrappers within the generalized informal recycling sector. The informal recycling sector is a broad category of individuals who scavenge for valuable waste at dumpsites, waste collection points or directly from consumers. They include individuals who scavenge only for plastics, paper, steel, e-waste, food, or perhaps a combination of two or all of them. This article argues that though individuals who engage only in e-waste recycling are also members of the informal recycling sector, they deserve to be recognized separately simply because of the toxic and valuable nature of e-waste, that gave life to the term e-scrappers. By employing the combined theories of assemblage of things in neo materialism and the capabilities approach, this article reveals that e-waste gains social recognition by becoming issuefied. In addition, e-waste further remains relevant in both government and private spheres through enactment and implementation of policies.

Furthermore, the article discusses the extrinsic and intrinsic capabilities that e-waste bestows on the e-scrappers, that facilitate the continuous existence of e-scrappers in the informal recycling sector. In so doing, the article answers especially to research question 2: 'through what material and social mechanisms has e-scrappers thrived despite the negative environmental perception of their activities?'. The study also shows that besides offering financial reward, e-waste acts as a medium of social material interaction. Social material interaction comes in form of the professionalism that e-scrappers acquire while e-scrapping, the social networks achieved as a result of e-scrapping activities (such as information acquisition from social networks), the process of acquiring e-waste and the sale of valuable e-waste extracts.

This article reveals that e-scrappers were originally inspired by the financial and economic aspects of e-scrapping e-waste. Soon, this inspiration gave way to the acquisition of social skills which helped enhance their social networks, professionalism in e-waste management, wealth of knowledge on the materiality of e-waste, respectable perceptions from other people in the society, and organizational skills. These capabilities were largely influenced by the

presence of the social network. This article speaks to research question 2. Figure 6 shows the social networks of e-scrapppers in Nigeria.

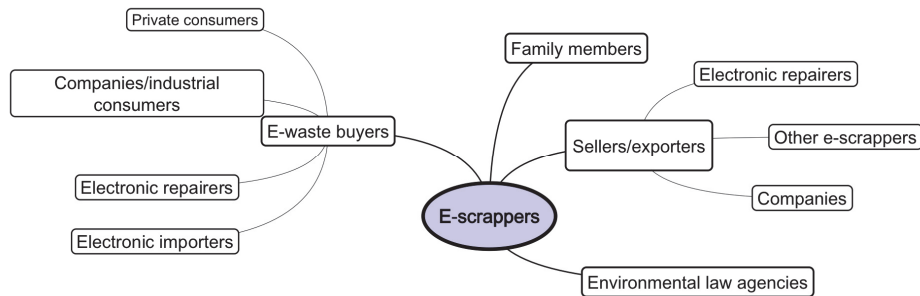


Figure 6 Social network of e-scrapppers in Nigeria (Source: Omokaro, 2016)

The social network of e-scrapppers plays an important role in facilitating the capabilities and freedoms they attain during e-scrappping activities, for instance, knowledge and skills attained via information disseminated through the social network. For e-scrapppers, acquiring the right information is an important aspect of e-scrappping; the quality of information enhances the learning process of the e-scrapppers during training, the quality of e-waste that is acquired, extraction methods employed and the best channels for sale of valuable extracts (research question 2). Additionally, learning the business of e-scrappping is dependent on the apprenticeship model, which is also achieved by and enhanced through the social network.

The extraction method employed by the e-scrapppers is a very important aspect of the e-scrappping activity. E-scrapppers employ specific methods depending on the demand of the buyers of valuable e-waste extracts and the type of e-waste that is recycled at a point in time. The extraction methods are explained briefly.

#### *Systematic extraction method*

The systematic method is used when the purpose is to preserve every part of the e-waste device. It involves the use of basic tools such as screwdrivers, tweezers and pliers for careful extraction of valuable materials. This method is often used on big e-waste devices such as computer Central Processing Units (CPU) and refrigerators. Figure 7 shows this method.



Figure 7 Systematic extraction of motherboard from a DVD device (Source: Omokaro)

Figure 7 shows an e-scrapper at Ikeja computer village systematically extracting valuable materials from a DVD device. A discarded computer monitor serves as a sitting support while his lap serves as the work table. This activity was carried out in a dilapidated row of building and this workspace is situated in a residential building. At the time of interview (2014), the e-scrapers had been told to leave the environment because the owner had sold the buildings to a private individual. Hence the reason for the setup as seen in the image.

#### *Smashing extraction method*

The smashing extraction method is used mostly on smaller e-waste devices. The purpose is to extract valuable materials such as gold and silver from hidden parts of the devices. This method is also used as a separation method, for instance to dislodge plastic from a piece of copper. Volume is very important in this case as valuable extracts such as gold and silver usually occur in small sizes. Figure 8 shows this extraction method.



Figure 8 Smashing extraction process (Source: Omokaro)

Figure 8 shows the smashing method carried out by two e-scrapers in Ikeja computer village (left) and Owode market (right). Both e-scrapers employ basic tools such as stone and hammer in this e-scraping process. The bare floor is used as a work table while feet serve as support for the e-waste device they are working on. After smashing, valuable materials such as copper are meticulously separated and stored in bags for sale to interested buyers.

*Mixture of smashing and systematic extraction*

This method involves a combination of smashing and systematic extraction method. It is often used on large and small devices alike. The tools used include bare hands, hammers, mallets and screwdrivers. To effectively manage the extraction process, e-scrapppers depend on their ability to recognize valuable components of in e-waste based on the characteristics that is presented. Utilizing industry news on manufacturing trends of electronic devices and possessing knowledge of demand inclinations in valuable extracts helps the e-scrapppers stay relevant in the e-waste management sector as well as in society.

The article concludes that attaining particular skills and professionalism in e-waste management, affords the e-scrapppers a certain level of positive societal recognition, specialization of skills and self-esteem, and provides an answer to research question 1.

### **5.3 Article III: Into the world of e-waste: mobility among e-scrapppers in Nigeria.**

This article addresses the aspect of mobility in e-waste management in Nigeria. Whether virtual or physical, mobility is an essential part of e-scrappping activities. By investigating the assemblage of things, such as road infrastructure, e-waste acquisition processes and social networks, the article provides insights into the mobility pattern of the e-scrapppers, thus answering research question 2. By being on the move constantly and actively participating in e-waste management, e-scrapppers prove their importance and relevance in the community and society.

*Mobility: Physical and virtual movement*

E-scrappping activities begin with either virtual or physical mobility. It is an indispensable aspect of e-scrappping - e-waste management as a whole. While providing economic stability, e-waste has the ability to mobilize e-scrapppers. However, the mobility of e-scrapppers is influenced by external and personal factors. These factors form the assemblage of things that enhances the ability of e-waste to be recognized by the e-scrapppers in the environment. It was discovered that e-scrapppers interviewed for this dissertation acquired their e-waste from private consumers, businesses, government institutions, importers of e-waste and electronic repairers. These acquisition channels influenced the use of mobile phones for transacting purchases of e-waste and the manner of physical mobility required. As an aspect of the external factors, accessibility to transport plays a significant role in the acquisition of e-waste and the exportation of extracted valuable materials. The e-scrapppers face the challenge of poor road infrastructure, flooded roads when it rains and increasing petrol prices, which influence the availability of transport. While these external factors cannot be controlled by the e-scrapppers, it was discovered that those interviewed were

able to derive alternative methods of mitigating these challenges by utilizing the tools offered by their social network (see figure 6 earlier in the text).

The issue of space also plays an important role in the mobility of e-scrapppers. Due to limited spaces at residential buildings and marketplaces, e-scrapppers are compelled to share and rotate their working and storage spaces. This results in the drive for quick turn over of extracted valuable materials. The prompt sale of valuable extracted materials ensured that storage spaces were freed up for new valuable materials. Additionally, where there is conflict between the e-scrapppers and the owners of the residential buildings, the e-scrapppers constantly moved from one location to another. Such movement creates a situation of coexistence of permanence and non-permanence. It was discovered that e-scrapppers' permanence occurred in locations like market places simply because they are institutionally owned while non-permanence occurred mostly in residential buildings which are often privately owned. The issue of permanence and non-permanence is discussed in depth in Article IV.

This article also shows that personal factors such as social contacts and formal educational experiences afford an advantage for e-scrapppers, helping them thrive in the business. For example, buyers of valuable extracts perceived e-scrapppers with formal educational experiences and credible social contacts with professional qualifications. This perception is heightened when the e-scrapppers show a certain viable level of knowledge in the e-scrappping processes.

#### **5.4 Article IV: Revisiting informal recyclers: understanding the organizational and operational paradigm of Nigerian e-scrapppers.**

In the academic arena, e-scrapppers have been studied as unorganized nomads devoid of any form of legality and structure (Chi, et al. 2010). E-scrapppers have been perceived as environmental deviants and as such should be discouraged and their activities abolished (Puckett, et al., 2005). However, based on data analysis and the theoretical approaches as presented above, it is revealed in this article that e-scrapppers in Nigeria operate in two main categories: as operators in an association or union, hereto referred to as unionized e-scrapppers, or as independent operators.

Figure 9 is a diagram illustrating the network and organizational structure of e-scrapppers in Nigeria. The figure presents data in a collection of nodes connected by lines in a condensed but detailed format. The nodes display the events, processes or actions of participants in the data (Miles, Huberman and Saldana 2014).

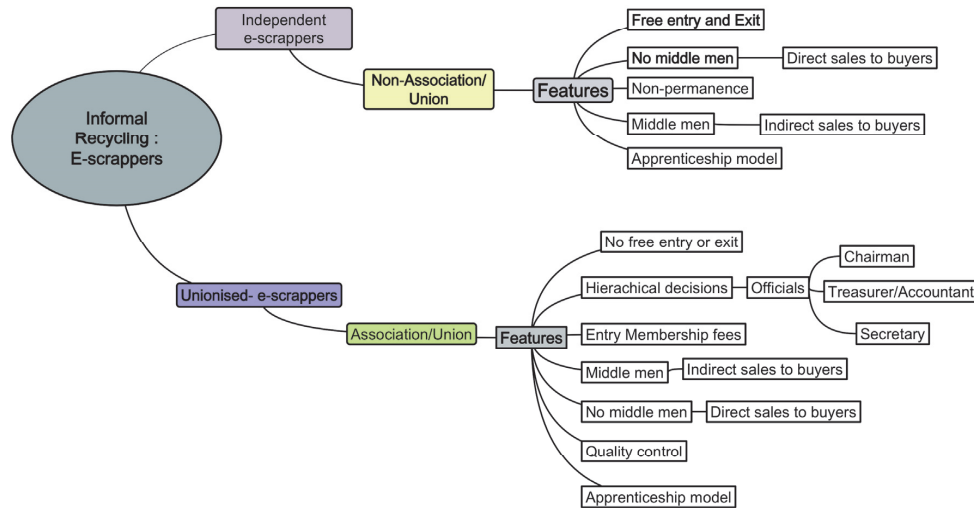


Figure 9 A network model showing the organizational structure of e-scrapppers in Nigeria (Omokaro, 2017)

Of the 29 e-scrapppers interviewed, 13 were unionized e-scrapppers while 16 were independent e-scrapppers. As shown in figure 9, e-scrapppers operate under two main structural and operational frameworks. Both assemblages of things possess peculiar characteristics that enhance their operations. Unionized e-scrapppers operate under an organizational structure that prevents free entry and exit into the market. Entry into the e-waste business as a union member incurs a membership fee that must be paid. Additionally, operational activities such as the quality of e-waste extracts and pricing is monitored by union officials.

As revealed in the article, the union officials place importance in providing quality extracts for buyers hence, e-scrapppers break this rule were often given, earning a hefty fine. The members were also required to pay taxes to the government and to ensure that they adhere to environmental rules and regulations. Although pricing of valuable e-waste extracts was regulated by union officials, e-scrapppers were free to sell directly to the buyers without the use of middle men or indirectly via the middle men. Due to the recognition unionized e-scrapppers enjoy from the government, they oftentimes benefit from a level of permanence which can be further enhanced by the location of their e-scrappping activities, e.g. marketplaces.

On the other hand, independent e-scrapppers enjoy free entry and exit into the market. However, they do not enjoy the same measure of protection the unionized e-scrapppers enjoy from the relevant stake holders such as e-waste buy-

ers. The independent e-scrapers, like their unionized counterparts, are free to sell valuable e-waste extracts via the middle men if they choose. Even though independent e-scrapers can often be found alongside the unionized e-scrapers in market places and residential buildings, they do not always enjoy the same level of permanence. This is largely attributed to the free entry and exit of the independent e-scrapers and the level of legality they can attain from the government institutions individually. Even though both assemblage can operate independent of each, they often rely on each other to carry out their activities successfully. This reflects the combination of the theoretical applications of the assemblage of things and the issuefication of things.

The study further revealed that unionized e-scrapers operate in established locations such as market places. Market places provide a certain level of permanence that is lacking in residential buildings. Thus, it was common to find unionized e-scrapers at market places and independent e-scrapers at residential buildings.

Though it appears to be unregulated, getting into professional e-scraping requires some proper training. Individuals may enter into it as part of a union or as independent e-scrapers, but there is a myriad of ways individuals can have run-ins with the laws if not properly trained. E-scrapers learn the profession of e-scraping through the apprenticeship model. The apprenticeship model is a process where an e-scrapper is schooled in the complexities involved in the business of e-waste, technical skills are developed, and social networks are built. The technical skills are an important aspect of e-scraping; it involves the recognition of valuable e-waste materials and the know-how for extracting them. Depending on learning abilities, individuals typically spend between three to two years learning the business from an experienced e-scrapper. At some agreed time, the e-scrapers are released by their trainers to carry out their e-scraping activities independently.

Reflecting on research question 2 (through what material and social mechanisms have e-scrapers thrived despite the negative environmental perception of their activities?), it can be deduced that the apprenticeship model is one channel through which e-waste and e-scrapers remain relevant in the overall management of e-waste. The model offers a solid foundation for learning the e-scraping business. It also fosters and preserves the transfer of knowledge from one generation to the next. Additionally, it provides invaluable knowledge on virtual and physical mobility. E-scraping activities begin with mobility. The e-scrapers interviewed were quite aware of the important role they played in e-waste management. The ability to virtually or physically engage with e-waste during e-waste acquisition presents the e-scrapers with a feeling of being valuable in the society. Workspaces for e-scraping was very paramount for the e-scraping. Achieving a place of permanence gave them stability, enhanced reputation, legality and a sense of belonging. However, the e-scrapers often experienced non-permanence when they are forced to relocate. This could be due to a number of factors including environmental controls, reconstruction or flood. In addition to feelings of displacement and non-permanence, it also had signifi-



cant impact on the overall e-scraping activity including volume of e-waste extracts obtained. The article further presented an extended network model that addresses integrational issues raised in the article (see Figure 10).

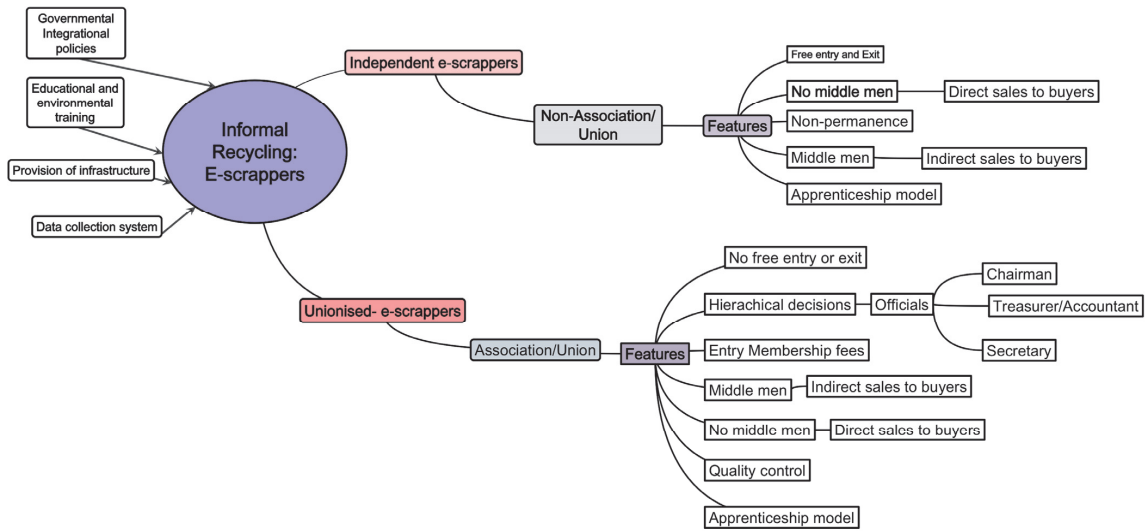


Figure 10 Proposed operational framework (Omokaro, 2017)

As a final outcome, the article proposes an extended operational framework that includes elements which ensure that e-scrapers are regarded as formal recycling operators in Nigeria. This pattern is presented as figure 10. The article proposes that while retaining the organizational and operational structure of the e-scrapers, relevant government institutions should encourage the provision of an integrated data collection system that will help to improve the positive growth of this sector. Also, provision of the relevant infrastructure would minimize the negative environmental impact of the e-scrapers’ activities and enhance the already developed capabilities and e-scraping processes.

## 6 DISCUSSION AND CONCLUSIONS

This dissertation set out to investigate the social and material interactions between e-scrapppers and e-waste in Nigeria by examining two main research questions:

1. How has e-waste gained recognition and remained relevant in both government and private spheres?
2. Through what material and social mechanisms has e-scrapppers thrived despite the negative environmental perception of their activities?

The articles presented answer the aforementioned questions by studying the mechanism through which e-waste becomes issuefied and gains recognition (Article I), the capabilities that interaction with e-waste bestows on the e-scrapppers (Article II), the ways e-waste mobilizes e-scrapppers (Article III) and the organizational and operational characteristics that e-scrapppers derive from interacting with e-waste (Article IV).

In responding to research question 1, the study argues that in Nigeria, consumers generally perceive e-waste as trash destined to be destroyed and forgotten (Article 1). Unlike societies such as Finland, the United States, the United Kingdom and other industrialized countries where there are strong systems of proper disposal of e-waste (Ylä-Mella, Pongrácz, Tanskanen, & Keiski, 2007), e-waste is very visible in Nigeria. The inadequate disposal methods enhance the visibility of waste in general and e-waste in particular (Osibanjo & Nnorom, 2008, Puckett, Adesanya, Davis & Saidu , 2005). However, for e-scrapppers, e-waste is lively matter; it is not just a source of livelihood, it is a medium of acquiring valuable capabilities and improving social mobility. This dissertation investigates the social material interaction between e-waste and e-scrapppers based on the premise that e-waste is vibrant matter capable of eliciting responses from other elements such as e-scrapppers within a host environment. The theories of assemblage of things in new materialism (Bennet, 2010) and the issuefication of things (Marres, 2014) in conjunction with the capability approach, open system theory and the mobilities paradigm was employed to examine the vibrant ability of e-waste. E-waste in its dormant state gives off

chemical reactions with its immediate environment. This reaction can be seen in the form of swollen batteries within the e-waste device or weathered casing of the e-waste device. At this stage, e-waste has not attained issuefication status because its reactions are not strong enough to cause significant changes amongst the society. However, in the hands of e-scrapppers, e-waste gains issuefication status when prolonged extraction activities, such as the use of smashing extraction method, lead to the pollution of land, water and air. This pollution elicits reactions from other actors such as residents in the environment. These reactions often result in public discourses of the negative impact of e-scrapppers' activities. Hence, when e-waste attains issuefication status through e-scrapppers' activities and the negative perception of e-waste and e-scrapppers by the community, e-waste gains recognition among relevant stakeholders and remains relevant in both government and private spheres of discourse.

In responding to research question 2, the study finds that e-scrapppers in Nigeria have often been characterized as uneducated, low income individuals who carry out e-scrappping as a last resort. They are generally perceived as environmental deviants, scavengers acting against existing environmental laws and regulations. While this perception may be true among the general informal recycling sector in the country, this study shows that e-scrapppers carrying out e-scrappping activities full time, adhere to the environmental laws and regulations. In fact, adherence to environmental rules and fulfilment of institutional obligations such as payment of taxes was an important prerequisite for the legalization of their activities. Additionally, it has been revealed in this study that e-scrapppers, whether operating as independents or unionized, are very organized in carrying out their e-scrappping activities. However, it is argued here that membership in a union enhanced e-scrapppers' chances of legitimacy and permanence.

Therefore, the ability of e-scrapppers to successfully organize themselves, operate within the confines of environmental regulations and perform obligatory institutional duties such as payment of tax has been significant factors in sustaining the presence of e-scrapppers in e-waste management in Nigeria. The e-scrapppers knowledge and ability to recognize value in e-waste also enhances their role in e-waste management.

Taking into consideration that technological advancement in the electronic industry will continue, the strategy of perceived obsolescence and planned obsolescence will ensure that there is continuous increase in consumer consumption. The implication for both the formal recycling industry and the e-scrapppers is that there will be corresponding movement of e-waste and e-waste extracts between the two sectors (Fleischmann, Krikke, Dekker & Flapper, 2000). Importantly, with the increase in internally generated e-waste in Nigeria (Borthakura & Govindb, 2016), more regulations are likely to be enacted, which could result in e-scrapppers' activities being deemed 'formal recycling'.

## 6.1 Applicability and policy implications

Nigeria has adequate and quite recent environmental laws and regulations for the management of e-waste (NESREA 2013). The regulations outlined in section three indicates that there is a strong basic policy structure already in place. As observed during fieldwork, what is lacking is the political will and provision of appropriate infrastructure to implement these regulations. Additionally, it was observed that cultural habits played a role in how e-waste and waste in general was handled by the e-scrapppers and government institutions. Nigerians do not sort waste. Electronic devices were either abandoned with electronic repairers, used as spare parts, resold or disposed in the main waste stream. Specifically, waste was generally perceived as trash and not a resource to be used for further creations. Unlike the e-scrapppers who recognize value in e-waste, the government institutions do not perceive e-waste as a resource that can be used to solve a host of other social and environmental problems. For example, the metal elements found in e-waste can be used to remanufacture steel sheets. Therefore, e-waste is an industry with promising opportunities for the e-scrapppers and other stakeholders.

Understanding the consumption and disposal behavior of Nigerians and acknowledging that e-scrapppers play a very significant role in e-waste management in Nigeria, especially with the lack of formal recycling plants, it is important that the activities of the e-scrapppers be fully integrated in national policies as proposed in the operational framework in figure 10. For instance, provision of a standardized policy framework for establishing a workspace, away from residential buildings and marketplaces will go a long way to mitigating the short and long term environmental impact of the e-scrappping process, such as dismantling e-waste devices on the bare floor. The standardized framework could also include provisions for e-scrappping in enclosed buildings equipped with proper aeration, an elevated workstation and sorting stations for valuable extracts. The elevated workstation will prevent the e-scrapppers from working on the floor while the sorting stations will ensure valuable extracts are categorized according to their types.

As observed during fieldwork, work safety monitoring was non-existent among e-scrapppers. Therefore, implementing the proposed operational framework in figure 10 could provide for storage of valuable extracts in enclosed spaces where exposure to environmental elements such as rain and sun is not possible. Also, standardized e-scrappping gear such as grip-hand gloves that offer friction for handling e-waste devices and face masks to prevent inhalation of particle e-waste dust become necessary. Furthermore, the leftover waste from the e-scrappping process is a concern that requires considerable attention. Is the leftover waste safe enough to be included in the main waste stream? Should it be discarded separately? What other uses can it satisfy? These questions deserve to be investigated and included in a policy framework designed to formally integrate e-scrapppers into the management of e-waste.

There is also the important question of how to acquire reliable data on the amount of e-waste generated and recycled in Nigeria. From fieldwork observations, Nigerian e-scrapppers generally do not record data on their activities. This is also true with government agencies tasked with disposal of general waste. Where data existed at all, it was for accounting purposes (see Article 3). Data on e-waste acquisition, recycling, valuable extracts acquired from the e-scrappping process and resale of such valuable extracts is especially important in today's technological world. It is important because it provides archaeological insights into the consumption of natural resources used in the manufacture of electronic devices and the evolution of chemical compounds housed in e-waste processing. This data would help in designing an effective and efficient educational and environmental programme, infrastructure specifically for the e-scrapppers and the leftover waste disposal system.

There is still a lot to be done to effectively and sustainably manage e-waste in Nigeria. It is important to acknowledge and understand that despite the unfriendly environmental practices, e-scrapppers have fashioned out a profession that is solving a problem and providing services to various stakeholders. Thus, moving forward sustainably in e-waste management requires a material and social understanding of the conditions influencing the activities of e-scrapppers and therefore integrating them into the environmental regulations is important.

## **6.2 Recommendation for further studies**

E-scrapppers play a significant role in the general management of e-waste in Nigeria, specifically in preventing significant amounts of e-waste from entering the main waste stream. Although this dissertation has been able to provide new perspectives into the activities of e-scrapppers, there is room for further research into other aspects of the overall e-scrappping business in Nigeria. For instance, it could be beneficial to conduct an in depth study of the inner workings of the association/unions formed by the e-scrapppers. Associations/unions usually possess knowledge of other stakeholders such as importers and buyers of valuable extracts involved in the e-waste business. Questions relating to the legitimacy of e-scrapppers activities, level of influence with relevant government agencies and the actual volume of e-waste e-scrappped could be investigated.

On the issuefication of e-waste, further research is needed in examining how many layers of issuefication e-waste can attain within an assemblage before it gains enough significant attention to result in policy changes. It would also be important to determine if or how this issuefication redefines the dynamics of relationships within the assemblages is of interest. Reflectively, it will be interesting to observe and record the continuous issuefication of e-waste and how the continuous changes positively or negatively influence the development and enactment of regulations affecting e-scrapppers activities.

As can be detected from the data collection, e-scrapppers interviewed for this study were men. Women were only present as care givers. Additionally, the e-scrapppers began e-scrappping quite early in life. This raises the issues of gender and child labor that would be interesting for future studies.

## REFERENCES

- Agamuthu, P., Kasapo, P., & Nordin, N. (2015). E-waste flow among selected institutions of higher learning using material flow analysis model. *Resource Conservation Recycling*, 105, 177–185.
- Akrich, M. (1992). The De-Description of Technical Objects. W. Bijker, & J. Law, *Shaping Technology / Building Society: Studies in Sociotechnical Change* (p. 205–224). Cambridge, Massachusetts: MIT Press.
- Aljazeera. (17. June 2011). *Environment: Q&A: E-waste goes to Post-recycling afterlife*. (B. Piven) Accessed 13<sup>th</sup> November, 2015. Retrieved from Aljazeera:  
<http://www.aljazeera.com/indepth/features/2011/06/2011615214124394643.html>
- American Mensa. (25. July 2004). They're Accomplished, They're Famous, and They're MENSANS. *American Mensa*, 476.
- Balde, C., Wang, F., Kuehr, R., & Huisman, J. (2015). The global e-waste monitor – 2014. *United Nations University*, 80.
- Baldé, C., Wang, F., Kuehr, R., & Huisman, J. (2015). *The global e-waste monitor – 2014*. Bonn, Germany: United Nations University, IAS – SCYCLE.
- BAN. (2011). *Basel Convention: Protocol on liability and compensation for damage resulting from transboundary movement of hazardous wastes and their disposal. Texts and Annexes*. Basel Convention. Switzerland: Basel Convention and UNEP.
- Barad, K. (2007). *Meeting the Universe Halfway: Quantum physics*. London: Duke University Press.
- Basel Action Network. (2011). *What is the Basel Ban?* Accessed 28<sup>th</sup> April, 2017. Retrieved from Basel Action Network:  
[http://archive.ban.org/about\\_basel\\_ban/what\\_is\\_basel\\_ban.html](http://archive.ban.org/about_basel_ban/what_is_basel_ban.html)
- Basel Convention. (22. March 1989). *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal*. Chemin des Anémones, Châtelaine, Switzerland.
- Basel Convention. (2011). *Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*. Accessed 28<sup>th</sup> April, 2017. Retrieved from Basel Convention: Control of Transboundary Movements of Hazardous Wastes and their Disposal:  
<http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx#enote1>
- Bastedo, M. N. (2006). Open Systems Theory. In F. W. English, *Encyclopedia of Educational Leadership and Administration* (p. 1264). California: SAGE Publications, Inc.
- BBC News. (19. March 1999). *Flying through the ages*. Accessed 26<sup>th</sup> January, 2017 Retrieved from BBC News:  
[http://news.bbc.co.uk/2/hi/special\\_report/1998/11/98/great\\_balloon\\_challenge/299568.stm](http://news.bbc.co.uk/2/hi/special_report/1998/11/98/great_balloon_challenge/299568.stm)
- Bennet, J. (2010). *Vibrant Matter*. Durham & London: University Press.

- Bennett, J. (2010). *Vibrant Matter: A Political Ecology of Things*. Durham and London: Duke University Press Books.
- Bhat, V., & Patil, Y. (2014). E-waste consciousness and disposal practices among residents of Pune city. *Procedia - Social and Behavioral Sciences*, 133, 491 – 498.
- Bożyk, P. (2006). Newly Industrialized Countries. In P. Bożyk, *Globalization and the Transformation of Foreign Economic Policy*. Hampshire: Ashgate Publishing, Ltd.
- Bonta, M., & Protevi, J. (2004). *Deleuze and Geophilosophy: A Guide and Glossary*. Edinburg: Edinburg University Press.
- Borthakura, A., & Govindb, M. (2016). Emerging trends in consumers' E-waste disposal behaviour and awareness: A worldwide overview with special focus on India. *Resource, Conservation and Recycling*, 117, 102-113.
- Briassoulis, H. (1999). Sustainable development and the informal sector: an uneasy relationship? *Journal of Environment and Development*, 8(3), 213–237.
- Brigden, K., Labanska, I., Allsopp, M., & Santillo, D. (2005). *Recycling of electronic waste in China and India: Workplace and environmental contamination*. Greenpeace. Amsterdam: Greenpeace International.
- Bulow, J. (November 1986). An Economic Theory of Planned Obsolescence. *The Quarterly Journal of Economics*, 101(4), 729-749.
- Ceballos, D. M., & Dong, Z. (2016). The formal electronic recycling industry: Challenges and opportunities in occupational and environmental health research. *Environment International*, 95, 157-166.
- Chaves, I., Engerman, S. L., & Robinson, J. A. (2014). Reinventing the Wheel: The Economic Benefits of Wheeled Transportation in Early Colonial British West Africa. *Africa's Development in Historical Perspective*, 321-365.
- Chi, X., Streicher-Porte, M., Wang, M. Y., & Reuter, M. A. (2010). Informal electronic waste recycling: A sector review with special focus on China. *Waste Management*, 31, 731–742.
- Coole, D., & Frost, S. (2010). *New Materialisms: Ontology, Agency, and Politics*. Durham and London: Duke University Press Books.
- Cooper, T. (2016). *Longer Lasting Products: Alternatives to The Throwaway Society*. London and New York: Taylor & Francis.
- Cossu, R., Salieri, V., & Bisinella, V. (2012). *Urban mining: a global cycle approach to resource recovery from solid waste*. Padova: CISA Publisher.
- Cresswell, T. (2006). *On the Move: Mobility in the Modern Western World*. New York: Routledge Taylor and Francis group.
- Creswell, J. W. (1998). *Qualitative Inquiry and Research Design: Choosing among Five Traditions*. Thousand Oaks, CA: SAGE Publications.
- Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd Edition). Thousand Oaks, CA: SAGE Publication, Inc.
- Dauids, K. (2012). *Religion, Technology, and the Great and Little Divergences: China and Europe Compared, C. 700-1800*. Netherlands: Brill.



- de Barros, H. (2006). Santos Dumont and the Invention of the Airplane. *Brazilian Ministry of Science & Technology and the Brazilian Centre for Research in Physics*, 24.
- DeLanda, M. (2006). *A New Philosophy of Society: assemblage theory and social complexity*. London & New York: Continuum.
- Deleuze, G., & Guattari, F. (1988). *A Thousand Plateaus: Capitalism and Schizophrenia*. London: University of Minnesota Press.
- Deleuze, G., & Guattari, F. (1993). *A Thousand Plateaus*. Minneapolis: University of Minnesota Press.
- Denzin, N. (2006). *Sociological Methods: A Sourcebook*. Aldine: Transaction Publishers.
- Douglas, M. (2001). *Purity and Danger: An Analysis of the Concepts of Pollution and Taboo*. London and New York: Routledge.
- Durrheim, K. (2008). Research design. In M. Blanche, K. Durrheim, & D. Painter, *Research in practice* (p. 33–59). Cape Town: UCT Press.
- Edwards, P. R. (2013). *Manufacturing Technology in the Electronics Industry: An introduction*. New York: Springer-Science Business Media.
- Emerson, L. (2014). *Reading Writing Interfaces from the Digital to the Bookbound*. Minneapolis, London: University of Minnesota Press.
- EU Directive. (2012). Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) (recast). *Official Journal of the European Union DIRECTIVE*, 197, 38.
- EU-Directive. (2011). Directive 2011/65/EU of the European Parliament and of the Council. *Official Journal of the European Union*, 88-110.
- Evenson, E. A. (2000). *The Telephone Patent Conspiracy of 1876: The Elisha Gray – Alexander Bell Controversy*. Jefferson, North Carolina: McFarland Publishing.
- Fantom, N., & Serajuddin, U. (1. December 2016). *Classifying countries by income: A new working paper*. Accessed 20<sup>th</sup> April, 2017. Retrieved from The World Bank: <http://blogs.worldbank.org/opendata/classifying-countries-income-new-working-paper>
- Fei, F., Qu, L., Wen, Z., Xue, Y., & Zhang, H. (2016). How to integrate the informal recycling system into municipal solid waste management in developing countries: Based on a China's case in Suzhou urban area. *Resources, Conservation and Recycling*, 110, 74-86.
- Fine, B., & Leopold, E. (1993). *The World of Consumption*. London: Routledge.
- Fleischmann, M., Krikke, H., Dekker, R., & Flapper, S. (2000). A characterization of logistics networks for product recovery. *Science Direct Omega*, 28(6), 653–66.
- Flick, U. (2014). *The SAGE Handbook of Qualitative Data Analysis*. Los Angeles and London: SAGE Publications Inc.
- Flor, A. G. (2002). Ethnovideography: video-based indigenous knowledge systems. Philippines

- Fortunati, L., & Taipale, S. (2017). Mobilities and the network of personal technologies: Refining the understanding of mobility structure. *Telematics and Informatics* 34 (2), 560-568.
- Fox, N. J., & Alldred, P. (2015). New materialist social inquiry: designs, methods and the research-assemblage. *International Journal of Social Research Methodology*, 18(4), 399-414.
- Freudendal-Pedersen, M., Hannam, K., & Kesselring, S. (2016). Applied mobilities, transitions and opportunities. *Applied Mobilities*, 2380-0135.
- Georg-August-Universität Göttingen. (ND). *Erster elektromagnetischer Telegraph der Welt über den Dächern von Göttingen (First electromagnetic telegraph in the world over the roofs of Göttingen)*. Retrieved from Georg-August-Universität Göttingen: <http://www.uni-goettingen.de/de/32448.html>
- Gerxhani, K. (2004). The informal sector in developed and less developed countries: a literature survey. *Public Choice*, 120(3-4), 267-300.
- Golev, A., & Corder, G. D. (2017). Quantifying metal values in e-waste in Australia: The value chain perspective. *Minerals Engineering*, 107, 81-87.
- Golinska, P., & Romano, C. A. (2012). *Environmental Issues in Supply Chain Management: New Trends and Applications*. New York Dordrecht London: Springer Heidelberg.
- Goosey, M. (2009). Introduction and Overview of E-waste. In R. E. Hester & R. M. Harrison, *Electronic Waste Management: Design, Analysis and Application* (p. 11). Cambridge: Royal Society of Chemistry.
- Gopakumar, G. (2016). Social Life of a Bus. *Journal of Video Ethnography*, 3(1), 0.
- Guerrero, S. H. (1992). *Inception Report for Improving the Implementation of Environmental Impact Assessment*. Philippines: Asian Development Bank.
- Guha-Khasnobis, B., Kanbur, R., & Ostrom, E. (2006). Beyond formality and informality. In B. Guha-Khasnobis, R. Kanbur & E. Ostrom, *Linking the Formal and Informal Economy: Concepts and Policies* (p. 1-4). New York: Oxford University Press.
- Hart, K. (1970). Small scale entrepreneurs in Ghana and development planning. *Journal of Development Studies*, 6(4), 104-120.
- Heath, C., Hindmarsh, J., & Luff, P. (2010). *Video in Qualitative Research: Analysing Social Interaction in Everyday Life*. London, UK: SAGE publications Ltd.
- Herat, S., & Agamuthu, P. 2. (2012). E-waste: a problem or an opportunity? Review of issues, challenges and solutions in Asian countries. *Waste Management & Research*, 30(11), 1113-1129.
- Hieronymi, K., Kahhat, R., & Williams, E. (2013). *E-waste Management: From Waste to Resource*. New York and London: Routledge Taylor & Francis Group.
- Holmes, I. (2009). Dumping, Burning and Landfill. In R. Hester & R. Harrison, *Electronic Waste Management: Design, Analysis and Application*. (p. 263). Cambridge, UK: The Royal Society of Chemistry.

- Jarzabkowski, P., & Kaplan, S. (8. May 2014). Strategy Tools-in-Use: A Framework for Understanding 'Technologies of Rationality' in Practice. *Strategic Management Journal*, 36(4), 537-558.
- Jensena, O. B., Lannga, D. B., & Winda, S. (2016). Mobilities design – towards a research agenda for applied mobilities research. *Applied Mobilities*, 26-42.
- Joe, W. (2012). *E-Waste Gold - Recovery of Gold & Other Precious Metals from Electronic Waste (Surplus Secrets)*. Frontier Marketing.
- Kahhat, R., Hieronymi, K., & Williams, E. (2013). *E-waste Management: From Waste to Resource*. London and New York: Routledge Taylor & Francis Group.
- Kellerman, A. (2012). *Daily Spatial Mobilities: Physical and Virtual*. Surrey, England: Ashgate Publishing Limited.
- Kettering, C. F. (1947). Thomas Midgley Jr. 1889–1944. *National Academy of Sciences*, 24, 359–380.
- Khokhar, T., & Serajuddin, U. (16. November 2015). Should we continue us term developing world? Accessed 18<sup>th</sup> April, 2017. Retrieved from The World Bank: <http://blogs.worldbank.org/opendata/should-we-continue-use-term-developing-world>
- King, P. (2010). The First Shropshire Railways. In B. G, & G. Boyes, *Early Railways 4: Papers from the 4th International Early Railways Conference 2008* (p. 70–84). Sudbury: Six Martlets.
- Knoblauch, H., Tuma, R., & Schnettler, B. (2014). *Videography: Introduction to Interpretive Videoanalysis of Social Situations*. New York: Peter Lang GmbH, Internationaler Verlag der Wissenschaften.
- Knoblauch, H., Tuma, R., & Schnettler, B. (2015). *Videography: Introduction to Interpretive Videoanalysis of Social Situations*. Oxford: PL Academic Research.
- Kreibe, S. (2013). Current and new electronic waste recycling technologies. In K. Hieronymi, R. Kahhat, & E. Williams, *E-waste Management: From Waste to Resource* (pp. 25-48). London: Routledge: Taylor and Francis.
- Krippendorff, K. (2013). *Content Analysis: An Introduction to its Methodology*. London: SAGE Publications.
- Kumar, A., Holuszko, M., & Croce Romano Espinosa, D. (2017). E-waste: An overview on generation, collection, legislation and recycling practices. *Resources, Conservation and Recycling*, 122, 32-42.
- Lagos State Government. (15. January 2016). *About Lagos State*. Accessed 29<sup>th</sup> April 2017. Retrieved from Lagos State Government: <http://lagosstate.gov.ng/about-lagos/>
- Landers, T. L., Browne, W. D., Fant, E. W., & Malstrom, E. M. (1994). *Electronics Manufacturing Processes*. Switzerland: Pearson.
- Latour, B., & Weibel, P. (2005). *Making Things Public: Atmospheres of Democracy*. Masschusettes: The MIT Press.
- Lejano, R. P., & Stokols, D. (6. March 2013). Social ecology, sustainability and economics. *Ecological Economics*.

- Leonard, A., & Conrad, A. (2010). *The Story of Stuff: How our obsession with Stuff is trashing the Planet, our Communities and our Health - and a Vision for Change*. New York: Free Press.
- Lepawsky, J. (2015). Electronic Waste. *International Encyclopedia of the Social & Behavioral Sciences (Second Edition)*, 364-373.
- Letcher, T. M., & Vallero, D. A. (2011). *Waste: A Handbook for Management*. Burlington, MA: Academic Press.
- Loeb, A. (1995). Birth of the Kettering Doctrine: Fordism, Sloanism and Tetraethyl Lead. *Business and Economic History*, 24(2), 72-87.
- Mahoney, M. L., & Tang, T. (2017). *Strategic Social Media: From Marketing to Social Change*. West Sussex: John Wiley & Sons, Inc.
- Mallawarachchi, H., & Karunasena, G. (2012). Electronic and electrical waste management in Sri Lanka: suggestions for national policy enhancements. *Resources Conservation Recycling*, 68, 44-53.
- Marres, N. (2014). The environmental teapot and other household objects: reconnecting the politics of technology, issues and things. In P. Harvey, E. C. Casella, G. Evans, H. Knox, C. McLean, E. B. Silva, K. Woodward. *Objects and Materials: A Routledge Companion* (p. 260). London and New York: Routledge: Taylor & Francis Group.
- Marres, N., & Rogers, R. (2005). Recipe for Tracing the Fate of Issues and Their Publics on the Web. In B. Latour, & P. Weibel, *Making Things Public: Atmospheres of Democracy* (p. 922). Karlsruhe/Cambridge, Massachusetts: ZKM/MIT Press.
- McLaughlin, M. W., & Talbert, J. E. (2001). *High School Teaching in Context*. Chicago: University of Chicago Press.
- McPherson, S. (2009). *Tim Berners-Lee: Inventor of the World Wide Web*. Minneapolis, Minnesota, United States: Twenty-First Century Books.
- Michael, B. L. (2001). *The automobile in American history and culture: a reference guide*. London: Greenwood Publishing Group.
- Michaud, V. (2014). Mediating the Paradoxes of Organizational Governance through Numbers. *Organization Studies*, 35(1), 75-101.
- Miles, M. B., Huberman, M. A., & Saldana, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook* (3rd Edition). United States: SAGE Publications, Inc.
- Model, D., & Model, L. (2010). *Selling Out: Consuming Ourselves to Death*. Bloomington: Author House.
- Morse, J. M. (1994). Designing funded qualitative research. In N. K. Denzin & Y. S. Lincoln. *Handbook of qualitative research* (2nd Edition). Thousand Oaks, CA: SAGE Publication, Inc.
- Mulcahy, D. (2012). Affective assemblages: Body matters in the pedagogic practices of contemporary school classrooms. *Pedagogy, Culture & Society*, 20, 9-27.
- Murphy, S. F., Jeremy, G., & Randolph, K. (2013). Evaluating the performance of recycling systems: Examples of North American and European Electronics Recycling Systems. In H. Klaus, K. Ramzy, & W. Eric, *E-waste Management:*

- From Waste to Resource* (p. 115). London & New York: Routledge Taylor & Francis Group.
- Nakamura, T., & Halada, K. (2014). *Urban Mining Systems*. Japan: Springer.
- National Population Commission, Nigeria. (2017). *Nigeria's population now 182 million – NPC*. Accessed 15<sup>th</sup> March 2017. Retrieved from National Population Commission, Nigeria:  
<http://www.population.gov.ng/index.php/80-publications/216-nigeria-s-population-now-182-million-dg-npopc>
- NESREA. (19. April 2013). *Guide for Importers of Used Electrical and Electronic Equipment into Nigeria*. Retrieved from env.go:  
[https://www.env.go.jp/recycle/yugai/reg/nigeria\\_20130419\\_2.pdf](https://www.env.go.jp/recycle/yugai/reg/nigeria_20130419_2.pdf)
- NESREA. (16. January 2016). *About Us*. Accessed 28<sup>th</sup> April 2017. Retrieved from NESREA: <http://www.nesrea.gov.ng/about/index.php>
- Nnorom, I. C., & Oladele, O. B. (2007). Electronic waste (e-waste): Material flows and management practices in Nigeria. *Waste Management*, 28, 1472–1479.
- Norris, L. (2010). *Recycling Indian Clothing: Global Contexts of Reuse and Value*. Bloomington, Indiana: Indiana University Press.
- Nussbaum, M. (1988). Nature, Functioning and Capability: Aristotle on Political Distribution. *Oxford Studies in Ancient Philosophy (Supplementary Volume)*, 6, 145–84.
- Nussbaum, M. (1995). Human capabilities, female human being. In N. M.C., & G. J, *Women, Culture, and Development: A Study of Human Capabilities* (p. 61–105). Oxford, New York: Clarendon Press: Oxford University Press.
- Nussbaum, M. (2013). *Creating Capabilities The Human Development Approach*. Cambridge: Belknap Press.
- O'Brien, M. (1999). Rubbish values: Reflections on the political economy of waste. *Science as Culture*, 8(3), 269 - 295.
- Ogungbuyi, O., Nnorom, I. C., Osibanjo, O., & Schlupe, M. (2012). *e-Waste Country Assessment*. Basel Convention, e-Waste Africa project of the Secretariat of the Basel Convention. Switzerland: Basel Convention.
- Omokaro. (2017). Into the World of E-waste: Mobility among E-scrappers in Nigeria. *Journal of Applied Mobilities*.
- Omokaro Ideho, B. (2016). Building capabilities among E-scrappers in Informal Electronic waste management: the case of the Nigerian E-scrappers. *Environmental Sociology Journal*, 2325-1042.  
 doi:10.1080/23251042.2016.1155791
- Omokaro, B. (2017). The Issuefication and Assemblage of Things in E-waste Management: A Methodological Approach. *Manuscript Submitted for Publication at Journal of Sociological Forum*.
- Omokaro, Ideho, B. (2017). Revisiting Informal Recyclers: Understanding the Organizational and Operational Paradigm of Nigerian E-scrappers. *Manuscript Submitted for publication and under review at Journal of Current Sociology*

- Ongondo, F., Williams, I., & Cherrett, T. (2011). How are WEEE doing? A global review of the management of electrical and electronic wastes. (31), 714–730.
- Osibanjo, O., & Nnorom, I. C. (2008). Material flows of mobile phones and accessories in Nigeria: Environmental implications and sound end-of-life management options. *Environmental Impact Assessment Review*, 28(2-3), 198–213.
- Oudshoorn, N., & Pinch, T. (2005). *How Users Matter: The Co-Construction of Users and Technology (Inside Technology)*. Massachusetts: The MIT Press.
- Perkins, D. N., Drisse, M.-N. B., Nxele, T., & Sly, P. D. (2014). E-waste: A Global Hazard. *Annals of Global Health*, 80(4), 286–295.
- Pink, S. (2013). *Doing Visual Ethnography*. Los Angeles and London: SAGE Publication Inc.
- Pope, K. (2017). *Understanding Planned Obsolescence: Unsustainability Through Production, consumption and waste generation*. London: Kogan Page Ltd.
- Porges, N. (1960). Newer Aspects of Waste Treatment. In U. W. Wayne, *Advances in Applied Microbiology* 2 (2). New York and London: Academic Press.
- Puckett, J., Adesanya, O., Davis, I., & Saidu, Y. (2005). *The Digital Dump: Exporting Reuse and Abuse to Africa*. Seattle: The Basel Action Network.
- Puckett, J., Westervelt, S., Byster, I., Davis, S., Dutta, M., Hussain, A., & Gutierrez, R. (2002). *Exporting Harm: The High-Tech Trashing of Asia*. Seattle: The Basel Action Network(BAN) and Silicon Valley Toxics Coalition (SVTC).
- Qizilbash, M. (2008). The Capability Approach: Concept, Measures and Applications. In Qizilbash Alkire, & Comim, *Amartya Sen's capability view: insightful sketch or distorted picture?* (p. 53–81). Cambridge: Cambridge University Press.
- Rinkesh. (ND). *World's top 10 worst toxic pollution problems*. Accessed 29<sup>th</sup> January 2017 Retrieved from Conserve Energy Future: <http://www.conserve-energy-future.com/top-10-worst-toxic-pollution-problems.php>
- Robeyns, I. (2005). The capability approach: a theoretical survey. *Journal of Human Development*, 6, 93–114.
- Robinson, B. H. (2009). E-waste: An assessment of global production and environmental impacts. *Science of the Total Environment*, 183-191.
- Rothbauer, P. (2008). Triangulation. In L. Given, *The SAGE Encyclopedia of Qualitative Research Methods* (p. 892-894). Los Angeles and London: SAGE Publications.
- Rujanavech, C., Lessard, J., Chandler, S., Shannon, S., Dahmus, J., & Guzzo, R. (2016). *Liam - An Innovation Story*. Cupertino: Apple Inc.
- Saiz-Álvarez, J. (2016). *Handbook of Research on Social Entrepreneurship and Solidarity Economics*. Spain: IGI Global.

- Schaeffer, J. H. (1995). Videotape: New Techniques of Observation and Analysis in Anthropology. In P. Hockings, *Principles of Visual Anthropology* (s. 255). Berlin: Mouton de Gruyter.
- Schluep, M., Ogungbuyi, O., Nnorom, I. C., & Osibanjo, O. (2012). *e-Waste Country Assessment Nigeria*. e-Waste Africa project of the Secretariat of the Basel Convention. Switzerland: Basel Convention.
- Schneider, F., & Enste, D. (2003). *The Shadow Economy: An International Survey*. Cambridge, UK: Cambridge University Press.
- Scott, R. W. (2002). *Organizations: Rational, natural, and open systems*. Upper Saddle River, NJ: Prentice Hall.
- Sen. (1992). *Inequality Re-examined*. Oxford: Clarendon Press.
- Sen. (1993). Capability and Well-being. In A. Sen, & Nussbaum, *The Quality of Life* (p. 30-53). Oxford: Clarendon Press.
- Sen, A. (2010). *The Idea of Justice*. London: Penguin Books.
- Sen, A. K. (1990). Justice: Means versus Freedoms. *Philosophy and Public Affairs*, 2(19), 111-121.
- Sheller, M., & Urry, J. (2006). The new mobilities paradigm. *Environment and Planning*, 207-226. doi:10.1068/a37268
- Sheller, M., & Urry, J. (2016). Mobilizing the new mobilities paradigm. *Applied Mobilities*, 1(1), 10-25.
- Skirmantė 2015. 23 Creative Ways To Reuse Old Plastic Bottles. Accessed: 29<sup>th</sup> April 2017.
- Songa, Q., Wanga, Z., & Lib, J. (2013). Sustainability evaluation of e-waste treatment based on energy analysis and the LCA method: A case study of a trial project in Macau. *Ecological Indicators*, 30, 138-147.
- Stake, R. (2005). Qualitative case studies. In N. Denzin, & Y. S. Lincoln, *The sage handbook of qualitative research* (p. 433-466). Thousand Oaks, CA: SAGE Publication Inc.
- Standaert, M. (17. December 2015). *China's Notorious E-Waste Village Disappears Almost Overnight*. Accessed 20. April 2017 Retrieved from Bloomberg News: <http://www.bna.com/chinas-notorious-ewaste-n57982065266/>
- Step Initiative. (3. June 2014). *What is e-waste?* Accessed 3. October 2015 Retrieved from Step-Solving the e-waste problem: <http://www.step-initiative.org/what-is-ewaste.html>
- Taipale, S. 2016. Do the mobile-rich get richer? Internet use, travelling and social differentiations in Finland. *New Media & Society* 18 (1), 44-61.
- Taylor, S., & Bogdan, R. (1984). *Qualitative research methods*. New York, NY: John Wiley.
- Terazono, A., & Yoshida, A. (2013). Current International Trade in Electronic waste: An Analysis of International Agreements and National Policies in Asia. In K. Hieronymi, R. Kahhat, & E. Williams, *E-Waste Management: From Waste to Resource* (s. 137). London and New York: Routledge Taylor & Francis Group.
- The African Union Commission. (30. January 1991). Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary

- Movement and Management of Hazardous Wastes within Africa. Addis Ababa, Addis Ababa, Ethiopia.
- The Economist. (21st. July 2014). *Where gadgets go to die*. Accessed 16. January 2016 Retrieved from <http://www.economist.com/blogs/babbage/2014/07/difference-engine-1>
- Tuma, R., Knoblauch, H., & Schnettler, B. (2014). Video Analysis and Videography. In U. Flick & U. Flick, *The Sage Handbook of Qualitative Data Analysis* (s. 435). London: SAGE Publications Ltd.
- UNICEF. (2013). *UNICEF Annual Report 2013 - Nigeria*. Nigeria: UNICEF.
- UNODC. (2013). Transnational Organized Crime in East Asia and the Pacific. *United Nations Office on Drugs and Crime*, 192.
- Wang, F., Huisman, J., Meskers, C. E., Schlupe, M., Stevels, A., & Hagelüken, C. (2012). The Best-of-2-Worlds philosophy: Developing local dismantling and global infrastructure network for sustainable e-waste treatment in emerging economies. *Waste Management*, 32, 2134–2146.
- Wang, F., Huisman, J., Stevels, A., & Baldé, C. P. (2013). Enhancing e-waste estimates: Improving data quality by multivariate Input–Output Analysis. *Waste Management*, 33(11), 2397–2407.
- Waugh, D. (2000). Manufacturing industries (chapter 19), World development (chapter 22). In D. Waugh, *Geography, An Integrated Approach* (3rd Edition p. 563, 576–579, 633, and 640). Delta place, United Kingdom: Nelson Thornes Ltd.
- Widmer, R., Oswald-Krapf, H., Sinha-Khetriwal, D., Schnellmann, M., & Böni, H. (2005). Global perspectives on e-waste. *Science Direct: Environmental Impact Assessment Review*, 436-458.
- Wiener, N. (1954). *The Human Use of Human Beings: Cybernetics and Society*. Garden City, NY: Doubleday Anchor.
- William, L. (2007). *Fundamentals of Geophysics*. London: Cambridge University Press.
- Wilson, D. e. (2001). *Strategic Planning Guide for Municipal Solid Waste Management*. Washington, DC: World Bank.
- Woolard, D. L., Loerop, W. R., & Micheal, S. S. (Toim.). (2003). *Terahertz Sensing Technology, Vol. 1: Electronic Devices and Advanced Systems Technology (Selected Topics in Electronics & Systems, Vol. 30)* (Osa/vuosik. 30). New Jersey, London, Singapore, Hong kong: World Scientific.
- Ylä-Mella, J., Pongrácz, E., Tanskanen, P., & Keiski, R. L. (2007). Environmental Impact of Mobile Phones: Material Content. *International Conference on Solid Waste Technology and Management* (s. 6). Philadelphia: Solid Waste Org, 1-7.
- Zimring, C. A., & Rathje, W. L. (2012). *Encyclopedia of Consumption and Waste. The Social Science of Garbage, Volume 1*. Los Angeles and London: SAGE Publication, Inc.



## APPENDIX 1

### Fieldwork questions for Ibadan/Lagos

*Target interviewees:* e-scrapppers

*Interviewer:* Benedicta Ideho Omokaro  
University of Jyväskylä  
Finland.

#### Semi structured questions:

##### *Preliminary questions*

- Can you tell your name?
- How old are you?
- How long have you been doing this business?

##### *Collection process*

- How do you acquire e-waste?
- How do you handle e-waste?
- On average, what volume of e-waste do you collect per day

##### *Recycling process*

- Are there manual or automatic operations involved in the recycling process? If there are, what are they?
- What happens to e-waste after it gets to you?
- What do you do with the extracted materials from e-waste

##### *Qualifications/requirements*

- Do you have any formal training in recycling e-waste?
- How do you know how to extract materials from e-waste?

##### *Laws*

- Are you aware of any laws or regulations regarding recycling of e-waste?
- What are they?
- How do these laws affect you in recycling e-waste?
- What health hazards do you experience?

##### *Collaboration/networking*

- Is there any e-waste association (s)?
- Do you belong to any?
- if there are, how did you know about them
- How do they affect your interaction with e-waste?

***Social and economic impact***

- What environmental risks or implications of recycling e-waste do you have in your environment.
- What challenges do you face in terms of recycling e-waste?
- What opportunities have you experienced?
- From the economic point of view, do you think recycling e-waste is a sustainable business?
- What economic challenges do you face in recycling e-waste?
- What effects does the material in e-waste have on you?
- What does your family and community think of your e-scraping?

***Knowledge***

- What is e-waste to you?
- Have you gained any kind of knowledge while e-scraping e-waste
- What are they?

**ORIGINAL PAPERS**

**I**

**THE ISSUEFICATION AND ASSEMBLAGE OF THINGS IN E-  
WASTE MANAGEMENT: A METHODOLOGICAL APPROACH**

by

Benedicta Ideho Omokaro, 2017

Submitted for publication and  
under review at the Journal of Sociological Forum

*Benedicta Ideho Omokaro*  
*Department of Social Sciences and Philosophy*  
*University of Jyväskylä, Jyväskylä, Finland*  
*Keskussairaalan tie 2*  
*P.O.Box 35*  
*40014*  
*[benedicta.ideho@jyu.fi](mailto:benedicta.ideho@jyu.fi)*

## **The Issuefication and Assemblage of Things in E-waste Management: A Methodological Approach**

### **Abstract**

This article contributes to the evolving studies on assemblages of things in new materialism and its application in e-waste management research. It examines e-waste as issuefied matter. Issuefied matter is matter capable of constantly eliciting positive and negative reactions. Consequently, it invokes and influences political and social discourses within an assemblage of things. Accordingly, the object can be recognised as issuefied only if its reactions with other elements within the assemblage of things invokes significant change(s) inside the environment. E-waste management is investigated from the perspective of agency, which investigates how relationships between human and non-human subjects in the assemblages of things are affected by their environment. This study proposes a conceptual framework based on recommended symbiotic relationship between the assemblage of things and the issuefication of things. Example(s) gotten from data collected and analysed from Nigerian e-scrapppers is used to understand this symbiotic relationship.

Keywords: e-waste, issuefication, informal recyclers, assemblage of things, Nigeria

### **1. Introduction**

Our world is increasingly modified by the continuous presence of electronic devices. Growing dependence on these devices pushes the boundaries of technological advancements. But, increase in technological advancements also implies an increase in consumption of new products accompanied by a rapid obsolescence of the old (Aro and Wilska, 2014). Every electronic device is deliberately equipped with a visual and functional appeal. But encased in these desirous electronic devices is a cocktail of toxic metals unsuitable for humans, animals and the environment. Unlike the immediate visual and negative impact of other solid waste such as exposed bio-waste, the aesthetic design and slow degrading nature of exposed e-waste in the environment can sometimes go unnoticed. How then is e-waste gaining significant recognition in the society so that it is taken seriously? By what means has the social, political and environmental issues it

evokes been engrained in policies? This study seeks to provide a conceptual framework to consider these questions by employing the theories of assemblage of things (Bennett, 2010) and issuefication of things (Marres, 2014) in new materialism. This methodological article argues that the self-organising ability of e-waste can be revealed by the combined application of the assemblage of things and the issuefication of things as relevant dimensions of new materialism.

By acknowledging the relationship between the assemblage of things and the issuefication of things, new materialism is presented as a more viable methodological tool for studying different social issues related to e-waste management and beyond.

Since the emergence of new (or neo) materialism, the very essence of matter and its capacities and abilities have been the focus of attention in the academic sphere (Mellström, 2004, Thomas, 1991, Coole and Frost, 2010, Dolphijn and van der Tuin, 2012, Sansi-Roca, 2005). It is a generic approach addressing current and emerging developments in various fields of materialism studies. Recent studies have sought to rethink and emphasize the subjectivity of non-human forces and the role they play in human daily activities (Barad, 2007, Liboiron, 2016 and Abrahamsson et al, 2015, Alaimo; Hekman and Hames-Garcia 2008, Connolly, 2013). The central focus of these studies is placed on the self-organising ability of objects to influence different relationships that arise between human and non-human relationships<sup>1</sup>.

Self-organising ability or capacity refers to the collective reactions of different elements within an environment. This is exemplified in the complex relationships and patterns in which e-waste management is organised in developing countries. So far, studies have only focused on the recycling processes and the environmental effects involved in e-waste (Hieronymi, et al., 2013, Kreibe, 2013, Hester and Harrison, 2009), hence paying little attention to the other factors which informs the self-organising capacity of e-waste. E-waste is matter capable of slowly releasing chemicals into its immediate environment (Balde, et al., 2015, Bhat and Patil, 2014, Brigden, et al., 2005, Chi, et al., 2010). For instance, left alone in a dark basement, the chemical attributes of e-waste can go unnoticed. E-waste can react with the dampness of the air or the absence of light by slowly discharging chemicals into the atmosphere. Therefore, the air, the absence of light and the basement contributes to the capacity of e-waste to self-organise and react with other human and non-human subjects in the basement.

From here on, the article is structured as follows. The section two discusses the vitality of matter and the assemblage of things in new materialism. In relation to self-organising ability and recognition of matter, section three introduces and elaborates upon the issuefication of things. Thereafter, section four delves into the dynamics between normative objects and scripted objects placing it within the issuefication of things approach. Section five examines the applicability of assemblage of things and issuefication of things in new materialism as a

---

<sup>1</sup> The terms 'objects', 'material' and 'matter' will be used interchangeably in this study. This is because in the field of new materialism, there is no a priori agreement as to the distinctive meanings of the terms.

methodological tool. Finally, in section six the study revisits the aforementioned questions of social recognition, policy consequences and changes e-waste management can evoke through feelings of discomfort and subsequent reactions from the humans in the environment. It discusses the combined applicability of assemblage of things and issuefication of things in new materialism. It also presents recommendations for further study.

## 2. The vitality of matter and the assemblage of things

In the academic discourse on new materialism, Jane Bennett's perspective presents visual representations of the symbiotic relationship of human and non-human organisms. This symbiotic, as used in this study, relationship denotes the close interaction and dependency of human and non-human organisms. According to Bennett (2010), new materialism refers to manmade items (matter), which have extended their state as objects to exhibit certain levels of independence outside the experience of humans. In addition to Bennett's definition, it is worthy of note that new materialism includes the interactions and reactions between humans and naturally occurring objects (Donna and Gerald, 1993, Coole and Frost, 2010). In e-waste management, such human interactions and naturally occurring objects includes mining gold and cobalt for production of electronic devices and the environmental effects and policy implications arising from the mining activities.

Bennett reflects that objects possess a certain measure of vitality and vibrancy which becomes interactive with its immediate environment. Vibrancy refers to the liveliness of matter in reaction to its environment. By "vitality" Bennett (2010) alludes to matter's ability to act as a combination of seemingly static and active agents with tendencies of their own. In the context of e-waste management, it implies the ability of e-waste to present itself as valuable matter demanding reaction and the ability of e-scrapppers to recognize valuable metals during a recycling process. E-scrapppers are individuals who recycle only e-waste. They collect, dismantle and sell valuable material extracts from e-waste (Omokaro, 2016). Therefore, in projecting the vibrancy of matter, e-scrapppers encounter e-waste not as trash, but as valuable resource propelling physical mobility (Omokaro and Taipale, 2017), in terms of e-waste acquisition, sale and workspace, as well as policy formulation, implementation and even social mobility. In this study, social mobility manifests itself as a slow but determined upward movement of e-scrapppers from the lowest strata of the society toward a higher degree of specialisation in the field of e-waste management (Higginbotham and Weber, 1992, Harris, 2008).

The active characteristic of matter does not, however, happen in a vacuum. It is activated by the assemblage of *'things'*, a network of heterogeneous groupings of elements, inherent in its environment. This assemblage of *'things'* are organisms forming relationships with one another in order to improve their power or activity. In other words, assemblage of things possesses the ability to self-organize thereby increasing its sphere of influence outside its immediate boundaries (Bonta and Protevi, 2004).

The notion 'assemblage' has its roots in the works of Deleuze and Guattari (1993), DeLanda, (2006) and Bennett (2010). It is the active elements inherent in an environment, which thrives as an independent system or a collective body regardless of other challenging elements within. The focus of assemblages is not on what human agents or objects are but rather on what capacities emerge from the interactions (Bennett, 2010). A classic example is Connolly's (2013) narrative of the Millennium Bridge - also nicknamed the 'wobbly bridge' by local residents - crossing the Thames River in London. The bridge was designed for pedestrians only. Whenever there was a light wind, the bridge responded by rocking to and fro gently; similar to the way a boat would sway gently in response to the waves of the sea. Pedestrians were unconsciously forced to adapt their walk to suit this movement. The relationship between the bridge, the weather elements and the pedestrians flowed seamlessly. Each adapting to the factors around them. However, an increase in the movement of the wind also results in a corresponding intense and often dangerous increase in the movement of the bridge almost causing it to collapse. The bridge was later modified so that this dangerous experience was no longer felt by the pedestrians or the bridge.

In this example, the bridge is a self-organising system; an assemblage of things born out of an interplay between the pedestrians, the wind and its movement. This shows that even if matter is inert in its vibrant nature and abilities to elicit reactions from its immediate environment, it requires the collective assemblage of other 'things' to be felt, noticed or acted upon.

### 3. Issuefied objects

Thinking about assemblages, we must reflect on the ways in which material objects gain active or passive recognition; that is, becoming charged with issues. Marres and Rogers (2005) call this the 'issuefication of things' referring to the process in which objects exude influences and come to obtain new meanings. The impact of these processes can be measured in terms of the chain of reactions and issues that is evoked (Oudshoorn and Pinch, 2005). Issuefied objects occur outwardly, eliciting responses from other entities outside its sphere. The response could be to eradicate the object in question, reposition it or accommodate it. For a while the issuefied object may seem innocuous but as it emits serious and communicable vibrancies, it provokes new reactions such that new identities, approaches and movement are formed (Latour and Weibel, 2005). New identity indicates the redefined role, attributes or perspectives the object gains after issuefication occurs.

An example which shows this ability to evoke reactions from within its environment is the open burning of e-waste as a method of extracting valuable materials. Open burning releases toxic metals into the soil and atmosphere. Globally, informal recyclers have been known to employ burning as a way of separating valuable materials such as copper and aluminium from e-waste.

For example, in Nigeria<sup>2</sup> the act of open burning involves a blazing pile of e-waste in an open courtyard or behind a residential building. The toxic fume released from this blaze is unchecked or unconfined. It floats freely in the atmosphere, finding its way into the homes of residents nearby. In the evening, the fumes settle in form of residues on exposed food, water, furniture and anything else within the environment. At first, this act could be ignored, but continuous burning results in highly polluted air, which in turn generates related illnesses such as respiratory issues, headaches and skin infections. Residents presenting with any of these illnesses would visit a hospital where the medical examination can confirm open burning as a relational cause. Therefore, the knowledge that their health issues are strongly related to environmental pollution caused by open burning of e-waste spreads among the residents. Consequentially, these attributes a negative connotation to e-waste and the e-scrapppers thus making e-waste an issuefied object.

Nigerian residents are quite vocal about the pollution of their environment so that this knowledge of the environmental dangers of open burning produces an outcry of environmental injustice. Eventually, the environmental agencies become involved and the e-scrapppers are either displaced or allowed to remain if they abstain from further open burning practices. Consequently, this method of recycling e-waste greatly informs the perception of e-scrapppers as environmental deviants. As such, property owners are unwilling to allocate workspace to the e-scrapppers. Hence, workspace which is an essential aspect of recycling activities is very limited and often shared by rotation. E-scrapppers require a fairly large amount of space for extracting valuable metals and storage of extracted metals. Often times, the e-scrapppers can only obtain workspaces among residential buildings, market places and unoccupied vacant land only if they promise not to burn or attract the attention of the environmental agencies. Therefore, strict adherence to the environmental laws and obtaining the good will of the local residents is an important part of the assemblage of things influencing the e-scrapppers success in e-waste management.

Reflectively, it can be seen that while e-waste may be regarded as trash, the very act of burning or deviations from environmental laws can be the driving force behind the negative reactions and perceptions the e-scrapppers receive within the society.

Hence, the self-organising capability of e-waste to invoke reactions from the e-scrapppers and the local residents is likely to produce a variety of responses, which in turn redefines how e-waste and e-scrapppers are perceived within the assemblage of things. First, it reinforces the identity of 'dirty, pollution and low income class' that has been associated with e-waste on the e-scrapppers. Secondly, the environmental agencies are propelled into action – instigating the implemen-

---

<sup>2</sup> To answer the aforementioned questions, data collected from 29 e-scrapppers at Ladipo market, Alaba International market, Owode market and Ikeja computer village in Lagos state and Ibiwe and Isihori both in Benin City, Edo state, Nigeria (Omokaro, 2016) will be used to exemplify the application of assemblage of things and issuefication of things. The data was collected between 2015 and 2016 using videography methods.



tation of environmental regulations that prohibits the open burning of e-waste. For the e-scrapers, these reactions have not only had a significant influence on the workspace made available to them, it has also forced them to be creative in deriving new methods of extracting valuable materials.

It can be deduced therefore that in the field of new materialism, there is a strong relationship or interplay between the assemblage of things and the issuefication of things. It is a symbiotic relationship – a strong interaction between two different organisms co-existing in proximity and sharing a common environment - as reflected in the examples of the bridge and e-waste open burning by the e-scrapers. This connection is not obviously visible in previous studies specifically in Noortje Marres (2014). In the symbiotic relationship between assemblage of things and issuefication of things in new materialism, matter moves from within the assemblage of things where its interactions with other elements inside the assemblage is visibly recognised by human organisms in the environment. This recognition facilitates the issuefication of things. In the example of the open burning of e-waste by the e-scrapers, the connection between assemblage of things and issuefication of things is shown by the feelings of discomfort and dissatisfaction invoked by the activities of the e-scrapers from within the assemblage of things. Consequently, e-waste is perceived as negative objects deserving immediate solutions such as enacting environmental regulations. Thus, e-waste gains issuefication status. Therefore, the connection occurs when an object is able to react strongly with other subjects within the assemblage of things such that it becomes issuefied enough to evoke actionable and implementable reactions from the humans in the environment.

Considering the symbiotic relationship of the two connected processes, it can be inferred that assemblage of things and issuefication of things are complementing dimensions of new materialism, which have been so far only separately discussed by Jane Bennett (2010) and Noortje Marres (2014) respectively. It is the premise of this study that these two conceptual frameworks should be treated as interconnected. Matter's vibrant nature can only become issuefied if its reactions within the assemblage of things in a given environment can be significantly felt or recognised by human organisms. On its own, an object lacks the capacity to invoke significant reaction from human organisms within its environment. However, in response to other elements within the assemblages of things, matter is able to evoke significant responses which in turn facilitates its issuefication. To delve deeper into the conceptual framework of issuefication of things, we must further investigate the connection and movement of matter between assemblage of things and issuefication of things.

#### **4. Dynamics between normative objects and scripted objects**

To be regarded as an issuefied object, e-waste as matter must experience a process where its purpose is redefined from its normative nature to scripted nature. In other words, to fit into the world of new materialism, an object must possess the capacity to move between the assemblage of things where it functions as a part of a system and the issuefication of things where it attains and evokes new

identities. As shown in the example of the e-waste open burning and the Millennium Bridge, matter can perform functions other than that which it was created for. Recalling the example of e-waste open burning, once discarded, e-waste is regarded as trash meant for total destruction. But in the hands of e-scrapppers, e-waste evokes positive and negative imagery. On one hand, it is a valuable resource for precious metals needed for the manufacturing of electronic devices. On the other hand, it is a haven for dangerous health related chemicals. This dual, functional nature implies that e-waste can be normative or scripted (Akrich, 1992, Marres, 2005).

According to Marres (2014) normative objects are objects designed to serve the basic functions for which they are built. They are normative in so far as they are able to project particular roles on a subject such as properly taking e-waste to a designated site or recycling plant instead of mixing it with other forms of waste. Normative objects also possess the ability to create new attributes, meanings and interpretations through their natural functions. In other words, normative objects can become scripted. Marres' analysis and utilization of normative objects and scripted objects does not provide a clear distinction between the two.

Popularized by Akrich (1992), matter attains the attributes of scripted object when its normative intended use becomes redefined by the environment and human elements. Scripted objects, refers to objects that are able to evoke a range of issues such that the impact of such issues possess a significant social, economic and political impact on subjects (Marres, 2014). In Akrich's extensive discuss on scripted objects, it can be deduced that indeed, normative objects and scripted objects are two opposite ends of a continuum. Though at opposite ends, the relationship and interactions between normative objects and scripted objects is so closely related that they are indeed not easily distinguishable from the other.

E-waste provides an interesting platform for understanding the movement from normative to scripted. In current environmental discourses, e-waste is globally gaining both positive and negative attention (Wang, et al., 2012, Puckett, et al., 2005). E-waste functions as a kind of symbolic object used to invoke a variety of interconnected but disparate issues such as environmental degradation, dangerous health effects, and social stratification. It functions as lively matter which does not only come about after the phase of final consumption but as vivid object living through an eventful life after its alleged 'end-of-life'.

Once an electronic device is discarded as trash by a consumer, its normative function of 'dirt' or 'waste' becomes scripted. In Nigeria where formal recycling plants is almost non-existent, data analysis from the e-scrapppers (Omokaro, 2016), revealed that normative e-waste gains its scriptedness in the hands of e-scrapppers where it is transformed from trash to spare parts for electronics repair or valuable resource for manufacturers of electronic devices. Additionally, the processes of extracting valuable materials gain significant attention from the environmental agencies so that new social, economic and environmental policies are formed. Such policies could include the ban on importation of electronic de-

vices containing prohibited materials such as lead, cadmium and mercury (Hwang, 2004) or the prohibition of open burning of e-waste by the e-scrapppers.

Reflecting on the open burning of e-waste by e-scrapppers, it therefore indicates that the activities within the assemblage of things determines how e-waste as normative objects becomes scripted objects. Most importantly, objects become scripted in so far as it is able to project issues resulting in political and/or social change. Additionally, objects such as e-waste which derives its power to react as part of the assemblage of things can become part of the issuefication of things if it gains recognition from the human organisms within the larger environment. Therefore, I propose a reconsideration of the connection between the assemblage of things and the issuefication of things that is illustrated in Figure 1. In this new model, I argue that matter in its normative form reacts with other elements within the assemblage of things. Consequently, it becomes issuefied and gains scriptedness. In this state, the scripted matter is reabsorbed into the assemblage of things where its new scripted nature strongly influences the activities of the other elements within the assemblage of things. Thus, the new scripted nature becomes the normative function of the assemblage of things within the environment.

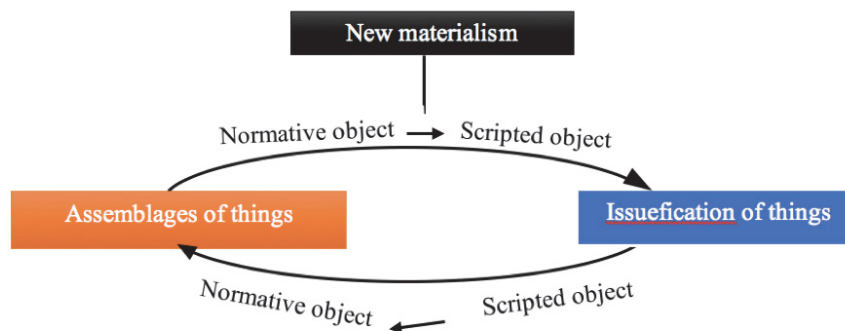


Figure 1: Interplay of assemblage of things and issuefication of things revisited.  
Source: Omokaro

In the overarching framework of new materialism, Figure 1 shows the movement of matter from the assemblage of things as normative objects to scripted objects within the issuefication of things. As the unidirectional arrow pointing from assemblage of things to issuefication of things indicates, objects such as e-waste function in their normative form within the assemblage of things. At this stage, the interactions in the assemblage of things can be easily ignored because its responses to other organisms in the assemblage is seemingly passive. However, when the assemblage generates intensive responses as seen in the example of open burning of e-waste, e-waste moves from assemblage of things to issuefication of things. Its normative functions become scripted by the responses from

human organisms within the environment. Additionally, when an object becomes scripted, it can sometimes attain the dual role of shifting between issuefication and assemblage of things. This is made possible by the dynamic role the object within the assemblages perform at a time and the reactions they elicit. Once matter becomes issuefied, its function within the assemblage of things is redefined. As such, the assemblage of things assimilates the new identity of the issuefied objects. This informs the new normative functions of every human and non-human organism of the assemblage.

### **5. Is there a methodological benefit to linking assemblage of things and issuefication of things?**

Reflecting on the example of the capabilities exhibited by the millennium bridge in London (Connolly, 2013), it is deduced that the bridge became dangerous because the assemblage of things such as the number of people walking at a particular time and the velocity of the wind became virulent in their responses. That is, the responses of the bridge to the wind and the reaction of humans to the violent movement of the bridge. The bridge went beyond its normative functions thereby transforming itself into an issuefied object. Thus, it becomes an issuefied object that demanded immediate attention such that its normative function was reconsidered, redesigned and redefined and in other words, scripted. In the process of the issuefication, its ability to elicit unique reactions from human organisms was dampened; further providing an interesting perspective that issuefied objects can occur as scripted objects or normative objects (Marres, 2014).

It is evident that the vibrant nature of matter can only be fully appreciated through the assemblage of things that is inherent in its immediate environment. As reflected in the Millennium Bridge and open burning of e-waste examples, matter becomes issuefied when its reactions within the assemblage of things becomes visibly noticeable, felt and sensed, in the environment.

While Marres' (2005, 2014) analysis of issuefied objects does not distinctively point out the importance of assemblage of things in the process of issuefication, this study argues that the effective methodological application of new materialism in studies such as e-waste management cannot be achieved without first understanding the assemblages of things surrounding it. Therefore, from Figure 1, it can be inferred that there is a methodological benefit to be found in the mutual dependencies by combining the assemblage of things and issuefication of things.

To fully apply the combination of the assemblage of things and the issuefication of things in new materialism approach as a methodological tool, first, the object has to be seen as possessing a certain vibrancy that can become active through the presence of the assemblages of things (Bonta and Protevi, 2004, Bennett, 2010). Second, the object in relation with other actors within its assemblage of things must evoke strong reactions from both human and non-human organisms. The intensity of the reactions must be difficult to overlook and should produce noticeable consequences from other objects within the assemblage. Third, the issuefication of things that occur from such interactions within the assem-

blage of things must produce significant political and social change, so that there is movement of vibrant matter between assemblage of things and the issuefication of things. As in the case of the Millennium Bridge and the open burning of e-waste, minute activities did not elicit any reactions from the human organisms. Political and social change occurred only after there was a high volume of visible effects from the activity of the assemblages in each context.

## 6. Discussion and conclusion

With the world so well connected, it is getting increasingly difficult to go a day without interacting with an electronic device. In contrast to the very visible nature of electronic devices, the reality of the resultant e-waste becomes almost invisible once discarded. Visibility only happens when the assemblages in which e-waste is situated becomes vibrant. How then has e-waste gained significant recognition in the society? And by what means has the social, political and environmental issues it evokes been engrained in policies?

E-waste offers an interesting platform for a broader examination of how vibrant matter exhibits certain noticeable characteristics within the assemblage of things such that it becomes charged with issues (Marres, 2014). Matter so charged, has the ability to differentiate itself normatively from other general issues especially those displayed in mainstream media (Akrich, 1992). In this study, it is argued that while the assemblage of things brings forth the reactive nature of matter, it is the issuefied ability the matter possess that acts as the pivot for assemblages to occur. Assemblage of things plays a vital role in the issuefication of e-waste. It is a medium by which e-waste exerts itself in the environment.

E-waste has been closely associated with the notion of 'dirt' and environmental degradation as projected in the society and perception of the e-scrappers. It invokes a disturbing trend of over consumption and wastage. But for the e-scrappers and the environmental agencies in developing countries like Nigeria, the issuefication of e-waste presents itself as a political and social object. As a political object, it represents their political willingness and participation in e-waste management which further elicits discussions on the political will to initiate environmental regulations, propelling the organisation of e-scrappers into conformity; or social policy issues that arise from the constant movement of the e-scrappers in search of workspaces or societal perceptions of them as environmental deviants. From the analysis, it is deduced that assemblage of things and the issuefication of things in new materialism can be used as a methodological tool in e-waste management research. This is because e-waste possesses the characteristics that show the symbiotic relationship which enables it to move between the two conceptual framework.

It is shown in this study that issuefied e-waste is used as a conduit for creating linkages between divergent issues, environment and participants. These assemblages help to connect the local activities of the informal recyclers so that it becomes issuefied. Reflecting on the movement of matter as normative objects from assemblage of things to issuefication of things as scripted object, it would be important to further examine how the reorganisation of the assemblage of

things in conformity with the scripted object occurs so that its new normative nature produces unexpected issues and conflicts. Perhaps, following the new normative nature of the elements within the assemblage of things, new sub-assemblages may occur within the larger assemblages.

This article proposes that further study is needed to examine the application of the combined use of assemblage of things and the issuefication of things in other areas of study in the social sciences. Additionally, the possibilities of investigating the complex relationships and the processes that may arise from within the assemblage of things as a result of its new normative nature is recommended. Perhaps, the new normative nature of the object may generate conflicts within the assemblage of things such that the ability of the whole assemblage to self-organise is redefined in terms of the roles each human or non-human element plays in the environment.

## References

- Abrahamsson, S. (2015). Living with Omega-3: New materialism and enduring concerns. *Environment and Planning D: Society and Space*, 33(1), 4-19.
- Akrich, M. (1992). The De-Description of Technical Objects. In W. Bijker, & J. Law, *Shaping Technology / Building Society: Studies in Sociotechnical Change* (pp. 205–224). Cambridge, Massachusetts: MIT Press.
- Alaimo, S., Hekman, S., & Hames-Garcia, M. (2008). *Material Feminisms*. Bloomington: Indiana University Press.
- Aljazeera. (2014, February 12). *In Pictures: Ghana's e-waste magnet*. (K. McElvaney, Producer) Retrieved April 2, 2016, from <http://www.aljazeera.com/indepth/inpictures/2014/01/pictures-ghana-e-waste-mecca-2014130104740975223.html>
- Aro, R., & Wilska, T.-A. (2014). Standard of living, consumption norms, and perceived necessities. *International Journal of Sociology and Social Policy*, 34(9/10), 710 - 728.
- Balde, C., Wang, F., Kuehr, R., & Huisman, J. (2015). The global e-waste monitor - 2014. *United Nations University*, 80.
- Barad, K. (2007). *Meeting the Universe Halfway: Quantum physics*. London: Duke University Press.
- Basel Convention. (2004, May 17). *Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*. Retrieved February 16, 2016, from Basel Convention: <http://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx>
- Bennett, J. (2010). *Vibrant Matter*. Durham & London: University Press.
- Bennett, J. (2010). *Vibrant Matter: A Political Ecology of Things*. USA: Duke University Press.

- Bhat, V., & Patil, Y. (2014). E-waste consciousness and disposal practices among residents of Pune city. *Procedia - Social and Behavioral Sciences*, 133, 491 – 498.
- Bonta, M., & Protevi, J. (2004). *Deleuze and Geophilosophy: A Guide and Glossary*. . Edinburg: Edinburg University Press.
- Brigden, K., Labanska, I., Allsopp, M., & Santillo, D. (2005). *Recycling of electronic waste in China and India: Workplace and environmental contamination*. Greenpeace. Amsterdam: Greenpeace International.
- Chi, X., Streicher-Porte, M., Wang, M. Y., & Reuter, M. A. (2010). Informal electronic waste recycling: A sector review with special focus on China. *Waste Management*, 31, 731–742.
- Connolly, W. E. (2013). *The Fragility of Things: self-organizing processes, neoliberal fantasies, and democratic activism*. Durham and London: Duke University Press.
- Connolly, W. E. (2013). The New Materialism and the Fragility of Things. *Journal of International Studies*, 41(3), 399–412.
- Coole, D., & Frost, S. (2010). *New Materialisms: Ontology, Agency and Politics*. Durham & London: Duke University Press.
- DeLanda, M. (2006). *A New Philosophy of Society: assemblage theory and social complexity*. London & New York: Continuum.
- Deleuze, G., & Guattari, F. (1993). *A Thousand Plateaus*. Minneapolis: University of Minnesota Press.
- Dolphijn, R., & van der Tuin, I. (2012). *New Materialism: Interviews & Cartographies*. Michigan: Open Humanities Press.
- Donna, L., & Gerald, M. (1993). *Materialist feminisms*. Cambridge: Blackwell.
- ERP. (2013, December 16). *About ERP Finland*. Retrieved from ERP recycling: <http://www.erp-recycling.fi/index.php?content=12>
- European Council. (2011). *DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL n the restriction of the use of certain hazardous substances in electrical and electronic equipment*. Brussels: European Council.
- Fox, N. J., & Alldred, P. (2015). New materialist social inquiry: designs, methods and the research-assemblage. *International Journal of Social Research Methodology*, 18(4), 399-414.
- Garlapati, V. K. (2016). E-waste in India and developed countries: Management, recycling, business and biotechnological initiatives. *Renewable and Sustainable Energy Reviews*, 54, 874–881.
- Gregg, M., & Seigworth, G. J. (2010). *The Affect Theory Reader*. USA: Duke University Press.
- Harris, A. L. (2008). Optimism in the Face of Despair: Black-White Differences in Beliefs About School as a Means for Upward Social Mobility. *Social Science Quarterly*, 89(3), 608–630.
- Hester, R. E., & Harrison, R. M. (2009). *Electronic Waste Management: Design, Analysis and Application*. Cambridge: Royal Society of Chemistry (RSC).

- Hieronymi, K., Kahhat, R., & Williams, E. (2013). *E-waste Management: From Waste to Resource*. London and New York: Routledge Taylor & Francis Group.
- Higginbotham, E., & Weber, L. (1992). Moving up with kin and community: Upward Social Mobility for Black and White Women. *Gender & Society*, 6(3), 416-440.
- HSY. (2013, December 16). *Instructions for the sorting of waste*. Retrieved from HSY: <http://www.hsy.fi/en/wastemanagement/instructionsandbrochures/sortingofwastes/Pages/default.aspx>
- Hwang, J. S. (2004). *Introduction to Implementing Lead-Free Electronics* (1st ed.). United States of America: McGraw-Hill Professional.
- Kreibe, S. (2013). Current and new electronic waste recycling technologies. In K. Hieronymi, R. Kahhat, & E. Williams, *E-waste management: From waste to resource* (p. 26). London and New York: Routledge.
- Latour, B. (2004). *Politics of Nature*. London, England: Harvard University Press, Cambridge, Massachusetts.
- Latour, B., & Weibel, P. (2005). *Making Things Public: Atmospheres of Democracy*. Massachusetts: The MIT Press.
- Lepawsky, J. (2015). Electronic Waste. *International Encyclopedia of the Social & Behavioral Sciences (Second Edition)*, 364-373.
- Liboiron, M. (2016). Redefining Pollution and action: The matter of plastics. *Journal of Material Culture*, 2(1), 87-110.
- Marres, N. (2014). The environmental teapot and other household objects: reconnecting the politics of technology, issues and things. In P. Harvey, E. C. Casella, G. Evans, H. Knox, C. McLean, E. B. Silva, . . . K. Woodward, *Objects and Materials: A Routledge Companion* (p. 260). London and New York: Routledge: Taylor & Francis Group.
- Marres, N., & Rogers, R. (2005). Recipe for Tracing the Fate of Issues and Their Publics on the Web. In B. Latour, & P. Weibel, *Making Things Public: Atmospheres of Democracy* (p. 922). Karlsruhe / Cambridge, Massachusetts: ZKM / MIT Press.
- Mellström, U. (2004). Machines and Masculine Subjectivities: Technology as an integrated Part of Men's Life Experiences. *Men and Masculinities*, 6(4), 368-382.
- Mulcahy, D. (2012). Affective assemblages: Body matters in the pedagogic practices of contemporary school classrooms. *Pedagogy, Culture & Society*, 20, 9-27.
- Omokaro, B. (2016). Building capabilities among e-scrapppers in informal electronic waste management: the case of the Nigerian e-scrapppers. *Environmental Sociology*, 2(2), 180-191.
- Omokaro, B., & Taipale, S. 2017. Into the World of E-waste-Mobility among e-scrapppers in Nigeria. *Journal of Applied mobilities*, <http://www.tandfonline.com/doi/full/10.1080/23800127.2017.1329974>.



- Oudshoorn, N., & Pinch, T. (2005). *How Users Matter: The Co-Construction of Users and Technology (Inside Technology)*. Massachusetts: The MIT Press.
- Puckett, J., Adesanya, O., Davis, I., & Saidu, Y. (2005). *The Digital Dump: Exporting Reuse and Abuse to Africa*. Seattle: The Basel Action Network.
- Sansi-Roca, R. (2005). The Hidden Life of Stone: Historicity, Materiality and the Value of Candomblé Objects in Bahia. *Journal of Material Culture*, 10(2), 139-156.
- Songa, Q., Wanga, Z., & Lib, J. (2013). Sustainability evaluation of e-waste treatment based on emergy analysis and the LCA method: A case study of a trial project in Macau. *Ecological Indicators*, 30, 138-147.
- Taylor, C., & Ivinson, G. (2013). Material feminisms: New directions for education. *Gender and Education*, 25, 665-670.
- The New York Times. (2015, June 1). *Bangladesh Rana plaza Murder Charges*. Retrieved April 2, 2016, from <http://www.nytimes.com/2015/06/02/world/asia/bangladesh-rana-plaza-murder-charges.html>
- The New York Times. (1988, July 17). *Waste Dumpers turning to West Africa*. Retrieved April 2, 2016, from <http://www.nytimes.com/1988/07/17/world/waste-dumpers-turning-to-west-africa.html?pagewanted=all>
- Wang, F., Huisman, J., Meskers, C. E., Schlupe, M., Stevels, A., & Hagelüken, C. (2012). The Best-of-2-Worlds philosophy: Developing local dismantling and global infrastructure network for sustainable e-waste treatment in emerging economies. *Waste Management*, 32, 2134-2146.
- Wang, F., Kuehr, R., Ahlquist, D., & Li, J. (2013). *E-waste in China: A country report*. Bonn: United Nations University/StEP Initiative.
- Widmera, R., Oswald-Krapf, H., Sinha-Khetriwalb, D., Schnellmann, M., & Bohnia, H. (2005). Global perspectives on e-waste. *Environmental Impact Assessment*, 25, 436-458.
- Yla-Mella, J., Pongracz, E., & Keiski, L. R. (2004). Recovery of waste electrical and electronic equipment (WEEE) in Finland. In E. Pongracz, *Proc. Waste Minimization and Resource Use Optimization Conference* (pp. 83-92). Oulu: Finland.
- Youdell, D., & Armstrong, F. (2011). A politics beyond subjects: The affective choreographies and smooth spaces of schooling. *Emotion, Space and Society*, 4, 144-150.

## II


### **BUILDING CAPABILITIES AMONG E-SCRAPPERS IN INFORMAL ELECTRONIC WASTE MANAGEMENT: THE CASE OF THE NIGERIAN E-SCRAPPERS**

by

Benedicta Ideho Omokaro, 2017

This is an Accepted Manuscript of an article published by Taylor & Francis in  
Journal of Environmental Sociology Journal, 2325-1042.  
<http://www.tandfonline.com/doi/full/10.1080/23251042.2016.1155791>doi:10.1080/23251042.2016.1155791

## Building capabilities among e-scrappers in informal electronic waste management: the case of the Nigerian e-scrappers

Benedicta Ideho Omokaro \*

*Department of social science and philosophy, University of Jyväskylä, Jyväskylä, Finland*

*(Received 9 July 2015; accepted 16 February 2016)*

This study examines the capabilities of e-scrappers developed through the constant interaction with electronic waste (e-waste). Video-based interviews were conducted with 29 male e-scrappers in Edo and Lagos States, Nigeria. Data analysis reveals that over time, e-scrappers in Nigeria are driven by aspirations not only of financial security but also of societal acceptance and recognition. Progressively, they have developed capabilities such as effective extraction methods based on individual abilities, market demand and the presence of an active social network, which have had a significant impact on the choices of the developed capabilities.

**Keywords:** aspirations; capabilities; e-scrappers; electronic waste management; e-waste

### 1. Introduction

In many societies, electronic waste (e-waste) at its end of life is considered trash and destined for the garbage. Similarly, individuals who engage in informal recycling of e-waste are regarded lowly in the society. However, in the hands of recyclers, especially informal recyclers, e-waste comes to life and becomes a valuable resource for social interactions and environmental discourses. This study aims to clarify the dynamics by which e-waste bestows valuable skills on informal recyclers. Towards this end, empirical material collected from Nigeria in 2014, will be analysed to illustrate the social and environmental importance of informal e-waste management. The article will extend previous theoretical research on the materiality of matter by investigating the relationships of e-waste as matter to recyclers' bodies, skills and knowhow.

The Step Initiative (2014) defines e-waste as 'a term used to cover all items of electrical and electronic equipment (EEE) and its parts that have been discarded by its owner as waste without the intent of reuse.' However, there is no standardized definition of the term e-waste, as its definitions, legislative and daily usages differ considerably among countries (EU Directive 2012; Tonetti 2007; Morgan 2006). High environmental standards and loopholes in e-waste regulations among developed countries make it easy for transboundary movement. Hence, e-waste is shipped in the guise of charity donations and second-hand goods to countries where environmental laws are easily circumvented. The complex composition of e-waste differs significantly by product, making it very difficult to manage.

In Nigeria where e-waste is received mostly as second-hand goods, the recycling industry has been operating since the 1990s enhanced as a trend by Nigerians' repairing culture (Author's fieldnotes, 2015). By 2010, the importation of second-hand (repairable) electronics, mostly originating from European and Asian countries, was estimated at 0.1 billion metric tonnes. Nigeria generates 0.22 billion metric tonnes of e-waste per annum domestically and is considered as one of the top three West African countries with the highest rate of e-waste generation (Ogungbuyi et al. 2012).

Among academia, the materiality of e-waste has gained significant attention in the social sciences and scientific disciplines of chemistry and engineering. This can be ascribed to the steady increase in the use of electronic devices as a medium of technological consumption and the challenges of managing the resultant e-waste. Scholars have focused on the local and international regulations governing disposal (Belenky 1999), chemical properties (Holmes 2009), environmental impact (Goodship and Stevels 2012), and economic value (Puckett, Westervelt, and Gutierrez 2005) that e-waste offers to both informal and formal recyclers. By formal recyclers, I refer to institutions that recycle e-waste with mechanized processes under legally approved conditions and strict environmental regulations.

Even though existing research has successfully highlighted the human and environmental benefits of formal recycling and condemned the practices of informal recyclers such as open burning, informal recycling continues to grow. The reason for this exponential growth is connected to the high economic value of extracted materials in e-waste (Byster et al. 2002), but it goes beyond that.

---

\*Email: [benedicta.ideho@jyu.fi](mailto:benedicta.ideho@jyu.fi)

Depending on the social context, e-waste proffers specific attributes, which the informal recycling sector recognizes.

Informal recyclers have continuously and erroneously been branded as global victims of a defective international recycling system (Zenga et al. 2013; Kiddee, Naidua, and Wong 2013). A major problem with this perspective is that it ignores the ability of e-waste to act as a skills acquisition resource for informal recyclers. In order to proffer any holistic solutions to sustainable e-waste management, it is important to address this problem by investigating both the external and intrinsic interaction of e-waste and informal recyclers.

This paper reveals that though the recycling of e-waste is a deliberate act, informal recyclers actually gain more beyond monetary benefits. Understanding how e-waste acts as skill acquisition is especially beneficial to environmentalist and policy makers especially those in charge of designing environmental and socially sustainable e-waste management system.

In Nigeria, informal recycling, as the main form of recycling, is a generic term comprising individuals who recycle all forms of waste (Author's fieldnotes 2015). Although they are sometimes referred to as scavengers, in this study informal recyclers who specialize specifically in manual dismantling and extraction of valuable materials from e-waste will be called e-scrapppers, which is the term they use themselves. I choose informal recyclers specifically because they are socially and environmentally active in the management of e-waste in Nigeria.

From here on, this article is structured as follows: Section 2 discusses the theories of new materialism and the capability approach. Section 3 explains the methodology used in data gathering and analysis. Section 4 reveals the results gleaned from the data analysis. Section 5 discusses the environmental implications of studying this aspect of the interaction of informal recyclers and e-waste. The article ends with discussions and conclusion on the new materialism nature of e-waste and the processes of building capabilities among e-scrapppers in Nigeria.

## 2. Theoretical approach

Societies, organizations and personal lives are ruled essentially by the information we get. How we process and utilize this information is dependent on the freedoms we have to choose from and the opportunities available to us. The combination of information, freedoms and opportunities is what Sen (2010) calls the capability approach. Sen defines capability approach as

... a person's capability to do things he or she has reason to value. A person's advantage in terms of opportunities is judged lower than that of another if she has less capability – less real opportunity – to achieve those things that she has reason to value. (2010, 231)

Sen's original research work has been further developed by other prominent scholars such as Nussbaum (1995), Alkire (2005) and Robeyns (2005). A common agreement among these authors is that the capability approach centres on the freedoms and opportunities available to individuals and how these factors facilitate achievements. The freedom to access multiple opportunities is weighed and measured differently depending largely on economic factors, environmental policies and cultural habits. For example, Byster et al. (2002) discovered that left to choose between environmental degradation and financial stability, the informal recyclers in Guiyu, China, chose financial stability because it attended to their immediate needs at that time. The demand for specific raw materials also informed the capability sets they needed and developed to extract materials from e-waste. In this sense, acid bath was a common method for extracting gold among informal recyclers in Guiyu, but as it will be shown in the results, this was not the case among the e-scrapppers interviewed for this study.

The capability approach has a deeper, richer application to economic and political issues. It focuses on availability of individual freedoms and agencies. Capability approach studies the complex interactions of social, economic and political factors influencing the choices and decisions available to an individual at a time (Nussbaum 2011). It is a conceptual framework for appraising individual well-being, evaluating social arrangements, constructing policies and initiating or recommending social change in the society. This study uses this approach as a lens into the social process of developing capabilities. Figure 1 illustrates this process.

The freedom to become an e-scrapper even in the presence of accessible white-collar jobs is a conscious decision e-scrapppers make. Once this choice is made, the quality of information and opportunities available enhances the quality of capabilities and freedom an e-scrapper experiences. I argue that e-waste scrapping has evolved from single-purpose use, such as extraction of only gold or copper (Puckett, Westervelt, and Gutierrez 2005), to multiple uses usually involving all aspects of the e-waste device. This evolution is made possible by the active presence of the social networks such as importers of e-waste, technological advancements, information dissemination and environmental factors (cultural habits and policies). Though e-scrappping can be regarded as an intuitive practice, it requires some level of training. The training involved in e-scrappping usually occurs in the form of apprenticeship; a situation where a person learns under the tutelage of someone considered to be an expert. This apprenticeship model forms an important part of the social and environmental network e-scrapppers require to sustainably remain in the business.

While the capability approach helps in understanding that e-waste facilitates self-development among e-scrapppers in Nigeria, *the new materialism* highlights the enabling characteristics of e-waste that allows it to be

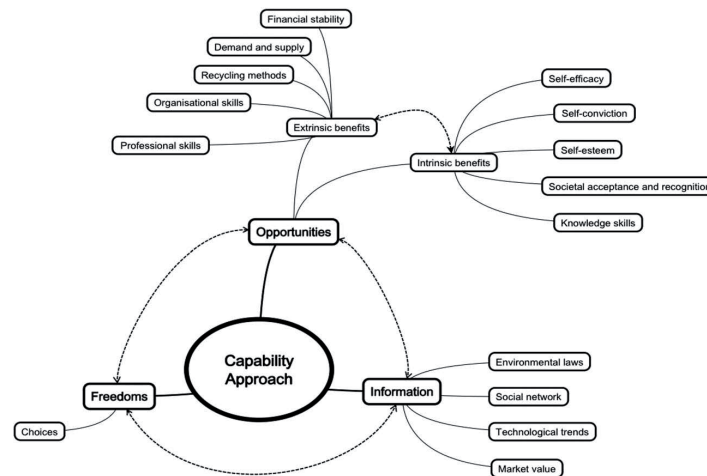


Figure 1. The capability approach framework.

transformed into valuable means. According to Bennet (2010), matter possesses certain measure of *'thing power'*, which becomes interactive within its immediate environment. *'Thing power'* refers to matter's ability of *'things'* to affect the very structure of economic, social and political life such that *'it (thing) and we (humans)'* - are attracted to its consideration (Coole and Frost 2010). This interactive nature of matter forms the basis of new materialism, which considers that matter is reactive even in a perceived stationary condition. It has the ability to invoke and evoke specific reactions from its environment. In the case of e-scrapers, it presents alternative uses. This is in stark contrast to a general view, which regards e-waste as unclean and those who process it are not highly regarded. Utilizing the new materialism approach brings to fore the non-verbal interaction and relationship that exist between e-scrapers and e-waste.

By combining the new materialism with the capability approach, this paper aims to disclose the latent potential of e-waste processing as a means of capability development and, more widely, of personal and social transformation. The ability to recognize the productive power of e-waste is a set of skills that e-scrapers develop while working on the field. These capabilities are deliberately acquired on the job, either through apprenticeship or through self-training, and it further translates into a higher status, such as self-esteem, professionalism and societal recognition within the community. The conceptual toolbox of new materialism helps in elaborating the seemingly invisible interplay between e-waste and e-scrapers and makes it possible to reveal the capabilities that e-scrapers develop within the wider community.

### 3. Method and data

The system of manually dismantling and extracting valuable materials from e-waste known as *'e-scraping'*, is a

very practical and visual process. It requires extensive knowledge of valuable materials and various techniques for material extraction. Capturing this visual process requires an ethnographic approach such as videography (Tuma, Knoblauch, and Schmettler 2014). Approaching potential interviewees was quite easy as my camcorder was the reliable ice-breaker. At these locations, the sight of a camcorder meant I was there for either repairs, resale or purchase. The interest in my camcorder started off conversations that would have otherwise been difficult and aggressive. I chose to interview only individuals who were involved in e-scraping full time and were willing to allow me capture the process on camera, audio and on-site note-taking.

Altogether, 29 male e-scrapers between the ages of 18 and 55 years agreed to be observed and interviewed in their natural settings contingent on my ability to be unobtrusive during the actual e-scraping process. The interviews were carried out in Benin City, Edo state, Ikeja Computer village, and Owode market in Lagos state, Nigeria in 2014. The e-scrapers in Benin City, Edo state, carried out their activities in a residential street-turned-marketplace. Residents were also traders in an intriguing blend of plastics, electronic parts and building materials. Ikeja Computer Village, on the other hand, is an Information and Communications Technology (ICT) accessories market situated within the Otigba community. It is a competitive market under The Computer and Allied Products Dealers Association of Nigeria (CAPDAN). Besides the sales of IT accessories, the market also offers repairs of electronic devices. Owode market is a steel market situated at Mile 12, Lagos. It houses over a 1000 sellers of steel products; 150 of which were e-scrapers.

The sites were chosen based on their geographical locations for electronic importation activities. Edo state is a civil servant state, which is in sharp contrast to the industrialized and populous Lagos state. Thus, electronic consumption and subsequent e-scraping activities also

differ considerably especially in the volume of extracted materials. E-scrapers are very mobile; therefore, the snowballing method was employed which in turn also helped to eliminate non-e-scrapers.

Female e-scrapers were conspicuously absent; perhaps it can be attributed to the prevalent heavy lifting of acquired e-waste. The interview was conducted in the local *Pidgin English* dialect and later transcribed into English during data analysis. Using *Pidgin English* helped to create comradeship and a relaxed atmosphere where the presence of the camera became part of the activities. The right to publish results from the data was received from the e-scrapers both on camera and in written form.

The data used in this article is chosen from among the 29 interviews carried out in 2014. It is based on the research questions and the specificity of the interaction between e-scrapers and e-waste. The video data was sequentially analysed using Heath's methods (Heath, Hindmarsh, and Luff 2010). To present the results gleaned from the data analysis, transcripts, sequential images (Heath, Hindmarsh, and Luff 2010) in form of vignettes (Jarzabkowski and Kaplan 2014; Michaud 2014) and video clips depict the influence of environmental and social policies on the capabilities developed by e-scrapers. For privacy sake, pseudonyms are used instead of real names and the faces of the respondents are either removed or blurred from the videos and pictures.

Due to insufficient research on this aspect of e-waste, it is necessary to state here that majority of the information in this study is derived from fieldwork.

#### 4. Results

Over the years, e-waste management has taken a new, interesting turn in Nigeria. With the increase in demand for valuable materials by manufacturers and the public awareness on dangers of open burning, e-scrapers have developed aspirations and built capabilities. The financial stability and the desire to be recognized as active positive participants in the society play a significant role in the way e-waste is handled. The presence of an active environmental law agency such as Lagos State Waste Management Authority (LAWMA) and Edo State Waste Management Board (EWMB) also defined the nature of e-scraping practices.

Data analysis revealed that of the 29 interviewees, 24 of them possessed basic and/undergraduate education with the highest qualification being a bachelor's degree. The other five interviewees have been trained in the sale and repairs of electronic devices. The interviewees were previously employed in other professional endeavour such as computer engineering and electronics repairs before becoming e-scrapers. Initially, increase in financial status and stability was the deciding factor but as they got more involved, other intrinsic and extrinsic benefits (see Figure 1) which are interrelated also surfaced.

For instance, e-waste provides economic opportunities for Chuks and his family. The constant demand for extracted materials ensures that he has a stable source of

income. Chuks confirmed during the interview that he had gained a lot of knowledge through e-scraping. By sight, he is able to determine what type of materials exists in an e-waste device. He believes that e-scraping is very sustainable financially and educationally (Allen and Wood 2006) because there will always be a high demand for it. Below is an excerpt from the interview:

**Interviewer:** So what have you gained from e-scraping?

**Chuks:** alot, so much. I know so much about e-waste. Where they come from. There is quality e-waste and not so quality e-waste.

**Interviewer:** really, how can you tell?

**Chuks:** (*laughs*) it is not something I can explain to you. Its a secret (*grins*) but I can tell by looking at them. You know, I get so many but, I have to know which one is quality and which one is low quality. It helps my business.

**Interviewer:** so what is not so quality e-waste?

**Chuks:** well (*looks thoughtfully at me*) ... not so quality e-waste does not bring good money. (*clearly, he was not ready to delve deeper*)

**Interviewer:** Do you think this is a sustainable business?

**Chuks:** yes, it is. As long as there is e-waste, business continues.

Societal perception of e-scraping is that of a dirty and low-wage menial job only practised by individuals on the low strata of the society. But as Chuks implied, he has gained a lot of self-confidence and self-efficacy dealing with e-waste. Buyers of extracted materials require efficiency when dealing with e-scrapers as reflected in the interview excerpt:

**Interviewer:** how do family and friends treat you knowing the job that you do?

**Chuks:** oh, they have no problem with it. As long as I bring money home. I make a lot of money you know... (*smiles*)

**Interviewer:** is money the only reason?

**Chuks:** oh... no, I have a lot of knowledge, you know... and people from China, USA, those foreign people who buy from me, they want to know that I can deliver quality. When I provide good quality for them, they bring more jobs and contacts too. Everybody around me knows I do business with foreign people and I deliver good materials. So they respect me... a lot.

Chuks relies on his social network for carrying out his e-scraping. Figure 2 displays the typical social network of an e-scrapper.

The social network plays a pivotal role among e-scrapers. As shown in Figure 2, formation of social network is centred on e-scraping activities. The process by which

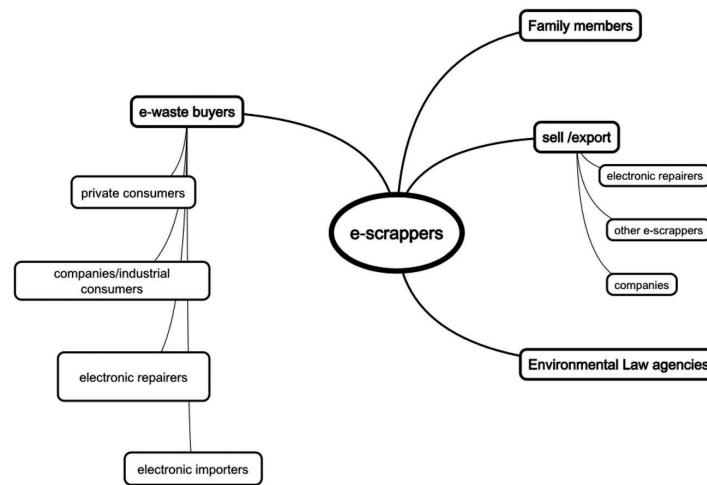


Figure 2. Social network of e-scrapppers in Nigeria.

e-scrapppers recognize the vibrant nature of e-waste, industry news, pricing strategy of extracted materials, foreign exchange rates, what manufactures are buying as well as what is trendy in the market are very valuable information for the e-scrapppers. This information is easily obtained from their social network, which is comprised of fellow e-scrapppers, electronic dealers and importers, private consumers, companies, family members and environmental law enforcement agencies. Family members serve as moral support and fulfil the emotional and psychological need of being useful, responsible citizens. Being responsible citizens means the e-scrapppers could provide for their families financially, adhere strictly to the environmental laws and are socially accepted as contributors to the well-being of the society. E-scrapppers either employ e-waste buyers or rotate the acquisition process of procuring e-waste from private or corporate electronic consumers among themselves.

Extracted valuable materials are then sold or exported to other companies who utilize them for reproduction of goods and services. E-scrapppers depend highly on both the companies they acquire e-waste from, and those they sell extracted valuable materials to, for trendy news on e-waste. Because e-scrappping is a very competitive market, the demand for specific e-waste parts also requires specific extraction skills. This tends to increase competition among e-scrapppers and hoarding of information in some cases. There is, however, a need to achieve balance because in as much as the e-scrapppers desire the competitive advantage of hoarding information, they also have to collaborate and share trade secrets if they were to gain an edge (in terms of pricing and environmental regulations) over companies who buy the extracted materials from them. The environmental law agencies such as LAWMA and EWMB ensure that e-scrappping activities do not breach environmental laws.

To learn the trade and build a viable, efficient social network, e-scrapppers are willing to learn trade secrets from

their peers. They are independent enough to decide what capabilities they need to develop in order to be successful. E-scrapppers are a well-organized, close-knit group, who depend strongly on the social network they have created to remain active players in the e-scrappping of e-waste.

#### 4.1. Extraction methods

Demand by manufacturing companies for specific material extracts determines the method of extraction employed by the e-scrapppers. Unlike their counterparts in Guiyu, China (Leslie et al. 2002), for instance, the e-scrapppers in Nigeria do not engage in acid baths or open burning because the environmental law agency (LAWMA) prohibits them to do so; roadside dumping of leftover e-waste is also discouraged. Where offenders are caught, a hefty fine and sometimes complete closure of their business are enforced. This restriction helps to categorize e-scrapppers according to their method of extraction and what valuable material extracts they obtain from e-waste. There are three main methods of extraction, namely the systematic, the smashing and a combination of both. These are discussed in detail below.

##### 4.1.1. Systematic extraction method

The systematic method involves the careful extraction of valuable material extracts with the use of basic tools such as pliers, screwdrivers and tweezers. The aim is to preserve every part of the e-waste with minimal destruction. This method is usually used on desktop computer devices and laptops. According to Oga S. who was a respondent interviewed at Ikeja Computer village, Lagos, e-scrappping for a high priced motherboard meant careful and systematic extraction which does not involve heat or smashing in anyway. Unlike his

counterparts in other parts of the state, his goal was to limit breakage of material extracts as little as possible.

Oga S. has been e-scraping for over 3 years. He is married and in his late 40s. Oga S. is self-taught. He was a successful electronic engineer before he got introduced to e-scraping during an acquisition trip. He learnt by what I refer to as e-waste-osmosis which implies that he learnt by immersion, on-the-job, and also by watching others who have had more work experience. Oga S. specializes in e-scraping computer CPU. His major extract is motherboard and computer casings, which are made of steel materials. His clients are major electronic and steel manufactures mostly from China and India. Due to the strict requirements from his clients, Oga S. has developed a systematic way of e-scraping which reduces waste (see video excerpt on Figshare.com). This skill ensures impurities such as plastics are eliminated from the extraction process, thus providing him with high pricing advantage. He further explained why systematic extraction was important:

- Interviewer:** Oga, why do you loosen it carefully, why are you not breaking it open like the others do?
- e-scrapper's colleague:** (*snorts*) Ha ha, this one is a silly question that you ask.
- Interviewer:** No, not really, because the guys working on handset, they break, they don't loose.
- e-scrapper's colleague:** can't you see the nut? Can't you see the nut? (*points angrily at the half scrapped computer CPU on the pile*)
- Oga S.:** (*smiling*) This one... it will not be easy to break. Even if you break it, it will not come outside unless you loosen that screw (*points to a screw*), it will never come out. (*He takes in a breath and tries to explain again*). This very one, you have to remove the motherboard; you have to use screwdriver to remove the screw first before you can take the board out. Even if you break it the board will never come outside

To demonstrate further, he proceeded to show a little of his extraction process as reflected in Figure 3 (also see video excerpt on Figshare.com).

Figure 3 shows the extraction process employed by Oga S. during e-scraping at Ikeja Computer village where over 20 e-scrapers carry out their activities independently of each other. Sometimes, they would collaborate; for example, helping an electronic repairer find a particular motherboard or steel frame. It is interesting to see the delicate balance of cooperation among the e-scrapers. They tend to hoard information but not so much that it would be detrimental to their overall business success.

Oga S. carries out his e-scraping using manual methods. His tools include screwdrivers, pliers, soldering iron, hammer and bare hands. On very busy days, a desktop monitor serves as his chair and his lap serves as support for the device he is e-scraping. Despite the inadequate facilities, Oga S. enjoys what he does, not because it was the only option available to him, but because he has a flair for electronics. E-scraping provides financial security for him and his family. It also affords him the opportunity of being an active, responsible member of the society. Being responsible meant he could financially provide for himself and his family and could contribute meaningfully to his immediate social network. This was very important to him. Additionally, strict adherence to environmental laws such as clean workspace meant that he could continue his e-scraping in that environment.

#### 4.1.2. Smashing extraction method

Smashing extraction involves the use of mallet or hammer on e-waste. The aim is to retrieve certain parts that are hidden in smaller e-waste. Like the e-scrapers, manufacturing companies are also specialized in acquiring certain valuable extracts from e-waste. These valuable extracts, which are usually found in very compact devices and require some measure of smashing to extract them, include copper, aluminium and gold. They are often used for reproduction of goods such as jewellery. Quantity is very important to this category of e-scrapers because valuable extracts are bought in kilograms.

Figure 4 shows Ajayi, an e-scrapper in Owode market, Lagos state extracting copper, aluminium and steel from e-waste. The process involves the use of hammer, mallet and chisel to break the e-waste device before prying away the desired materials with hands. Ajayi has been

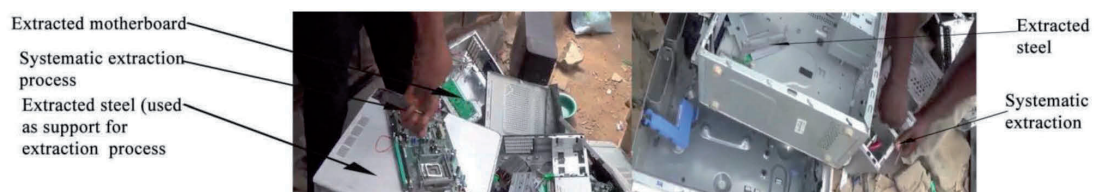


Figure 3. Systematic extraction of motherboard from computer CPU. Source: the author.





Figure 4. Smashing extraction process (also see video excerpt on Figshare.com). Source: the author.

e-scraping for over 6 years in Lagos, Nigeria. He learnt via apprenticeship for 2 years before starting off on his own. After extraction, he sells the valuable extracts to manufacturing companies mostly based in Nigeria. His volume of extraction depends on the availability of e-waste and the demand of manufacturing companies. Ajayi acquires e-waste from private consumers, industries and manufacturing companies who import e-waste solely for extraction.

4.1.3. Mixture of smashing and systematic extraction

This method involves both smashing and systematically extracting valuable materials from e-waste. It is a method expertly utilized by Olu who was once an engineer and has been e-scraping for less than a year. He was a repairer of flat screen TV, monitors and other electronic products before becoming an e-scrapper. Realizing the lucrativeness of e-scraping, Olu converted to the process full time. He is self-taught because of his background but picked up some trade secrets from other e-scrapers along the way. Olu is an e-scrapper specialized in steel. He scraps all forms of e-waste as long as it has steel in it. He also sells motherboard panels if they occurred in his e-scraping process. Olu's method of manual e-scraping was both smashing and systematic extraction. Depending on the type of e-waste, he uses smashing mallet, pliers, bodily support, screwdriver, bare hands and hammer. This extraction method is shown in Figure 5 (see also video excerpt on Figshare.com).

Figure 5 shows Olu unscrewing a piece of plastic from a steel extract on the left side of the image and smashing an e-waste device on the right side. The workspace is very large compared to other e-scrapers. Olu requires more space because his extracted steel is larger in size. On the

floor at his feet is the steel mallet for smashing larger steel. Olu is very particular about removing plastics from his extraction because manufacturing companies who purchase from him could make monetary deductions if any plastic is found within them. Olu reveals this in the transcript.

**Interviewer:** What has e-scraping taught you? What have you learnt?

**Olu:** (*grins*) this is just like any other business. (*he pauses to gently extricate a piece of motherboard panel from a steel frame*) There is nothing really special to learn. But when companies request for steel, it must be steel. They will make monetary deductions if they find plastic or any other material in it. That is what I have learnt. Also there are companies who need the plastic but not steel and they are very particular too. Every company is very specific.

This specificity from manufacturing companies has also made Olu very meticulous and careful in buying electronics for e-scraping. The extracted steel is smashed to compress them; afterwards, they are weighed in kilograms and then stored in bags before transporting to manufacturing companies. Extracted steel can be very heavy and towing it all by himself is usually demanding. It is also very capital intensive but Olu is happy because he does make considerable profit from this business. Additionally, he is also happy because he believes he is contributing meaningfully to environmental sustainability by adhering strictly to the environmental laws of the state. However, a major constraint for Olu is transportation. It



Figure 5. Systematic and smashing process of extraction. Source: the author.

costs a substantial amount to transport extracted materials to the companies and to take the leftover waste materials from the e-scraping process to the dump sites. Olu wishes the environmental agents will provide a proper disposal network system that may help to reduce transportation costs. His costs are so high because he works with larger e-waste products, but this is, however, not typical for every e-scrapper hence a holistic disposal network system would have to take this into consideration.

#### 4.2. Knowledge skill

E-scraping is a sophisticated process which also requires a high level of economic and management skills. For the e-scrapers, it was interesting to discover that they found the act of e-scraping very invigorating and rewarding. Besides the financial reward, the other intrinsic and extrinsic benefits were a welcome unintended bonus. This was shown in the interview with Eke, who has been e-scraping for 7 years. Unlike Oga S., Eke learnt e-scraping through apprenticeship. He specializes in motherboard and steel extraction from computer CPU and DVD players. E-scraping has presented new learning experiences for Eke. Through e-scraping, he has been able to recognize different parts of materials in e-waste just by sight. Recognizing valuable extracts is a necessary skill in e-scraping. It helps to encourage quality buying, fetch better pricing, eliminate loss and expand the range of mineral extracts from e-waste.

**Interviewer:** So each motherboard fetches different prices? (*Eke nods in affirmative, his attention on the motherboard pieces at his feet. He had an amused smile on his face.*)

**Interviewer:** How do you know which motherboard is which?

**Eke:** (*smiles fully*) This one now, is a DVD. We call this one DVD. (*Points at the motherboard panels lying at his feet. They looked quite the same to the novice eye.*) We call this one, panel for television, but this one is a DVD. So, it is not the same price. Two of them are not the same price, they are different, different prices. It is easy for me to recognize them in e-waste because I am used to it. For you, that will not be easy.

Eke relies solely on his ability to recognize different motherboard types based on their characteristics because there are no facilities or equipment available to test and categorize material extracts. Depending on the environmental conditions, this ability is made possible by the dynamic and constantly evolving nature of the e-waste sector. Industry news was also important to him. Knowing which valuable extract was in demand helps him reduce the waste he gets from his e-scraping and also what kind of e-waste he should invest in. Eke's extraction process was also very systematic. The aim is

to limit the damage of the e-waste parts to the barest minimum. He acquired this systematic extraction process from buying working computers and taking them apart. The level of knowledge gained from e-scraping is revealed during the interview.

**Interviewer:** What kind of knowledge have you gained from this business?

**Eke:** (*wide grin*) A lot! Through this business, I know how to handle computer. I can handle computer, I can repair, I know what a capacitor is, many things, all those things, I learn a lot.

**Interviewer:** But did you attend any computer school or training?

**Eke:** (*shakes his head*) No, I did not attend any computer school; I learnt everything here. Sometimes, I buy a working computer, open it up and then use it to fix another one. That is how I learn.

Eke enjoys the dynamic nature of his e-scraping activities and the societal recognition it provides. But there are also risks involved such as buying 'bad e-waste' (e-waste containing inferior materials in them). Eke has contacts abroad who ship computers to him. Sometimes, the computers can be of low grade, which reduces the value of the extracts he may get for them from manufacturing companies.

**Interviewer:** what kind of risks do you experience in this business?

**Eke:** (*shrugs*) yea, they are numerous. Sometimes, I may buy this one (*points at a computer*) 500 naira (2.23€), when I reach company I will sell it for 400 (1.79 €) or 300 naira (1.34€). That is a loss. So it's a risk because, maybe the price I bought it will not be the same price companies I am selling it to will pay for it. Each motherboard has different price value (*cost variation*).

Cost variation was a big risk for Eke as well. Companies he sold to were very particular about the quality of the extracts. This specificity also manifested in the interview exchange with Olu and Mohammed.

#### 4.3. Professionalism skill

For Mohammed, an 18-year-old e-scrapper who has been e-scraping for over 5 years, e-waste was a valuable means to achieving professionalization. He is a college student and he initially did e-scrap mainly for financial reasons. But as he progressed, he has been able to develop accurate recognizable skill needed to extract copper, aluminium, steel motherboard panels and brass from densely packed e-waste such as table fan. He can tell what

materials are found in specific electronics and what he terms 'good' and 'bad' e-waste by sight.

Mohammed employs a mixture of systematic and smashing extraction process which can be an intense exercise. For a novice, it could be very dangerous but for Mohammed, it seems very easy due to his long acquired experience. The extracted materials are sorted in bags and then weighed before transporting to manufacturing companies.

During the interview, Mohammed revealed that e-scraping has helped him develop accounting skills. This was validated when a fellow e-scrapper called him the accountant in the group (see Figure 6 and interview transcript).

*(While watching Mohammed at work, an e-waste buyer passes by. Mohammed points at him and explains) these are the people we give money to buy e-waste for us. When they come back from the market, we check our calculations and pay back balances.*

Mohammed and his colleagues are very organized. Mohammed keeps accurate records of their transactions and makes contact with buyers in Lagos state. He also ensures that the leftover waste from their activities were properly disposed according to environmental laws. Mohammed commands respect from his social group. When asked what his family thought about his e-scraping ventures, he replies:

... they respect me, since I am not stealing. I do what I have to do to survive. I work to survive. They do not have any problem with me.

Besides the respect he commands, Mohammed is happy that he is useful to himself and the society. He reveals that he has learnt a lot in e-scraping. The ability to negotiate price is very important as it could improve profit margin. He explains:

... we give money to buyers and send them to the market. If for example they buy a load of e-waste for 300 naira (1.34€), we could sell it to people here for 800 (3.57€) naira. But if we go to Lagos, we could sell it for 920 naira

(4.11€). It is more profitable in Lagos and we sell per kilo". *(Smiling widely, he continues)* I get to meet people a lot. I travel to Lagos in some cases and meet with foreigners. It is very good to meet others who also do what we do. I also have to know what the companies want to buy. It is very good.

E-scraping for Mohammed is very lucrative even though it is a temporary venture for him. He wishes however that he could gain access to better equipment for e-scraping as it ensures efficient productivity. Through e-scraping, Mohammed is slowly getting close to his dream of becoming an accountant as well as been financially stable for himself and his family for he spends most of his earnings on his education.

#### 4.4. Organizational skills

As important as record keeping is to the e-scrapers, the ability to properly organize acquired e-waste and extracted materials is imperative. Workspace is often very limited and shared among the e-scrapers. Extracted materials are stored on bare floor and open air forcing the e-scrapers to quickly process acquired e-waste for export thus releasing space. Interestingly, there are no visible tags to indicate which pile of e-waste or extracted materials belong to a particular e-scrapper (see video excerpt). But the spaces are shared in such a way that e-scrapers recognize where their piles end and another begins. Alabi, an e-scrapper at Owode, Lagos state, explains further:

**Alabi:** *(smiles)* it is easy to know which of the pile here is mine. We trust ourselves and we also keep record of how much we buy per day and how many kilos we have after weighing.

#### 5. Environmental implications

E-scrapers play an active role in preventing a substantial amount of e-waste from entering the local landfills. By scouting for e-waste at source (companies, private consumers, etc.), they help to separate e-waste from the

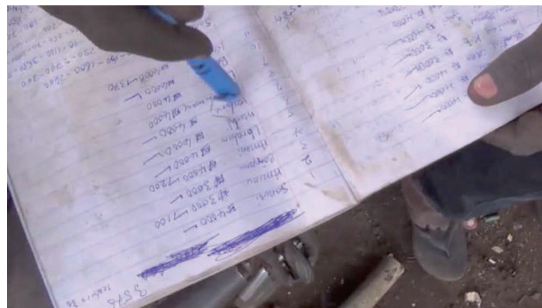


Figure 6. Mohammed discussing his accounting records. Source: the author.

mainstream waste thus minimizing ground water/land pollution. As already mentioned above, they also try their best to observe environmental laws, by not burning the leftovers, for which they also seem to take pride in.

While this may be regarded as a welcome development, the methods by which e-scraping is carried out do not eliminate hazardous materials from polluting the immediate environment. Extraction is done on the bare floor and the process releases harmful materials into the air and soil, thus posing a great threat to humans and organic and inorganic organisms. Valuable materials are removed but the leftovers which usually contain some amount of harmful materials are not removed from the ground. Bare floor storage exposes extracted materials to weather elements. Rainfall gradually leaches eroded materials into the ground. Some of the sites visited had water puddles and are susceptible to flooding. Though material extracts are usually transported to manufactures within one to two weeks, it is environmentally unfriendly to expose them to the open air. When asked if they experienced health problems, the e-scrapers revealed that apart from occasional body ache from heavy lifting, constant mobility, and headaches, they had no major health issues.

## 6. Discussion and conclusions

### 6.1. Discussion

The capability approach questions what people are actually able to be and do with the freedoms and opportunities available to them. It focuses on encouraging the freedom of choice for people so that they are able to develop the capabilities needed for attaining a quality life (Nussbaum 2011). This raises some critical questions. What does 'quality life' imply in the context of Nigerian e-scrapers? Is the availability of freedoms and choices a necessity for building capabilities? Quality of life is relative (Banister and Bowling 2006). It depends largely on a number of factors such as cultural and social norms, social network and economics. For the e-scrapers, their quality of life is defined by the relevant role they play in the society.

One of the key observations of this study is that e-scrapers are able to recognize the extended value of e-waste beyond financial gains. As such, they develop certain valuable skills, which have a huge impact on their quality of life. In Nigeria, e-waste is currently considered as fit-for-garbage and e-scrapers are likewise not regarded professionally. However, for e-scrapers, e-waste is not useless or a waste. It is not only a means of livelihood; it is also a medium of attaining social and economic recognition in the society. It is a valuable tool for acquiring capabilities in different specialized areas such as extraction methods, and recognizing and categorizing e-waste parts.

The vibrant nature of e-waste makes this recognition and categorization possible for the e-scrapers. The ability of e-waste '*thing-power*' (Bennet 2010; Coole and Frost 2010) to present itself in different valuable forms and the subsequent demands by companies requesting for particular parts

of valuable extracts ensures that different skillsets or 'capabilities' (Nussbaum 2011) are developed. This in turn creates specialization and diversity among the e-scrapers.

As revealed in this article, freedoms and choices are a necessity for building capabilities. Contrary to popular belief of poverty being a major driver, the e-scrapers examined in this study lead professional lives. As shown in Section 4, for Oga S., the freedom to choose to become an e-scrapper is born out of the lucrativeness of e-waste and the educational opportunity it offers. Even though financial gain was an initial motivator, the formation of an active social network, which is centred on his e-scraping activities, propelled the formation of new capability sets. Financial stability became an added bonus as he strived to remain relevant in the business. Industry news on what is trendy and the prevalence of eager buyers of valuable extracted materials ensured that he became innovative in his e-scraping activities.

As indicated by the interview responses from Olu, Eke, Alabi and Mohammed, professionalism, societal recognition as responsible citizens and active participants in environmental sustainability are strong driving forces for developing new imaginative ways of recycling e-waste. The effective implementation of environmental laws also determines the method of extraction, which in turn pushes the e-scrapers to engage in environmentally friendly practices and also find markets for various parts of e-waste; thus maximizing their economic value and improving the knowledge on e-waste. Although e-scrapers strive to obey environmental laws, more can still be done to reduce the leaching of hazardous materials into the environment.

### 6.2. Conclusions

E-waste at its end of life is commonly regarded as trash doomed for the garbage. Similarly, individuals who engage in informal recycling of e-waste are regarded lowly in the society. However, in the hands of recyclers, especially informal recyclers, it comes to life and becomes a valuable resource for social interactions and environmental discourses. This study has been able to clarify the dynamics and processes by which e-waste bestows valuable skills on informal recyclers through the presentation of results gleaned from fieldwork data.

By utilizing the theoretical and conceptual toolbox of both the capability approach and new materialism during data analysis, this article has revealed that the change in perception of e-waste as valuable matter beyond financial gains is highly related to the e-scrapers' attainment of certain valuable skills. These skills significantly influence e-waste management and the societal role of e-scrapers in Nigeria. Reflectively, the results of this study indicate the holistic analytical tools which capability approach and new materialism offer to the study of e-waste management.

It is evident from the results in Section 4 that the erroneous belief of e-scrapers being global victims of a

defective international recycling system needs revisiting, especially among academics, policy makers and the media space. As reflected in the interviews carried out and analysed in this study, the capability skills developed and the new materialism nature of e-waste indicate that the current global e-waste management discourses need a reappraisal.

E-waste is not just a commodity for e-scrapppers in Nigeria; it is a means to achieving a level of total personal development. It is the vehicle by which capability sets are developed and aspirations are met, not just at the economic level but also socially and psychologically.

E-scrappping helps e-scrapppers develop a sense of positive well-being, stability and professional status in the society. The acknowledgement that they possess valuable productive skills helps to foster innovativeness in management of e-waste.

Proximity to effective social network, such as family and fellow e-scrapppers, influences the formation of aspirations (Sen 2010; Nussbaum 2011). Recognizing such information and fully utilizing it also depends on the self-esteem and self-conviction of the e-scrappper. E-scrappping requires a certain level of self-confidence. Until recently, the Nigerian society saw e-scrappping as a menial, dirty job and practitioners were treated as such. Even though the e-scrapppers are slowly gaining strong recognition as active players in environmental sustainability, they still lack the necessary standardized infrastructure for long-term efficient extraction processes.

The government also needs to formally recognize e-scrapppers as active actors in eliminating e-waste from the main waste stream. With the growth in electronic consumption, e-waste has come to stay and organized activities of e-scrapppers indicate that they have slowly moved from being informal to formal recyclers. It is only a matter of time before the society sees them that way.

### Acknowledgements

My sincere gratitude goes to every e-scrappper who made my fieldwork fun and to those out there whose innovativeness has not been documented, thank you for being a part of the e-waste family. To my supervisors, Adjunct Professor Sakari Taipale and Professor Marja Järvelä, thanks for being true mentors and to my loving husband Richardson Omokaro, thank you for an awesome support. I also wish to thank my colleagues, especially Sonila Danaj, for being my mood board of which I continuously bounce off ideas. Most importantly, my sincere thanks to Jehovah the Almighty for being my source of life.

### Funding

This work was supported by The Department of Social Sciences and Philosophy, University of Jyväskylä, Finland. Grant number: none. I could not have embarked on this journey without the funding and support of my amiable institution: University of Jyväskylä, Finland. Thank you for providing the financial assistance needed to make this research a reality.

### Disclosure statement

No potential conflict of interest was reported by the author.

### Notes on contributor

Benedicta Ideho Omokaro is a doctoral student and researcher at the University of Jyväskylä, Finland. She is passionate about electronic waste and has a Masters' degree in Development and International Cooperation from the University of Jyväskylä, Finland.

### Supplemental video data

The underlying research materials for this article can be accessed at [https://figshare.com/articles/Building\\_Capabilities\\_among\\_E\\_scrapppers\\_in\\_Informal\\_Electronic\\_Waste\\_Management\\_The\\_case\\_of\\_the\\_Nigerian\\_E\\_scrapppers/2062476](https://figshare.com/articles/Building_Capabilities_among_E_scrapppers_in_Informal_Electronic_Waste_Management_The_case_of_the_Nigerian_E_scrapppers/2062476) Figshare.com

### ORCID

Benedicta Ideho Omokaro  <http://orcid.org/0000-0001-5850-4939>

### References

- Author's fieldnotes, 2015. Interview carried out on 3rd of May, at Ikeja computer village, Lagos State, Nigeria with e-scrappper John (pseudonym name) on the origin of e-scrappping in Nigeria.
- Alkire, S. 2005. "Why the Capability Approach?" *Journal of Human Development* 6 (1): 115–135. doi:10.1080/146498805200034275.
- Allen, W. A., and G. Wood. 2006. "Defining and Achieving Financial Stability." *Journal of Financial Stability* 2 (2): 152–172. doi:10.1016/j.jfs.2005.10.001.
- Banister, D., and A. Bowling. 2006. "Quality of Life for the Elderly: The Transport Dimension." *Transport Policy* 11 (2): 105–115. doi:10.1016/S0967-070X(03)00052-0.
- Belenky, L. T. 1999. "Cradle to Border: U.S. Hazardous Waste Export Regulations and International Law." *Berkeley Journal of International Law* 17 (1): 43.
- Bennet, J. 2010. *Vibrant Matter*. Durham, NC: Duke University Press.
- Coole, D., and S. Frost. 2010. *New Materialisms: Ontology, Agency, and Politics*. Durham, NC: Duke University Press Books.
- EU Directive. 2012. "Parliament and of the Council of 4 July 2012 on Waste Electrical and Electronic Equipment (WEEE) (Recast)." *Official Journal of the European Union Directive* 197: 38.
- Goodship, V., and A. Stevels. 2012. *Waste Electrical and Electronic Equipment (WEEE) Handbook*. Oxford: Woodhead Publishing Limited.
- Heath, C., J. Hindmarsh, and P. Luff. 2010. *Video in Qualitative Research: Analysing Social Interaction in Everyday Life*. London: Sage.
- Holmes, I. 2009. "Dumping, Burning and Landfill." In *Electronic Waste Management: Design, Analysis and Application*, edited by R. E. Hester and R. M. Harrison. 263. Cambridge: The Royal Society of Chemistry.
- Jarzabkowski, P., and S. Kaplan. 2014. "Strategy Tools-in-Use: A Framework for Understanding 'Technologies of Rationality' in Practice." *Strategic Management Journal* 36 (4): 537–558. doi:10.1002/smj.2270.
- Kiddee, P., R. Naidua, and M. H. Wong. 2013. "Electronic Waste Management Approaches: An Overview." *Waste Management* 33 (5): 1237–1250. doi:10.1016/j.wasman.2013.01.006.
- Leslie, B., P. Jim, S. Westervelt, R. Gutierrez, S. Davis, A. Hussain, and M. Dutta. 2002. *Exporting Harm: The High-Tech Trashing of Asia*. Seattle, WA: The Basel Action Network (BAN) and Silicon Valley Toxics Coalition (SVTC).

- Michaud, V. 2014. "Mediating the Paradoxes of Organizational Governance through Numbers." *Organization Studies* 35 (1): 75–101. doi:10.1177/0170840613495335.
- Morgan, R. 2006. "Tips and Tricks for Recycling Old Computers." *SmartBiz*, August 21. Accessed October 3, 2015. <http://www.smartbiz.com/article/articleprint/1525/>
- Nussbaum, M. 1995. "Human Capabilities, Female Human Being." In *Women, Culture, and Development: A Study of Human Capabilities*, edited by M. C. Nussbaum and J. Glover, 61–105. Oxford: Clarendon Press.
- Nussbaum, M. 2011. *Creating Capabilities The Human Development Approach*. Cambridge: Belknap Press.
- Ogungbuyi, O., I. C. Nnorom, O. Osibanjo, and M. Schlupe. 2012. *E-Waste Country Assessment Nigeria*. Project Assessment, Basel Convention Coordinating Center for Africa (BCCC), Empa, Ibadan/Nigeria & St.Gallen/Switzerland: e-Waste Africa project of the Secretariat of the Basel Convention Switzerland.
- Puckett, J., S. Westervelt, and R. Gutierrez. 2005. *The Digital Dump: Exporting Re-use and Abuse to Africa*. Seattle, WA: The Basel Action Network.
- Robeyns, I. 2005. "The Capability Approach: A Theoretical Survey." *Journal of Human Development* 6: 93–117. doi:10.1080/146498805200034266.
- Sen, A. 2010. *The Idea of Justice*. London: Penguin Books.
- Step Initiative. 2014. "What is e-waste?" SteP. June 3. Accessed October 3, 2015. <http://www.step-initiative.org/what-is-ewaste.html>
- Tonetti, B. 2007. "US EPA's Regulatory Framework for "E-Waste"". *Electronics Waste and Spent Lead Acid Batteries Capacity Building Workshop*. USA: United States Environmental Protection Agency. 1–4.
- Tuma, R., H. Knoblauch, and B. Schnettler. 2014. "Video Analysis and Videography." In *The Sage Handbook of Qualitative Data Analysis*, edited by U. Flick, 435. London: Sage.
- Zenga, X., J. Li, A. L. N. Stevels, and L. Liu. 2013. "Perspective of Electronic Waste Management in China Based on a Legislation Comparison between China and the EU." *Journal of Cleaner Production* 51: 80–87. doi:10.1016/j.jclepro.2012.09.030.

### **III**

## **INTO THE WORLD OF E-WASTE: MOBILITY AMONG E- SCRAPPERS IN NIGERIA.**

by

Benedicta Ideho Omokaro and Sakari Taipale, 2017

This is an Accepted Manuscript of an article published by Taylor & Francis in  
Journal of Journal of Applied Mobilities. 1-17

<http://www.tandfonline.com/doi/full/10.1080/23800127.2017.1329974>

doi:10.1080/23800127.2017.1329974



## Into the world of e-waste: mobility among e-scrapers in Nigeria

Benedicta Ideho Omokaro  and Sakari Taipale

Department of Social Sciences and Philosophy, University of Jyväskylä, Jyväskylä, Finland

### ABSTRACT

In the management of e-waste, mobility of e-scrapers plays a pivotal role, especially in e-waste acquisition and sales of extracted materials. This research examines the relationship between e-scrapers and the locations of their work by analysing the influence of environmental and social factors on their mobility behaviour in Nigeria. A qualitative analysis of video material collected from 29 male e-scrapers in Nigeria between 2014 and 2015 reveals that e-waste has inherent properties that intermittently mobilise e-scrapers to search for recyclable and valuable electronic trash. Applying the new mobilities paradigm and the new materialism theory, we present that e-scrapers' mobility occurs within an interdependent network of connections. An assemblage of things consisting of workspace, social network, poor infrastructure, and weather conditions both produce and interrupt mobility among e-scrapers. As vibrant material, e-waste is capable of eliciting reactions from both organic and inorganic organisms. We conclude by arguing that the mobility of e-scrapers strongly determines the quality of extracts and the channel by which valuable extracts are sold. Therefore, mobility is one of the keys elements of successful e-waste management in Nigeria, providing economic stability and social recognition for e-scrapers.

### ARTICLE HISTORY

Received 1 September 2016  
Accepted 10 May 2017

### KEYWORDS

E-waste; applied mobility; new-materialism; assemblage of things; electronic waste management; informal recyclers

## 1. Introduction

In electronic waste management studies, much scholarly attention has been paid to the negative environmental consequences of informal recycling (Garlapati 2016; Goodship and Stevels 2012), chemical properties in electronic waste (hereafter e-waste), (Holmes 2009), international and local regulations governing the disposal of e-waste (Belenky 1999), new technological solutions enhancing efficient management of e-waste (Mallampati, Heo, and Park 2016), and economic benefits of extracting valuable materials from e-waste (Puckett, Westervelt, and Gutierrez 2005). Amidst all of these studies, Gabrys (2013, 134) argues that the informal sector of electronic waste management has remained inadequately documented, partly because technological, chemical, and environmental approaches applied so far do not fully capture the social and cultural factors included in e-scraping.

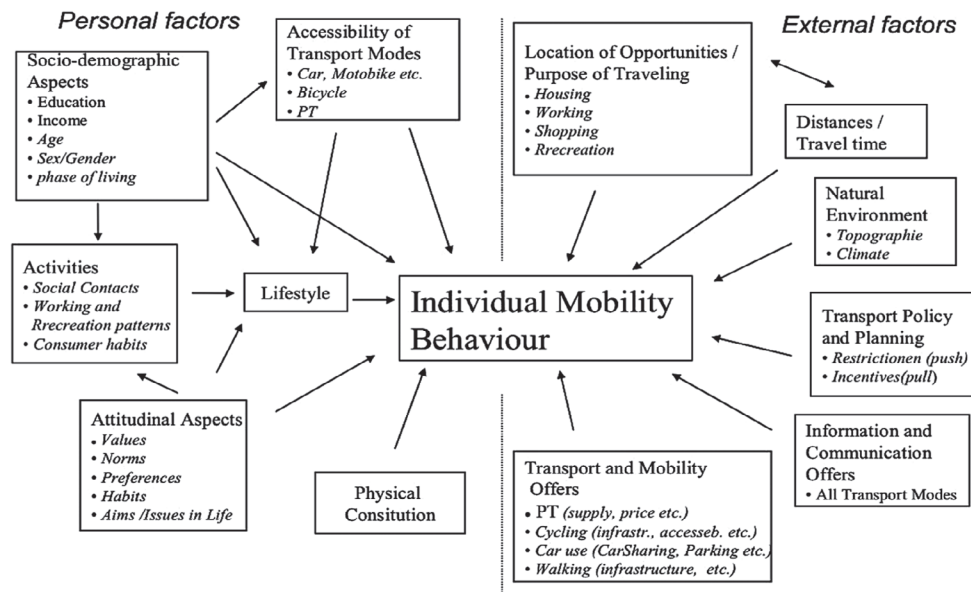


In this article, we contribute to this gap in research by clarifying how e-waste as vibrant material (Bennet 2010a) engenders mobility among informal recyclers, particularly e-scrapers in Nigeria, and in so doing, may provide them with economic stability and social recognition. By studying the mobility of e-scrapers, this article examines e-waste outside the limits of its environmental disadvantages that are prominent in current e-waste management research. Like other variants of informal waste management (Mitchell 2008), e-scraping is a mobility-intensive business, but it is growing very rapidly and requires continuous updating of skills and know-how from e-scrapers as new generations of abandoned technologies enter into the market all the time. With this study, we contribute to the theoretical thinking of new mobilities by showing how material and non-material objects involved in informal e-waste management are interconnected so that mobility occurs.

E-scrapers are people whose work involves collecting, dismantling and selling valuable extracts from disused electronic devices. Extraction is done with manual tools such as pliers, hammers and mallets in uncovered workspaces that are usually situated among residential buildings and marketplaces. E-waste is acquired from local consumers, private businesses, governmental institutions, and imports as second-hand goods from industrialised countries. In this line of work, e-scrapers are largely dependent on the ability to physically move from one place to another, while also staying in contact with one another virtually via mobile phones. Social relations between the e-scrapers, channels of e-waste acquisition, and the e-waste itself plays an important role in the activities of e-scrapers. At the same time, the work requires the capability to recognise the commercial potential of abandoned devices (Omokaro Ideho 2016) – in other words, the capability to recognise the lively powers of e-waste.

It is because these two elements of mobility and vibrancy of e-waste are inseparable parts of e-scraping that we propose combining the mobilities approach (Freudendal-Pedersen, Hannam, and Kesselring 2016; Sheller and Urry 2006) and the assemblage of things in new materialism studies (Coole and Frost 2010). While the mobilities approach helps to address the physical and virtual movement e-scrapers experience while carrying out e-scraping activities, the assemblage of things in the new materialism approach shows the relationship between the e-scrapers, e-waste acquisition processes, local environmental agencies, and sales of extracted valuable materials. The connection between the mobilities theory and the assemblage of things in the new materialism theory is discussed in Section 2. Using these approaches in concert aids the illustration of the social and environmental factors involved in e-waste management. By focusing on the assemblage of things in new materialism, this article contributes to the new mobilities paradigm by highlighting how the vibrant nature of material objects prompts the mobility behaviour of e-scrapers. This research uses Nigeria as a case study to investigate the applicability of this combined approach and of mobility behaviour.

Nigeria is regarded as the most populous country in West Africa, with a population of over 180 million people (National Population Commission, Nigeria 2017). With such a high population and increasing thirst for technology consumption, it is not surprising that the volume of e-waste is also high (Schluep et al. 2012). At the moment, there are no indigenous electronic manufacturers in Nigeria. Although some electronics assembling companies operate within the country, the majority of electronic consumption is imported either as new or second-hand. Recent crackdowns on illegal importing of non-tested electronics, and stronger enforcement of regulations on new vs. used electronics has made the import of



**Figure 1.** Factors influencing behaviour (Greger, Kemming and Brinkmann, 2007).

new electronics higher than before. It is estimated that in 2010, over 100,000 tonnes of e-waste was illegally imported into Nigeria (Schluep et al., 2012). Additionally, private consumers were estimated to be the highest consumers of small and large household devices. Institutional and corporate consumption comprising of IT and telecommunications equipment was estimated at over 400,000 tonnes. Approximately 1.1 million tonnes of electronic devices become obsolete each year in Nigeria (Schluep et al., 2012). With no formal e-waste recycling centres, a considerable fraction of this ends up at repair shops, in landfills, or in the backyards of informal recycling locations (Puckett, Westervelt, and Gutierrez 2005). Globally, a major challenge that the formal recycling sector faces is the high volume of e-waste required to efficiently run their machines. The method by which formal recyclers collect their e-waste also has a significant impact on the volume collected (Kreibe 2013). However, for e-scrapers, this low-volume challenge is almost non-existent. This is attributed to the mode of e-waste acquisition which defines mobility behaviour. This constitutive mobility behaviour is the focus of this paper.

The rest of the study is structured as follows. Section 2 presents the theoretical methods employed, and justifies the parallel use of two theoretical approaches: the new mobilities paradigm (Freundal-Pedersen, Hannam, and Kesselring 2016; Sheller and Urry 2016) and new materialism (Bennett 2010a, 2010b; Coole and Frost 2010). Section 3 presents the methodology and data applied in the study, reflecting the challenges and strengths faced in data collection. After this, the main results of the empirical analyses are presented in Section 4. Section 5 ends this article with a discussion and conclusions, showing the factors influencing the mobility behaviour of e-scrapers, and the capabilities that are developed and/or enhanced through the e-scraping process.

## 2. Theory

Mobility offers a broad standard for understanding the movement of people and material objects in a society (Freudental-Pedersen, Hannam, and Kesselring 2016). Renowned scholars such as Sheller and Urry (2006), Creswell (2006), and Kellerman (2012) have provided invaluable insights into the theoretical and empirical aspects of mobility studies. These insights break the traditional assumptions that the concept of “social life” in relation to “physical movement” is only achieved via intense relations amongst individuals within close proximity, thereby supporting current and significant methodological approaches and theoretical shifts in mobility studies. This opens up an emerging trend known as the “new mobilities paradigm” regarding the applicability and practicability of the fundamental approaches to the study of social issues in mobilities studies (Jensen, Lanng, and Wind 2016; Sheller and Urry 2016).

The new mobilities paradigm posits that social life and movements of human and non-human agents involve groupings and interactions of constituted organic and inorganic objects over space and time (Sheller and Urry 2006). The paradigm contends that the concept of social life and movement between places extends beyond just physical locations and the means of movement. It involves interdependent social relationships, means of communication, physical and virtual movement emerging from the complex network of connections, and activities carried out within an ecosystem. Interdependency, groupings, and connectiveness are all reflected in the new materialism theory.

New materialism seeks to understand how and what material objects people utilise (Bennett 2010a). It departs from the transcendental and humanist dualistic perspectives that distinguish between animate and inanimate actors, and presents matter as visually active components of the environment (Barad 2007). According to Bennett, Coole and Frost (2010), matter is a reactive agent with the ability to influence and induce reactions, including mobility, from its immediate environment. Matter is not only seen as animate objects, but also as exhibiting certain levels of independence and vitality outside the experience of humans. Additionally, its presence in an environment possesses the ability to initiate discussions and actions. However, the vitality of matter cannot happen in a vacuum; it needs the harmonious participation of other elements (assemblage of things) within its environment to fully exhibit itself (Barad 2007). Assemblage of things refers to groupings of relationships and interactions occurring between human and non-human agents within a particular ecosystem. Assemblage occurs in unevenly connected multiple relationships dispersed around space and time. Thus, humans are invariably connected with material and non-material objects.

This connectedness is exemplified among the e-scrapppers in their daily e-scrappping activities, and it is the theoretical focus of the mobilities approach in this study. In light of this connectedness, mobility can be considered a combination of movement, meanings, and power (Creswell 2006). What makes mobility more than movement is the temporally situated and culturally-specific social meanings ascribed to it. For example, the meaning of movement in the daily separation of e-waste is completely different in the affluent North, where recycling is more like an established habit, than in the developing South, where e-waste manifests itself as a source of livelihood for several e-scrapppers. Power inequalities are also a tangible part of the mobility of e-scrapppers. The ability to utilise various mediums of movement, such as bicycles, carts and automobiles, as well as transport infrastructure in

general, are unequally distributed in many societies, influencing the possibilities of e-scrap-pers to achieve their aspirational goals. In addition to work, the geographical dispersion of household, family and leisure activities also affects the daily mobility behaviour (Urry 2002) of e-scrapppers.

The categorisations of various forms of mobilities acknowledge that mobility occurs in different forms, including daily spatial mobility, terrestrial mobility and aerial mobility, and in different combinations (Kellerman 2012). Individual mobility is also influenced by personal choices and external factors. These external factors (i.e., e-waste acquisition), networking and personal factors (i.e., social significance and financial security) can coexist. These external factors form a significant part of the assemblage of things influencing mobility behaviour. In this study, we lean on the classifying of factors affecting mobility that makes a division between personal and external factors by following and further developing the model of Greger, Kemming and Brinkmann (2007; Figure 1). This model shows that individual mobility is influenced by a range of things comprised of personal and external factors. Although not as well-known as some other mobility models (e.g., Kellerman 2012), their model provides operative distinctions and categorisations that can be used in empirical research to identify the factors contributing to the assemblage of things, and that help unfold the social and environmental factors related to e-scrappping.

Greger, Kemming and Brinkmann (2007) define six main categories of external factors: location of opportunities or purpose of travelling; distances and travel times; natural environment; transport policy and planning; information and communication offer; and transport and mobility offers. In the transport policy and planning category, Greger, Kemming and Brinkmann highlight that external and personal factors have a dual effect of being restrictive and producing an incentive to move. The personal factors included in the same model are: socio-demographic aspects (i.e., education); accessibility of transport modes, such as cars; activities, such as social contact; working patterns; attitudes; and physical constitutions. These personal factors reflect the influences that form the decision-making process of individual mobility behaviour. They also signify the capabilities available to an individual. In fact, many of these personal factors are highly interrelated, and together they form an assemblage of things reflecting the personal lifestyles involved in everyday mobility.

Individual mobility also needs a trigger – a reason for movement and action to occur – and in this respect the work of Kellerman (2012) is useful. According to Kellerman, there are two categories of basic human mobility: needs and motivations. The first dwells on the questions around why we move, how we move, where we move, and the overall impact of this movement. Kellerman (2012) explains that humans are naturally curious beings. Even though this curiosity can now be partially satiated virtually with the use of technology, there is still a strong need for physical movement (locomotion), such as through the use of cars, bicycles, or even walking. The second category is comprised of three primary demands for mobility: the need for human proximity, locomotion, and curiosity. Kellerman (2012) also points out that there are derived demands of mobility that stem from people's activities outside the sphere of the home. This derived demand of mobility includes people, places, events, information, and knowledge. He highlights that these categories are geographically mediated and diversified in nature. Kellerman's analysis thus supports the six categories of external and personal factors highlighted by Greger, Kemming and Brinkman (2007). He provides a more clarifying analysis of the motives for mobility, social influences, and the factors influencing mobility.

We therefore propose that in order to understand the triggers associated with the mobility of e-scrapppers, e-waste as part of the assemblage of things (which includes personal and external factors) shall be taken into account. Although Figure 1 functions as a mobilities model competent to understand the why, how, where, and the impact of mobility behaviour in general, it does not provide an answer for the vibrant nature of e-waste. In this wider picture, the active nature of e-waste represents itself as a key derived demand for the mobility of e-scrapppers. As we will show, e-waste vibrates with signals of potential social recognition and economic success, triggering particular patterns of mobility among this actively mobile group of workers.

Following Kellerman's (2012) first category of primary mobility demands, we argue that the demands of proximity, locomotion, and curiosity afford e-scrapppers a form of upward social mobility in this context. By upward social mobility, we are referring to social recognition such as professional status and exclusivity that e-scrapppers derive from their activities within the community. Additionally, the needs related to basic livelihood makes e-scrapppers more prone to recognising the value in e-waste by capitalising on the vibrant nature of matter.

### 3. Method and data

Video ethnography (Tuma, Knoblauch, and Schnettler 2014) was considered as an appropriate way to study the mobility of scrapppers who learn their work mainly by following and observing more experienced colleagues. Video recordings ensured that the e-scrapppers' terminology and practices not studied before were captured during the e-scrappping process. The use of the video camera also acted as an icebreaker for starting off conversations between the first author and the e-scrapppers, who immediately paid attention to the presence of new technologies. However, the actual interview process also caused some concerns. E-scrapppers are a highly mobile group of people who guard their business jealously. Although they were comfortable being video-recorded during the e-scrappping process, they were against being video-recorded while out acquiring e-waste, as it would draw too much attention to them. After many negotiations and clarifications, the e-scrapppers' fears of been displayed on the Internet, and their trade secrets exposed, were allayed. It was also agreed upon that the interviewer would only take pictures while e-scrapppers went out to acquire e-waste, contingent upon obtaining permission from private consumers or e-waste suppliers we encountered. Private consumers are people who give or sell their obsolete devices directly to the e-scrapppers or electronic repairers. E-waste suppliers on the other hand are individuals whose main business it is to sell e-waste to the e-scrapppers.

Altogether, 29 male e-scrapppers between the ages of 18 and 55 were observed and interviewed for the study between 2014 and 2015. The 29 male e-scrapppers were interviewed as representatives of their various e-scrappping locations. Some of the interviewees had been employed in professional fields such as engineering before venturing into the world of e-waste. While working in the field, it became evident that e-scrappping is a male-dominated business largely due to its physical nature. The work consists of lifting heavy e-waste items, and continuous transportation of extracted and residual materials from place to place. Women only became visible when the e-scrapppers needed food or care.

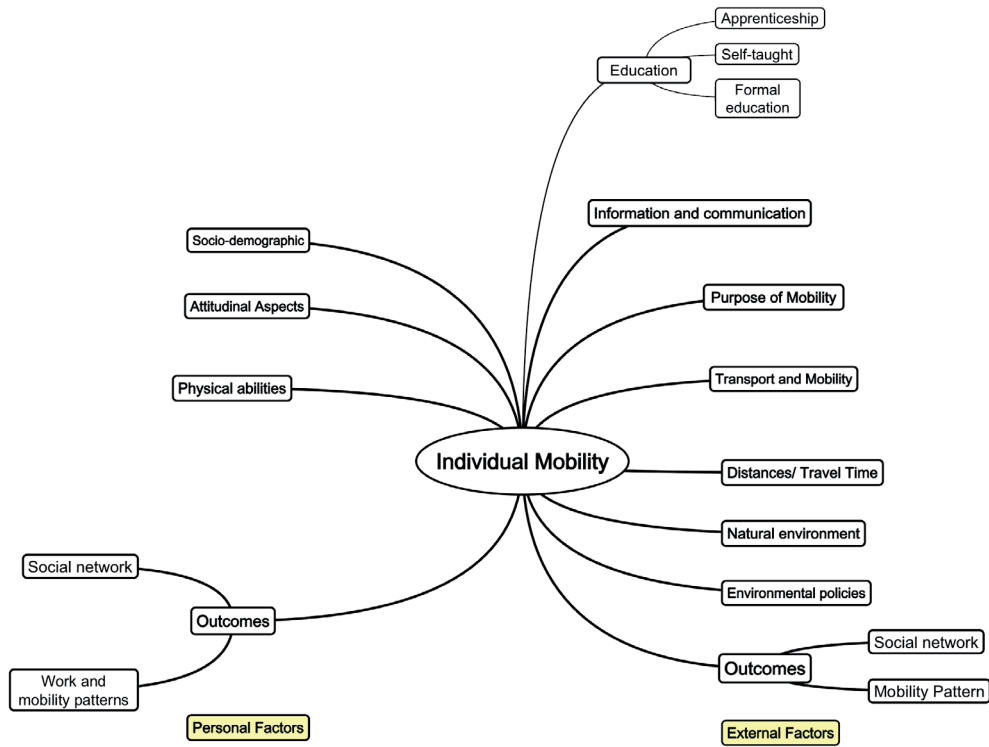
E-scrapppers were recruited for the study by applying the snowballing method, which was both practical and the only possible way of reaching these nomadic workers. While the e-scrapppers carried out their daily activities, the first author video-interviewed and observed

them in their natural setting, following their mobility from a close distance (Büscher, Urry, and Witchger 2010). This helped to reveal their work and mobility processes and to avoid disruption of work during the interview. The use of the local dialect, *Pidgin English*, helped to create rapport and an easy-going atmosphere where the presence of the camera was almost forgotten. The consent to collect video and interview material for academic reporting was received from the e-scrapers both on camera and in written form.

E-scrapers were interviewed following the procedure of semi-structured interviews. The topics addressed in the interviews ranged from the process of e-waste acquisition to the social perception of them as e-scrapers. In this paper, we analysed the data mainly derived from the questions dealing with e-waste acquisition process, sale of valuable extracts, social perception of their activities, and environmental regulatory influences.

The interviews were coded following the basic principles of qualitative content analysis (Krippendorff 2013), specifically conventional content analysis (Hsieh and Shannon 2005); and by exploiting MAXQDA software as computer-assisted qualitative data analysis. The use of conventional content analysis is well suited to this study because the aspect of e-waste management addressed in this study has very limited academic literature (Hsieh and Shannon 2005). Besides qualitative analysis, we also quantified certain background factors, such as education, from the data in order to present the socio-demographic profile of the interviewed e-scrapers. To ensure the anonymity of the interviewees, we promised to protect their identity and avoided close-up recording of their faces. In the results section, pseudonyms are used when presenting findings. For the purpose of showing the analysed results as defined by the e-scrapers, we use vignettes (Jacobsen 2014). Vignettes not only afford us the opportunity of presenting the terminologies and descriptions used by the e-scrapers in the field, they also allow the reader to gain insights into the world of e-scrapers.

The video interviews were carried out in Lagos State and Benin City, Edo State, Nigeria. In Lagos State, interview sites included: Ikeja Computer Village, Owode Market, Alaba International Market, and Ladipo Market. While in Benin City, Edo State, sites included the residential areas of Isihor and Ibiwe. Edo State is a civil servant state with less volume of e-waste extraction. This is in sharp contrast to the industrialised and populous Lagos State that has a higher volume of e-waste extraction. In Edo State, e-scraping activities are carried out among residential buildings and in open air spaces. These spaces are achieved via rent or private ownership, and are often located near major electronic sales and repair centres. In Lagos State, e-scraping activities took place in designated areas and market places. These e-scraping sites are usually formed based on their geographical locations, electronic consumption, and trading activities. Ikeja Computer Village, Alaba International Market, and Ladipo and Owode Markets are known destinations for everything electronic, spare car parts, and iron from abandoned cars. In these locations, e-scrapers are often in collaborative relationships with sellers and repairers of electronic devices. This acts as a viable source for e-waste acquisition. In both states, e-waste is acquired from multinational institutions, government institutions, private companies, private consumers, and electronic repairers. Besides being major hubs for electronic device transactions, the interview locations possess distinct characteristics. Lagos State is densely populated and experiences intense road traffic, increasing the use of mobile communication for coordinating e-waste acquisition and the sale of valuable extracts. In Edo State, the population is less dense and traffic is lighter; hence, the reliance on communication technology is not as intense as Lagos.



**Figure 2.** Factors influencing mobility of e-scrappers in e-waste management. Source: Adapted from (Greger, Kemming and Brinkmann, 2007).

#### 4. Results

The acquisition of e-waste has a significant impact on the mobility and activities of e-scrappers in Nigeria. Personal and external factors of mobility that constitute the “assemblage of things” (Bennett 2010a, 23) influences the ability of e-scrappers to fully interact with e-waste. As an offshoot from the personal factors displayed in Figure 1, we found that 27 of the 29 respondents had at least a basic formal education, the highest being a Bachelor’s degree. The remaining two interviewees had been trained informally in sales of electronics and repairing. The levels and types of education turned out to be very decisive factors influencing the level of interaction with e-waste. This influence ranged from the method employed during extraction, the formation of and quality of social networks (Easley and Kleinberg 2010, 1, 2; Omokaro Ideho 2016, 5), and the channel of sales to the mobility pattern. For example, the external factor of distance travelled has a significant impact on the amount of e-waste the e-scrappers acquire per day.

Personal and external factors, especially knowledge of valuable components of e-waste and infrastructure (workspace, road conditions), have a significantly associated impact on mobility behaviour, as they influence the choices made by the e-scrappers. For them, acquiring quality e-waste at locations where there is a steady flow is just as important as their

workspace. These locations serve as important moorings – fixed places (Hannam, Sheller and Urry 2006) that provide the basis for their daily mobility patterns.

As part of the external factors, accessibility to transport required for the purchase and exportation of extracted valuable materials helps to maximise gains and reduce the amount of invaluable waste from the e-scraping process. Poor road infrastructure, shifting petrol prices, and petrol availability often meant that transportation was expensive and challenging to manage. An e-scrapper named Olu, who works with large e-waste devices at the Ikeja Computer Village, attested to this during the interview:

... sometimes, I take it (extracted valuable materials) to them. Sometimes they come to get it. It depends on the volume I have. Sometimes, I spend 80,000 naira<sup>1</sup> just to transport it to them. It is really costly. (Olu, Ikeja Computer Village, Lagos State, Nigeria)

External factors such as road and petrol prices are beyond the control of the e-scrapers. However, they are able to adapt by sourcing for alternative methods for achieving their e-scraping goals. Access to alternative methods is often acquired by the quality of the social network that includes e-waste buyers, local environmental agencies, family members, business partners, local and international institutions, and private consumers (Omokaro Ideho 2016). The influence of social networks ensures that e-scrapers are constantly gaining new insights into the e-waste market and also pushing their knowledge of the trade. For them, it is important to know what manufacturers are buying and what they are willing to pay. Understanding how e-waste presents itself to manufacturers determines how much and how long e-scrapers are willing to travel to make acquisitions. This was confirmed by Olu:

... they (buyers) are very strict with what they want. If they request for steel only, that is what they want. If they find any plastic in it, they will deduct money. Quality is very important. I take the extracts to the buyers when I am ready.

Our results, therefore, indicate a need to adjust and streamline the model of individual mobility behaviour originally presented by Greger, Kemming and Brinkmann (2007; see Figure 1) to make it more relevant for studying this aspect of e-waste (see Figure 2).

The original model lacks some essential factors, such as outcomes of interconnected activities (e.g. formation of a social network) and environmental policies needed to understand the relationship between various places of e-scraping and mobility behaviour in particular. Personal and external factors such as modes of transportation, attitudinal aspects, physical abilities, purpose of mobility, travel time, information and communication and transport and mobility were added to reflect the assemblage of things specific to e-scrapers. E-scrapers' involvement in e-waste and subsequent activities revolve around the social network they find themselves in. The quality of information on e-waste acquisition and sales of extracted valuable materials is also highly dependent on the social network. Thus, the e-scrapers' activities often start with the purpose of mobility (such as e-waste acquisition) as an external factor, resulting in the formation of a social network and mobility patterns (outcomes in the personal factors), and end with outcomes of personal factors as shown in Figure 2.

To give a better description of the relationship between the factors depicted in Figure 2, we present the vignettes of e-scrapers, whose daily mobility exemplifies the adapted parts of the mobility model.



## 4.1. External factors

### 4.1.1. Vignette 1

Here is a typical day in the life of e-scrapper Ade (also see video excerpt on Vimeo (The password is: Sissan5)). Ade is a 16-year-old student who has been e-scraping for over six years in Benin City. He got into e-scraping via the apprenticeship model.<sup>2</sup> The apprenticeship model provides the needed background information and social network support he needs to start off on his own. Depending on the day of the week, Ade visits his clients, who are mostly e-waste repairers and electronic sellers, at designated areas for e-waste acquisition. Using carts, Ade walks long distances, typically 1 to 10 km per day. He does not own specific territorial areas. Nevertheless, he is very protective of his client base, especially those from whom he acquires quality e-waste. Hence, his ability to share or hoard relevant information and communication with his social network is very paramount to limiting conflicts and improving his client base. When he gets back from e-waste acquisition, Ade sets to work manually extracting valuable materials from the e-waste. He employs the smashing process, which involves hammering down on the e-waste device with a mallet or a hammer. He was very quick to ensure the extracts were totally separated before depositing them in the bag.

Depending on the buyers' demands, Ade extracts gold, copper, and brass. He is very particular about the quality of extracts he gets and would not mind travelling far to get it. Consistency in providing quality e-waste extracts has a significant impact on the type of buyers he gets for his products and the value they place on them. Buyers typically look out for e-scrapers who are consistent in providing quality extracts:

Ade: ... getting good e-waste is very important. When my product is good, it is easier to increase demand for it. You know ... when there is demand, I get to buy more e-waste and produce. It also means more money for me [*smiles widely*]. (*He explained further*). I like to do things properly. This business provides for my schooling and I want to make sure I give the best to my buyers.

Interviewer: How can you tell your extract is of good quality?

Ade: ... haaa [*grinning*], I can tell now ... If you have been doing this a long time, it is easy to tell. I know my customers who own very good e-waste. I value them a lot. I buy from them always [*smiling fully now, he had a glint in his eyes, like he knew something I did not*]. My buyers always come back to me because they know I can deliver [*he finished proudly*]. (Ibiwe, Benin city, Nigeria. June, 2015)

After the e-scraping process, valuable extracts are then weighed, bagged, and stored for transportation to buyers who are usually manufacturers situated within and outside Lagos State. Ade admitted that very few buyers patronise them in Benin City, but when they do, the profit is usually lower.

Interviewer: Who do you sell to?

Ade: ... I sell to buyers in Lagos State. It is more profitable. Sometimes I sell to buyers here in Benin City, but the prices are not as good as in Lagos State. So I export them directly to my buyers in Lagos State. (Ibiwe, Benin city, Nigeria. June, 2015)

This vignette shows that in order to maximise profits and reduce transportation, Ade pools his extracts with other e-scrapers for transportation to Lagos. He does this when his extracts are not enough to transport alone. This strengthens the relationship to his social network. Ade's collaboration with other e-scrapers also indicates that social network as an external factor influences his personal factors of attitudinal aspects and outcomes.



**Figure 3.** Moses, standing in front of a neat pile of e-waste, explained his activities.  
 Note: Photo: Benedicta Ideho Omokaro.

Interestingly, places of e-waste acquisition and sales of valuable extracts also have an impact on the daily spatial mobility (Kellerman 2012) of the e-scrapers. An example is Moses, who is an engineering student at the Polytechnic in Lagos State.

#### 4.1.2. Vignette 2

Moses is a 27-year-old male who has been e-scraping at Owode market, Lagos State Nigeria, for over 15 years. He acquires e-waste from big corporations and the Polytechnic where he studies. His formal education provides him with the needed social network and the ability to recognise valuable parts in e-waste:

I study at the Polytechnic and I e-scrap as well. I get a lot of quality e-waste from my school. I make lots of profit because it is good quality. (Moses, Owode, Lagos State, Nigeria. October, 2014)

Moses' association with the university provides a steady flow of quality e-waste, which in turn ensures a stable income (Figure 3). His social network was clearly beyond his peers in the business. Affiliating with his school gave him a competitive advantage and a different mobility pattern in e-waste acquisition and sales. Unlike some of his peers who utilised carts, Moses used a car for acquiring e-waste, especially in the mainland city of Lagos. Sometimes, his clients dropped off the e-waste at his workspace. On days when this drop-off occurs, Moses' volume of e-waste is usually larger because the drop off frees him to visit other consumers. When asked if he would rather work full-time at the Polytechnic as a computer engineer, considering that he had such a strong footing in the Polytechnic, he replied:

I have been offered employment at the Polytechnic, but the money I get from this business is much more than what they can pay me. I even help them out [*lecturers and administrators*] with computer repairs too [*smiles widely*]! (Moses, Owode, Lagos State, Nigeria)

Acquiring e-waste from various points in so-called "high placed" institutions provides Moses with the much coveted industry information he needs to stay ahead in the business. His mobility triggered by e-waste provides a platform for sharing ideas, networking, and building valuable relationships.

## 4.2. Personal factors

### 4.2.1. Vignette 3

Mohammed is an 18-year-old male who has been e-scraping for over six years at Ibiwe, Edo State. Mohammed attends a school during the day and e-scrapes in the evening after



**Figure 4.** Idowu back from purchasing e-waste.

Note: Photo: Benedicta Ideho Omokaro.

school. In contrast to most of his colleagues, he is more meticulous in keeping records of his transactions. His workspace is situated amongst residential buildings in the heart of Benin City. Because Mohammed does not e-scrap alone in this area, there is a huge competition to acquire e-waste from the surrounding neighbourhoods. This influences the distances he has to travel to purchase e-waste.

I wake up 6 am every day. I attend school first before going to buy (e-waste) from my customers ... electronic repairers are my favourite customers; they usually have good quality e-waste. I have a regular route and it is about 5–10 km every day. (Mohammed, Ibiwe, Benin City, Nigeria)

Walking long distances while pulling a heavy cart full of e-waste requires a certain level of strength and stamina. E-waste comes in various shapes and sizes. With a prevalence of bad roads, using carts becomes a viable option. Like his colleagues, Mohammed depends on his social network for trade secrets and trendy information. His social network is comprised of those he acquires e-waste from, the buyers of extracted valuable materials, environmental agencies, and his colleagues. These networks also inform his work and mobility patterns.

The vignettes presented above illustrate high mobility stimulated by e-waste, which represents itself as a source of social recognition and economic security for e-scrappers. Contrary to the throwaway cultures of industrialised countries (Cooper 2016), the repair culture in Nigeria ensures that e-waste is mainly collected at the repair shops. This makes the acquisition of e-waste easy for e-scrappers who can determine their value at first sight, based on the skills acquired through apprenticeship and learning-by-doing.

The use of carts (Figure 4) facilitates the acquisition of e-waste from the innermost parts of the cities where private consumers and repairers are located. It can also be deduced from the vignettes that e-waste acquisition occurs at multiple locations, signifying the intense mobility behaviour of the e-scrappers.

It is, however, not enough to acquire just any e-waste. The e-waste has to be of good quality to produce more valuable extracts. Acquiring quality e-waste is important for

e-scrapers; hence, they tend to reach out to even private consumers in locations where cars cannot access easily. The use of carts often designed by them and crafted by local welders makes this interior access possible. Due to competition among the e-scrapers, brokering deals for e-waste collection with small businesses and large corporations at competitive prices was also very common. This creates a certain level of stability and recognition for the e-scrapers.

E-scrapers' mobility is also greatly influenced by the occurrence of rainfall, which underlines the remarkable impact of the unexpected elements of the assemblage of things on the mobilisation of e-waste and e-scrapers. Poor road infrastructure and poorly constructed drainage systems make it easy for flooding to occur. In such cases, e-scrapers are limited in their mobility, therefore causing a deficiency in the mobility system (Hannam, Sheller and Urry 2006). E-scrapers tend to concentrate on a specific environment, which influences the availability of workspace. Thus, when flooding occurs, they often need to move their e-waste and the extracts to safe places, which are often scarce.

E-scrapers are only found at their workspaces when they are dismantling electronics or preparing the extracted materials for export to a local and/or international buyer. Workplaces are comprised of cut-out buildings or wooden sheds, and are usually situated among residential buildings and marketplaces. The actual process of e-scraping takes place outside in the open air. Workspaces prone to heavy floods are avoided, as valuable extracts could be washed away from the broken-down electronics, and work interruptions can occur. This was noted by e-scrapper, Idowu, in the following excerpt:

... when it rains, I pull my cart over and wait till it stops. I am not salt. The rain does nothing for me. But I am very particular about where I e-scrap. There should be no flood. It could cause rust and wash away my money [grins]. (Idowu, Isihior, Benin City, Nigeria; Figure 4)

Places of e-scraping activities are usually situated at electronic or steel marketplaces, and in some cases within or close to residential buildings. Besides a place of acquiring e-waste, the e-scraping workspace seems to be the only form of permanence (Hannam, Sheller and Urry, 2006) e-scrapers experience. Yet, even this can change when environmental agencies decide they are a menace to the neighbourhood. Environmental authorities still do not see e-scrapers as valuable assets in waste management. E-scrapers who do their work among residential buildings are mostly affected by the authorities. Those situated at the marketplaces usually have the market authorities and their peers to contend with. To avoid eviction, the e-scrapers ensure that they adhere strictly to environmental laws. The e-scraping environment must be kept clean, and burning of e-waste to extract valuable materials must not occur (Amoore, Marmura, and Salter 2008).

## 5. Discussion and conclusions

E-scrapers' mobility is an integral part of e-waste management that so far has not received much academic attention. In this article, we have clarified how e-waste engenders mobility among informal recyclers (e-scrapers), while providing them with economic stability and social recognition in Nigeria. Even if personal goals, such as financial stability, are strong incentives for e-scrapers, their mobility behaviour has some exceptional features, which in this study were exhibited by investigating the entire assemblage of animate and inanimate things that influence mobility (Figure 2).

Due to the constant demand for extracted quality materials and the limited storage spaces of individual workers, e-scrapers are forced to be always on the move. This external factor is very peculiar to the e-scrapers because the extracted valuables must be sold quickly to free up storage space for new valuable materials. We also found that mobility of e-scrapers, on the one hand, is highly dependent on their individual personal factors, such as formal educational qualities and social contacts. For example, personal factors such as values, goals and aspirations in life, and education provided social contacts in more institutional entities such as universities and Polytechnics. This also had an influence on how the e-scrapers were seen socially. Educational qualities provided an edge with the buyers so that the e-scrapers were perceived as very qualified. Additionally, the quality of e-waste extracts also differed in terms of how much the e-scrapers could get from the buyers. On the other hand, we also discovered that mobility is easily interrupted by external factors, such as sudden and extreme weather conditions in the absence of appropriate infrastructures (paved roads, effective drainage systems, etc.). This easily causes inertia among e-scrapers, which lasts until the assemblage of things normalises (e.g., rain stops or flood abates).

Apart from physical mobility, these activities require various forms of immaterial mobility, such as communication and information-seeking. In Lagos State, where traffic congestion was very prominent, and distances between places of e-waste acquisition, workspaces, and sales of extracted materials can be quite long, the use of mobile communication technology helped to enhance productivity and efficiency in carrying out e-scraping activities. Reflectively, we wonder if the corporeal need to travel will remain at a high level if there was provisions of advanced ICT tools and infrastructure supporting virtual mobility. Although e-scrapers typically possess sufficient knowledge and skills to utilise digital technologies in their work, IT's current infrastructure and pricing policy in Nigeria does not allow utilising them on a large scale.

Another form of immaterial mobility that is required in e-scraping and that keeps these workers mobile is the acquisition of new knowledge. E-scrapers have to be acquainted with current trends in the business, and must keep up with technological advancements, new environmental regulations and new extraction techniques. Trends such as prohibition of lead in electronic devices imply that outdated devices containing such prohibited substances will no longer be attractive to prospective buyers. Acquiring this knowledge helps the e-scrapers avoid the purchase of such devices, thereby preventing loss.

Our findings also emphasise that the quality of the social network formed during e-waste acquisition and from peers have a significant impact on the quality of e-waste and the information that is received. E-scrapers' association with an educational institution provides valuable information on the latest trends in technological advancements, as well as updates in global environmental laws. This affords the e-scrapers a competitive advantage.

A closer look at the e-waste acquisition process of the e-scrapers used in this study revealed that the conditions of certain infrastructures, such as roads, encouraged either the use of carts or cars. E-scrapers who used cars for e-waste acquisition felt they had acquired a higher social mobility. The availability of good roads and cars increased the volume of e-waste that can be acquired in one trip, further reinforcing the link between physical and possible upward social mobility as recognised by other mobility scholars (Adey 2010; Kaufmann 2003). Therefore, the high physical mobility among the Nigerian e-scrapers is

also related to the upward social mobility. Upward social mobility is signified by the quality of one's social network, perceived professionalism, and connections with multinational buyers. In their immediate society, mobility in every phase of e-waste management signifies that the e-scrapers are productive and responsible citizens, and therefore highly regarded. This presents a certain level of formality and a business savvy perception to buyers, especially foreign buyers who (according to the e-scrapers interviewed in this study) utilise the valuable extracts for other purposes, such as jewellery or steel manufacturing for housing. On the other hand, e-scrapers who utilise carts for acquisition due to poor road conditions and drainage systems acquire lower volumes of e-waste per trip. To make up for this limitation, some of the e-scrapers employ other colleagues called "e-waste buyers" to acquire e-waste. The act of employing e-waste buyers shows that mobility of e-scrapers can occur indirectly via other e-scrapers. This method of adaptation reflects the applicability of the new mobilities paradigm in e-waste management.

Although possessing a car could positively influence social perception, it did not have a significant impact on the sales of valuable e-waste extracts. This is because even though face to face contact with buyers was limited by distance, transactions were mostly carried out on the phone or through colleagues at point of sale.

We also found that the places of work (e.g., marketplaces, residential spaces) and related environmental laws highly influenced the mobility of e-scrapers. The environmental laws such as cleanliness and prohibited e-waste burning impacted the e-scrapers daily activities. Otherwise, the actual e-scraping process of dismantling is dependent on e-scrapers social network. These inanimate and regulatory factors push e-scrapers to find workspaces at locations that will ensure possible permanence of their work while adhering to environmental laws. This is in contrast to a common belief that e-scrapers in the South do not care about the obvious health risks of e-scraping or are immune to environmental laws.

In understanding e-scrapers' role in the management of e-waste, the vibrant nature of e-waste is effectively and efficiently recognised through the lens of new materialism. New materialism provides a wider framework, within which the personal and external factors (Figure 2) influencing e-scrapers' mobility occurs.

While the use of neo-materialism helped us describe and improve the understanding of the mobility behaviour of e-scrapers, many key issues remain to be studied. For instance, it would be important to further investigate how much mobility is required to acquire a certain amount of valuable extracts. In this context, the social network at individual and community levels as well as the impact of cultural and social habits of e-scraping on lifestyle also deserves more scientific attention.

We have shown that the symbiotic relationship between an e-scrapper, e-waste, and the environment is reflected in the vibrant and active nature of e-waste, which is recognised by the e-scrapers, and that the mobility behaviour of these e-scrapers denotes the success of their business and social relations. The sustainable management of e-waste starts with e-waste acquisition. We argue that effective e-waste management requires the more vigorous approach employed by e-scrapers in the acquisition of e-waste. The act of visiting and acquiring e-waste directly from consumers ensures that e-waste escapes landfills. In contrast to the formal recycling centres, where a low volume of e-waste is always a challenge, e-waste will always be available to e-scrapers.

## Notes

1. At the time of writing, 80,000 naira = 228 €.
2. An apprenticeship is a system that provides on-the-job training for individuals. It involves employer-apprentices relationships. The apprentice learns for an agreed period of time (Omokaro Ideho 2016).

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Funding

This work was supported by University of Jyvaskyla.

## ORCID

Benedicta Ideho Omokaro  <http://orcid.org/0000-0001-5850-4939>

## References

- Adey, P. 2010. *Mobility: Key ideas in geography*. London: Routledge.
- Amoore, L., S. Marmura, and M.B. Salter. 2008. Editorial: Smart borders and mobilities: Spaces, zones, enclosures. *Surveillance & Society* 5, no. 2: 96–101.
- Barad, K. 2007. *Meeting the Universe Halfway: Quantum Physics*. London: Duke University Press.
- Belenky, L.T. 1999. Cradle to border: U.S. hazardous waste export regulations and international law. *Berkeley Journal of International Law* 17, no. 1: 43.
- Bennett, J. 2010a. *Vibrant Matter*. Durham: University Press.
- Bennett, J. 2010b. A vitalist stopover on the way to a new materialism. In *New materialisms: ontology, agency and politics*, ed. D. Coole, and S. Frost, 47. Durham: Duke University Press.
- Büscher, M., J. Urry, and K. Witchger. 2010. *Mobile methods*. New York: Routledge.
- Coole, D., and S. Frost. 2010. *New materialisms: Ontology, agency, and politics*. Durham: Duke University Press Books.
- Cooper, T. 2016. *Longer lasting products: Alternatives to the throwaway society*. London: Taylor & Francis.
- Cresswell, T. 2006. *On the move: Mobility in the modern western world*. New York: Routledge Taylor and Francis Group.
- Easley, D., and J. Kleinberg. 2010. *Networks, crowds, and markets: Reasoning about a highly connected world*. Cambridge: Cambridge University Press.
- Freudendal-Pedersen, M., K. Hannam, and S. Kesselring. 2016. Applied mobilities, transitions and opportunities. *Applied Mobilities* 2380–0135.
- Gabrys, J. 2013. *Digital rubbish. A natural history of electronics*. Michigan: The University Michigan Press.
- Garlapati, V. 2016. E-waste in India and developed countries: Management, recycling, business and biotechnological initiatives. *Renewable and Sustainable Energy Reviews* 54: 874–881.
- Goodship, V., and A. Stevels. 2012. *Waste electrical and electronic equipment (WEEE) handbook*. Oxford: Woodhead Publishing Limited.
- Greger, S., Kemming, H., and Brinkmann, W. 2007. Verkehrsverhalten sozialer Gruppen. Soziale Aspekte der Mobilität [Mobility behaviour of social groups. Social aspects of mobility]. In *Institut für Landes- und Stadtentwicklungsforschung und Bauwesen des Landes Nordrhein-Westfalen*, 234. Dortmund: ILS-Trends. Entwicklungen in NRW.
- Hannam, K., Sheller, M., and Urry, J. 2006. Editorial: Mobilities, immobilities and moorings, mobilities. *Mobilities*, 1: 23.

- Holmes, I. 2009. Dumping, burning and landfill. In *Electronic waste management: Design, analysis and application*, ed. R. Hester, and R. Harrison, 27. 263. Cambridge: The Royal Society of Chemistry.
- Hsieh, H.-F., and S.E. Shannon. 2005. Three approaches to qualitative content analysis. *Qualitative Health Research* 15, no. 9: 1277–88.
- Jacobsen, A.J. 2014. Vignettes of interviews to enhance an ethnographic account. *Ethnography and Education* 9:35–50.
- Jensen, O.B., D.B. Lanng, and S. Wind. 2016. Mobilities design – towards a research agenda for applied mobilities research. *Applied Mobilities* 1, no. 1:26–42.
- Kaufmann, V. 2003. *Rethinking mobility: Contemporary sociology*. Aldershot: Ashgate.
- Kellerman, A. 2012. *Daily spatial mobilities: Physical and virtual*. Surrey, England: Ashgate Publishing.
- Kreibe, S. 2013. Current and new electronic waste recycling technologies. In *E-waste management: From waste to resource*, ed. K. Hieronymi, R. Kahhat, and E. Williams, 25–48. London: Routledge: Taylor and Francis.
- Krippendorff, K. 2013. *Content analysis: An introduction to its methodology*. London: Sage.
- Mallampati, S.R., J.H. Heo, and M.H. Park. 2016. Hybrid selective surface hydrophilization and froth flotation separation of hazardous chlorinated plastics from E-waste with novel nanoscale metallic calcium composite. *Journal of Hazardous Material* 306: 13–23.
- Mitchell, C. 2008. Altered landscapes, altered livelihoods: The shifting experience of informal waste collecting during Hanoi's urban transition. *Geoforum* 39, no. 6: 2019–2029.
- National Population Commission, Nigeria. 2017. *Nigeria's population now 182 million—NPC*. Nigeria: National Population Commission. <http://www.population.gov.ng/index.php/80-publications/216-nigeria-s-population-now-182-million-dg-npopc>; accessed March 15, 2017.
- Omokaro Ideho, B. 2016. Building capabilities among e-scrapers in informal electronic waste management: The Case of the Nigerian e-scrapers. *Environmental Sociology Journal* 2, no. 2: 2325–1042.
- Puckett, J., S. Westervelt, and R. Gutierrez. 2005. *The digital dump: Exporting re-use and abuse to Africa*. Seattle, WA: The Basel Action Network.
- Schluep, M., O. Ogungbuyi, I.C. Nnorom, and O. Osibanjo. 2012. *E-waste country assessment nigeria. E-waste Africa project of the secretariat of the Basel convention*. Switzerland: Basel Convention.
- Sheller, M., and J. Urry. 2006. The new mobilities paradigm. *Environment and Planning* 38, no. 2: 207–226. doi:10.1068/a37268.
- Sheller, M., and J. Urry. 2016. Mobilizing the new mobilities paradigm. *Applied Mobilities* 1, no. 1: 10–25.
- Tuma, R., H. Knoblauch, and B. Schnettler. 2014. Video analysis and videography. In *The sage handbook of qualitative data analysis*, ed. U. Flick and U. Flick, 435. London: Sage.
- Urry, J. 2002. Mobility and proximity. *Sociology* 36, no. 2: 255–257.



## **IV**

### **REVISITING INFORMAL RECYCLERS: UNDERSTANDING THE ORGANIZATIONAL AND OPERATIONAL PARADIGM OF NIGERIAN E-SCRAPPERS.**

by

Benedicta Ideho Omokaro, 2017

Submitted for publication and  
under review at Journal of Current Sociology

*Benedicta Ideho Omokaro*  
*Department of Social Sciences and Philosophy*  
*University of Jyväskylä, Jyväskylä, Finland*  
*Keskussairaalan tie 2*  
*P.O.Box 35*  
*40014*  
*[benedicta.ideho@jyu.fi](mailto:benedicta.ideho@jyu.fi)*

### **Revisiting informal recyclers: Understanding the organisational and operational framework of Nigerian e-scrapppers**

Since the emergence of e-waste recycling, prominent scholars have analysed the activities of both the informal and formal sectors, revealing the negative environmental aspects of informal recycling and the constraints faced by formal recycling plants. Relationships between these sectors have also been examined but very few have addressed the organisational and operational behaviour which sustains informal recyclers, specifically the e-scrapppers. To proffer a sustainable e-waste management framework, this study investigates this organisational and operational behaviour among e-scrapppers in Nigeria. To understand this paradigm, this article employs the use of new materialism theory. Contrary to previous theoretical approaches, the use of new materialism shows that e-waste is vibrant matter capable of eliciting reactions from the e-scrapppers. These reactions are manifested through the assemblages within the environment and the subsequent formation of a social system. The data analysed in this study is derived from video, audio and written recordings captured among 29 e-scrapppers in Nigeria. The analysis reveals that e-scrapppers are highly organised in their operations. The legality of their operations is determined by the kind of organisations they have formed. This article reveals that they fall under two broad organisational categories— independent e-scrapppers and unionised e-scrapppers. Each category is defined by the organised structures and the level of influence that is reflected in society. Based on the results, this study proposes an integrative operational framework for sustainable e-waste management. The proposed operational framework is derived from the existing assemblages within the e-scrapppers' environment and organisational structure formed during the e-scrappping process.

**Keywords:** e-waste management, electronic waste, e-scrapppers, new materialism, associations, informal recyclers

## 1.0. Introduction

In the world of electronic waste management, also known as e-waste, sustainable development of recycling practices has been a major concern among environmental activists, academic scholars and policymakers. At the core of this concern are the informal recyclers. Currently, it is quite challenging to ascertain how much e-waste is recycled at informal recycling centres and at formal recycling centres (Lepawsky 2015). Recent data suggest that informal recyclers manage most of the world's discarded electronics (Lepawsky 2015; Perkins et al. 2014); despite this, informal recyclers have often been lumped in a broad category and characterised as unorganised nomads devoid of any legal status in the society. This study challenges this notion by investigating the structural and operational framework of informal recyclers through the example of e-scrapppers in Nigeria. The aim is to present a new way of thinking about informal recyclers in general, and Nigerian e-scrapppers in particular. In this article, e-scrapppers refer to individuals who specialise only in e-waste recycling.

Due to differences in consumption habits and environmental laws in various countries, there are varied definitions of what constitutes e-waste. This has made a standard definition difficult. In this article, the definition from Step Initiative (2014) will be used; e-waste broadly refers to the devices that have been considered unusable and have been discarded by the consumer.

The specific amount of e-waste trade globally is still unknown. Current data on total e-waste management production are estimates and assumptions (The Economist 2014) based on proffered mathematical modelling for ascertaining the volume of e-waste that is recycled annually (Wang et al. 2013). Studies only estimate that in 2014, 41.8 million metric tonnes of e-waste were generated and there is a definite likelihood of a 50 million tonne increase by 2018 (Balde et al. 2015). In proportion to the amount of e-waste that is generated annually, it is estimated that 10 to 40 percent is recycled properly in formal recycling plants (UNODC 2013).

Scholarly research has mainly focused on the unsustainable environmental practices of informal recyclers (Brigden et al. 2005) and the integrated approach between the formal and informal recycling sectors. They have documented the inflow and movement of e-waste from the highly industrialised countries in which formal recycling organisations equipped with standardised technologies (Murphy, Jeremy, and Randolph 2013) are available, to emerging economies, such as India, China, Pakistan, Ghana and Nigeria, where informal recycling thrives and the presence of formal recycling is almost non-existent (Nnorom and Oladele 2007). The steady increase in the movement of e-waste from formal to informal recycling centres is generally attributed to the strict regulations, infrastructure, high cost of labour faced by formal recycling centres, and the low volume of e-waste that is collected from consumers. Besides the strict environmental regulations, acquisition of formal recycling equipment is capital intensive and requires a certain volume of e-waste to reach maximum output. A growing shortage of natural resources such as tantalum and dysprosium, fuelled by overconsumption and a hike in prices (Songa, Wanga and Lib 2013) coupled with the proliferation of competi-

tive electronic devices at cheaper prices and the outcry for eco-friendly products, has forced manufacturers to seek alternatives to mining natural resources. Thus, there is an increasing demand for materials recovered from e-waste at competitive prices, especially from informal recyclers. The demand acts as one of the continuous driving forces for the presence of e-scrapppers, who play an important role in diverting e-waste from landfill sites and incineration. However, the methods used by informal recyclers (Omokaro Ideho 2016; Kreibe 2013) for extracting valuable materials from the cocktail of toxic materials and complex composition of e-waste are not a sustainable environmental process (Chi et al. 2010). Subsequently, the environmental degrading practices have attracted global media coverage (Piven 2011).

Although the detrimental practices of the informal recycling sector have been well documented, the organisational methods, which seem to work in favour of the e-scrapppers, have not received the same in-depth attention. In order to proffer sustainable practices, such as the provision and utilisation of a proper working infrastructure among informal recyclers, it is imperative to understand the social organisation of e-scrapppers in e-waste management.

Across the emerging economies in which the informal recycling sector is very active, e-waste is approached and handled very differently (Bhat and Patil 2014; Wang et al. 2012). This differentiation is dependent on the organisational structure of the informal recyclers. Therefore, this article aims to clarify the social organisation of Nigerian e-scrapppers. The influence this form of operation has on e-scrapppers' activities will also be examined with the aim of proposing an operational framework for effective and sustainable e-waste management.

Other key players, such as e-waste suppliers, buyers of valuable extracts, the quantity of valuable extracts sold by the e-scrapppers, or the entire value chain of the e-waste scrapping process in Nigeria which have been studied by other scholars such as Nnorom and Oladele (2007) and Puckett et al. (2005), fall outside the scope of this study.

Specifically, this study focuses on the operational activities of e-scrapppers in Lagos State and Edo State, Nigeria. Edo State is a civil servant, middle-income state with about 4.1 million people (UNICEF 2013). Lagos State is home to over 17 million people and is a major exporter of manufacturing and consumer goods to other West African countries, making it a major player in the import and export of electronic devices. New, second-hand and refurbished electronic devices make their way to different seaports where e-scrapppers purchase large containers for extraction. E-scrappping in Nigeria gained significant recognition in the media in 2005 after Jim Puckett's documentary on e-waste was released on the internet (Puckett et al. 2005). This exposure had the dual effect of creating both e-waste awareness among consumers and aided the increase in the demand for extracted valuable materials by manufacturers.

From here on, this study is structured as follows: section 2 discusses two aligned theoretical approaches – new materialism (Bennett 2010; Barad 2007) and open systems theory (Scott 2002) – employed in understanding the social and economic organisation of e-waste management among e-scrapppers in Nigeria.

Section 3 reveals the methodology and data analysis utilised in this paper as well as the challenges experienced during data collection. Section 4 reveals the results obtained from empirical data analysis by presenting the structure and operational framework of the Nigerian e-scrapppers. This paper ends with section 5, showing the discussion and conclusions of the findings from data analysis such as the outcomes arising from the interaction between e-waste, e-scrapppers, and the divergent assemblages within the environment.

## 2.0. Theory

Societally, e-waste is generally perceived as unclean and designated for trash. However, e-waste is matter which is composed of very active chemical compositions that becomes vibrant under suitable conditions. The term 'vibrant' in the new materialist context means that matter possesses the capacity to elicit responses from its immediate environment. This vibrant nature of e-waste, which is recognised by e-scrapppers, has a significant impact on their socio-economic relationships and organisational structure.

In order to understand the relationship between e-waste and e-scrapppers, this study is undertaken from the perspective of new materialism theory supported by the open system theory. New materialism argues that the very essence of matter is active and vibrant. It pays attention to the organic and inorganic ontology and agency of matter (Bennett 2010). New materialism recognises that matter is not inert and does not necessarily wait to be acted upon. Rather, it has the ability to exert force and elicit reactions from within the assemblages (Deleuze and Guattari 1988) of its environment. However, the vibrant nature of matter and the process of eliciting responses are still highly dependent on the ability of the assemblages to recognise and act on it. Therefore, assemblages are seen as a combination of similar and disparate entities which come together to do or produce an outcome (Fox and Alldred 2015). Deductively, assemblages can be seen as mini organisations within a larger system, that is, as occurring in multi layers of organisations within the same system. It is therefore possible that two or more different assemblages can co-exist within a common system, producing different combinations of systems, but generating the same outcomes. This brings to mind the open systems theory (Bastedo 2006; Scott 2002; McLaughlin and Talbert 2001).

Open systems theorists, such as Scott (2002) and Bastedo (2006), posit that by acquiring key resources, organisations are actively influenced by their immediate and external environment which could lead ultimately to change. Additionally, the survival of the organisation depends on the emerging changes. The environment is thus, a combination of other organisations which exert social, political and economic energies. Open systems are self-contained assemblages whose internal and external relationships render them interdependent on each other. As Norbert Wiener in connecting this interdependent relationships of systems in relation to cybernetics, put forth: 'we must consider organisations as something in which there is an interdependence between the several organised parts but in which this independence has degrees' (1954, 322).

The varied degree of interdependence and composition of the assemblages is reflected in the outcomes. Therefore, in the sphere of e-waste management, the vibrant nature of e-waste presents itself as valuable extracts required by the manufacturing industry. Drawing from the ideologies of new materialism theory and the open system theory, I argue that in its still state, lying in a drawer, in a dumpsite or a trashcan outside, e-waste slowly ages and gives off passive chemicals in small amounts into the environment. In most cases, this emission could go unnoticed for a long period of time. However, in the hands of e-scrapppers, the vibrant nature is immediately noticeable; it comes alive and attains a renewed purpose. The assemblages that produce these noticeable attributes of e-waste consist of the presence of an organised operational structure, infrastructure, technical skills, social network and societal perception.

Thus, in this study, new materialism is applied to show the inherent vibrant ability of e-waste and the assemblages that cause e-waste to incite e-scrapppers to action, while the open system theory reveals the organisational and operational structures of the e-scrapppers which enable them to carry out their e-scrappping activities effectively and efficiently. The interaction between e-waste, e-scrapppers, and the assemblages within the environment is the focus of this study.

### 3.0. Methodology and data

This study is based on qualitative interviews and field observations carried out in 2014 and 2015 among 29 male e-scrapppers, between the ages of 18–55 years in Lagos State and Edo State, Nigeria. In 2014, 10 interviews were carried out and 19 interviews were carried out in 2015. Of the 29 respondents, nine e-scrapppers were interviewed at Ikeja Computer Village, six were interviewed at Owode Market, three at Alaba International Market and one at Ladipo Market all in Lagos state. In Benin City, Edo State, six interviews were conducted at the Ibiwe residential area and four at the Isihor residential area. Figure 1 shows the distribution of interviewees by their location.

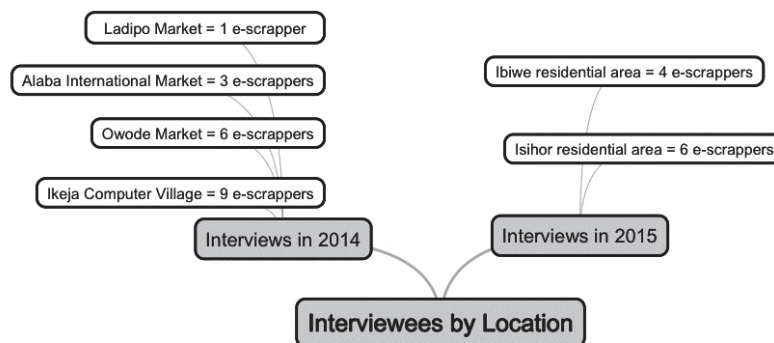


Figure 1: Distribution of interviewees by location  
Source: Omokaro

As discovered during the fieldwork and data analysis, e-scraping is a male-dominated activity. Women were visibly present when the men needed food or care. The informal recycling sector in Nigeria is comprised of individuals generally known as scavengers. The scavengers are further subdivided into those who actively scrap e-waste, known as e-scrapers, those who scavenge the main waste stream for any valuables, such as plastics, and those who trade only in metals, such as steel and copper.

The sites were chosen based on their geographical locations and activities in e-waste. Lagos State has many seaports which provide access to the importation of electronic products. Ikeja Computer Village is a bustling hub for electronic repairers and sellers. It is situated within the Otigba community and managed under the Allied Products Dealers Association of Nigeria (CAPDAN). E-scrapers typically occupy workspaces within this marketplace, thus ensuring a steady inflow of e-waste. Owode Market, on the other hand, is originally a steel spare parts market located at Mile 12, Lagos. Alaba International Market is known as the largest market for the sale and repair of electronic devices in Nigeria. It is located in Ojo, Lagos State. Ladipo Market is also known to local residents as Ladipo Auto Spare Parts Market, is considered as the biggest auto spare parts market in Lagos. It is located in the Mushin local government area of Lagos State.

Edo State, known as the heartbeat of the nation, is a transit point for the movement of goods between states. This makes it easy to acquire electronic devices from neighbouring states, especially Lagos and Delta. The workspaces occupied by e-scrapers in Benin city are usually situated within private residential buildings, town marketplaces and the outskirts. Some residents of these buildings are traders of food items and plastic products. For the e-scrapers, these are non-competitive products because the target market is different.

The fieldwork involved the use of videography (Tuma, Knoblauch and Schnettler 2014) as a suitable method for studying the visual process of e-scraping conducted at the e-scrapers' workspaces. While sourcing for e-scrapers to interview, I discovered that e-scrapers in Nigeria are generally curious about electronic devices. For them, an individual holding an electronic device in their vicinity meant the device was either to be sold or repaired. The presence of my camera, therefore, facilitated a somewhat easy access to the e-scrapers. The camera acted as an icebreaker for which conversations lead to the target group. The e-scrapers were chosen based on their willingness to be documented on camera or on paper. Being full-time e-scrapers and consenting to the recording of their activities – including sourcing for e-waste, e-scraping and resale of valuable extracts to buyers – were important selection criteria. Utilising the snowball method ensured that only those who actively e-scrap e-waste were interviewed. During the interviews, the camera was kept in motion, capturing the e-scrapers' movements and voices. This ensured that important aspects of their activities orally described by the e-scrapers were also visually documented. At the beginning, interviewees were assured of confidentiality and anonymity of any data derived from them. An advantage of using the snowball method

was that questions from previously interviewed e-scrapers could be cross-verified by other colleagues in order to ensure the accuracy of responses.

The data was analysed using Knoblauch, Tuma and Schnettler's (2015) interpretive video-analysis method supported by insights from Heath, Hindmarsh and Luff (2010). The results are presented using images and vignettes (Jarzabkowski and Kaplan 2014; Michaud 2014). This form of presentation enables reflection, clarity, and vivid representation of the activities carried out during the fieldwork. Due to the sensitive nature of the issues discussed during the interviews (such as illegal e-waste acquisition or police involvement), none of the respondents used in this article appear on video. Anonymity is achieved by using pseudonyms and blurring the faces of the respondents or totally removing them where necessary.

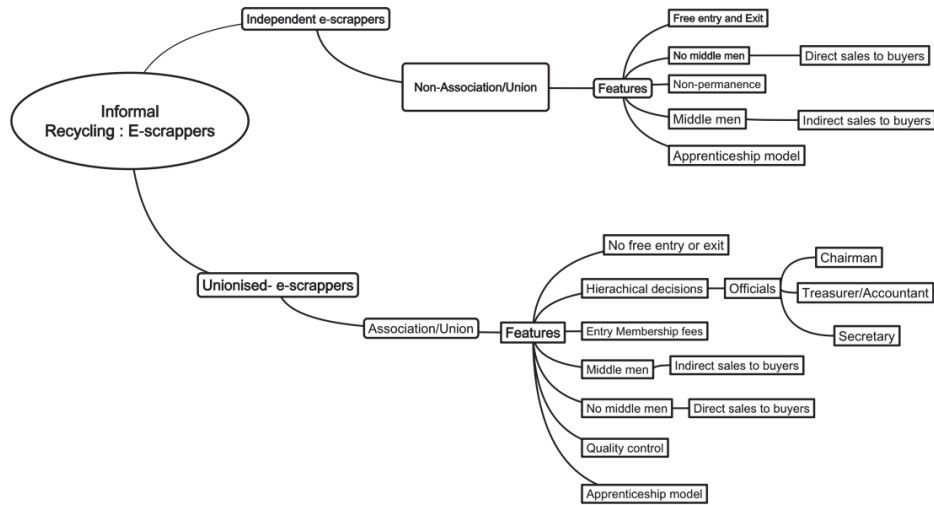
#### **4.0. Results**

Quality material extracts, obedience to institutional business obligations, and environmental regulations are the three most important aspects of continuous participation in the e-waste e-scraping world. Based on my fieldwork observations and data analysis, I discovered that e-scrapers in Nigeria operate in two broad categories, namely independent operators and operators under a state-recognised association or union, henceforth referred to as unionised e-scrapers. The terms 'association' or 'union' are the exact terms used interchangeably by the e-scrapers. For the purpose of brevity, only the term 'association' will be used from here on. Data analysis showed that of the 29 e-scrapers interviewed, 13 belonged to an association while 16 were independent e-scrapers. This study uses the Network Display format<sup>1</sup> (Miles, Huberman and Saldana 2014) as the means of presenting the responses of the 29 e-scrapers. The network model is shown in Figure 2.

---

<sup>1</sup> A network display format showcases the data collection in nodes or points connected by lines or links displaying the actions, events and processes of the participants. It is especially useful in case-oriented studies because it can be used to give a condensed but detailed snapshot of main events or processes in a data collection (Miles, Huberman and Saldana 2014).





**Figure 2:** A network model showing the organisational structure of e-scrapppers in Nigeria

Source: Omokaro

As reflected in Figure 2, there are two major assemblages of structural and operational framework influencing informal e-waste recycling in Nigeria. Both organisational structures form very distinct assemblages. The independent e-scrapppers are defined by their freedom to enter and exit the e-waste management scene without the presence of an association. Likewise, the unionised e-scrapppers are defined by the presence of an association.

It was discovered that membership or non-membership in an association influences e-scrappping activities in many ways. Interestingly, the two assemblages achieve similar outcomes of satisfying demand and staying relevant in e-waste management, even though they operate under very different sets of organisational structure and rules. To give more light to this interesting phenomenon, I use vignettes to present first the structural organisation and operational activities of the independent e-scrapppers, and then second, those of the unionised e-scrapppers. During data analysis, cross-verification of questions against e-scrapppers' responses showed similarities. Hence, in this article, interview excerpts from three independent e-scrapppers in Edo State and two unionised e-scrapppers in Lagos State interviewed in 2014 and 2015 are presented. Detailed and lengthy vignettes are used in this study with the aim of providing an in-depth analysis of every aspect of the independent e-scrapppers and the unionised e-scrapppers shown in Figure 2. Therefore, using more than five excerpts would not be plausible.

#### 4.1. *Independent e-scrapppers*

Independent e-scrapppers possess the freedom of entry and exit in the business. Nasiru (Figure 3), a 23-year-old male who has been e-scrappping for over 10 years in the Ibiwe residential area, Benin city, Nigeria helps us understand the dynamics of the independent e-scrapppers.



**Figure 3:** Nasiru e-scraping with his colleagues  
Source: Omokaro

**Vignette 1: Free entry and exit**

**Interviewer:** 'Are you a member of any association?'

**Nasiru:** *(pauses and stares at the interviewer for a few seconds as if he wasn't sure the interviewer's question was worth answering)* '... Umm...umm...no...no...I am not in any association.'

**Interviewer:** 'Why?'

**Nasiru:** *(pauses)* 'Oh... because... there is none here... *(pauses again)* and I am doing ok. *(looks up and smiles faintly at the interviewer)*'

**Interviewer:** 'Why... is there none? Was there any before now?'

**Nasiru:** 'Hmmm... there was none here before...at least none that I know of... *(smiles)*...and I do not see the need for it yet... maybe when we have more people here.'

**Interviewer:** 'So that means that anybody can start e-scraping here?'

**Nasiru:** *(smiles faintly)* 'Why not... as long as you find a space, anybody can join.'

**Interviewer:** 'How many people e-scrap e-waste here at the moment?'

**Nasiru:** 'Oh...maybe... 20 to 30 people... *(shrugs his shoulders)*.'

Nasiru's account indicates that formation of an association is dependent on the population of e-scrapers at a particular location. But reflecting on his response concerning the 20–30 people e-scraping at his location also raises the question of the actual number required for association formation. Organisations are created only when the assemblages that form such organisations become self-aware. In the Nigerian context, organisations cannot be perceived as legal entities until they are registered with the appropriate agencies and, therefore, duly recognised by the government. The e-scrapers attain this legality and recognition by being part of a registered association or as individual taxpayers. In the case of Nasiru, it appears that he and his colleagues have either not realised that

there are enough e-scrapers to gain legality and recognition with the government authorities or they are satisfied with the status quo and hence have no need to organise into an association.

Additionally, his responses reveal a belief that being an independent e-scrapper did not have a negative impact on his activities. He did, however, mention in the interview that workspaces are shared and each member followed a particular roster. This means that though they were not formally organised under an association, they possessed certain elements of organisational practices, such as rotating time of work and sharing a workspace. Nasiru confirmed this in the following excerpt:

**Interviewer:** 'So where are the 20 to 30 people?'

**Nasiru:** *(smiles)* 'Oh...it is not easy to find everyone at the same time. You know, we have to go out to get e-waste...and you know, *(points at his workspace, which was an open space with a wooden shed serving as shelter)* there are 5 people who work here, for instance. You cannot find all of us in the same place at the same time. Some people are out and other people are here working the e-waste.'

*(he picks up a half-opened radio device, balancing it in his left hand while holding a mallet in his right hand.)*

'...You know, this place is not so big. We have to share. We use a roster.'

**Interviewer:** 'A roster?'

**Nasiru:** 'Yes... it makes it easy for us. Everyone knows when they come here.'

**Interviewer:** 'So who makes the roster?'

**Nasiru:** *(smiles at the interviewer)* 'We share the job. The first person of each month writes the roster for the next month.'

E-scraping requires a considerable amount of space, especially for storage. In such a confined environment, how then do they organise themselves? Another e-scrapper, Abu, who is also an independent e-scrapper, shed more light on this. He is a 25-year-old male who has been e-scraping for over 10 years. Unlike Nasiru, he e-scrapes at Owode Market in Lagos State, Nigeria.

### **Vignette 2: Workspace dynamics and non-permanence**

**Interviewer:** 'So, do you own your own working space here?'

**Abu:** *(smiles)* 'Oh...no...it's not easy to own a space here... *(pauses and grins)* we have to help each other... we share a space... you know... it is not easy to have a space...the government is always pushing us away...so we move a lot...but it is easy for the government to push us when we are not together.'

**Interviewer:** 'Oh...really? Why?'

**Abu:** *(pauses; clearly he was deciding how much information he wanted to divulge, and then he shrugs)* 'When we are together, it is easy for us to pay tax. And as long as we keep this place clean, and pay our tax, they have stopped disturbing us.'

From the dialogue in vignette 2, it can be seen that workspace sharing was born out of the need to support each other. The e-scrapppers took turns working in their assigned spaces. Noticeably, even though they also share storage space, they are able to recognise individually owned e-waste extracts. Worthy of note is Abu's reference to the payment of tax. It is interesting that despite their independent status, shared spaces and settlements influenced their recognition by the government, such that they are perceived as legal entities, requiring the payment of taxes. It is also intriguing that even the payment of taxes facilitated a form of location permanence.

As I interviewed Abu further, it became clear that he had an interesting view on the requirements for association formation. Abu laid emphasis on individual business ownership as one of the prerequisites of starting an association. His responses also revealed that the majority of his colleagues were temporarily situated in terms of ownership resulting in non-permanence.

In situations where there is a reduction in their number, fieldwork observations showed that there is a constant influx of new e-scrapppers, which implies that when an e-scrapper drops out, a replacement is found almost immediately. Since they take turns in working at the workspace, it is usually not crowded. Hence the e-scrappping wheel is always turning as confirmed by e-scrapper Abayo who I revisited as part of my follow-up fieldwork in 2015.



Figure 4: Abayo at his workspace  
Source: Omokaro

**Interviewer:** 'So Abayo, where is Bello?' (*Bello is an e-scrapper colleague whom I had interviewed in 2014.*)

**Abayo:** (*smiles*) 'Oh! Bello... (*smiles again*) he has stopped this job here. (*pauses*)...He moved to Port Harcourt. A new guy Abel, (*points to a black duffel bag lying on the floor close to the entrance of the wooden shelter*) has replaced him.'

**Interviewer:** 'Oh really? Where is he?' (*I looked around*)

**Abayo:** 'He has gone out to buy e-waste. (*pauses and smiles again*) He is a good guy.'

**Interviewer:** 'Do you get new e-scrapers that easily?'

**Abayo:** (*glances at the interviewer, the smile still on his face*) 'Oh yes, it is very common. Soldier go, soldier come, you know...that is the way it is.'

The issue of non-permanence reflected in Abayo's comments was also implied in Abu's responses (vignette 2). It appears that the feeling of permanence only occurred when they were perceived as legal entities and participated actively in social responsibilities. Attaining the legal status meant that e-scrapers, first and foremost, paid the obligatory taxes and, secondly, that they obeyed the environmental regulations. Upon reflection, it can be inferred that though Abu and his colleagues regard themselves as independent e-scrapers, their organisational structure suggests that they have a semblance of formality that is very similar to unionised e-scrapers. Besides providing support for each other, the sharing of space also facilitated the transfer of knowledge and information in the form of an apprenticeship learning model. Abu also cast more light on this.

### **Vignette 3: Apprenticeship learning model**

**Interviewer:** 'How did you get into this business?'

**Abu:** 'Ha...(*grins*) I learnt from my oga (*boss*) over there (*points at his boss*).'

**Interviewer:** 'How long did it take you to learn?'

**Abu:** 'About 7 months.'

**Interviewer:** 'Was it necessary to learn from someone?'

**Abu:** 'Oh...yes, it is very good to learn from someone. You can injure yourself very easily. You need to learn how to do it from someone with experience. I learnt and I have the skills now.'

Without the proper guidance, e-scraping is often not an easy profession to get into. Though there is free entry and exit, there are a myriad of ways individuals could get into trouble with the government. This is because the industry has no formal regulation and thus information, especially in regards to e-waste acquisition and the sale of extracted valuable products, is hoarded and guarded jealously. Thus, e-scraping is often learned via the apprenticeship model where entry into the e-waste business is learnt and social connections are shared. The apprenticeship model also provides the technical skills needed to recognise valuable e-waste and effectively extract valuable materials from it.

The analysis also revealed that even though an association was not present, the e-scrapers organised themselves based on their social networks and personal relationships. Decision-making was personal and the e-scraping activities, even though they can be similar, were very dependent on personal preferences and ambitions. However, pricing strategies were often shared among independent e-scrapers so that buyers often found themselves working with ap-

proximately the same pricing system, even though the e-scrapppers were not operating under an association. Although the buyers had little control over the pricing system, sales depended on the type of valuable extracts that they wanted. The use of agents or middlemen also depended on the buyer's preference. It was observed that there was a lot of quality variation among the independent e-scrapppers. Price and quality control of extracted e-waste are negotiated between the e-scrapppers and buyers. This sometimes creates friction among them and, in some cases, resulted in hoarding of information. The reliance and non-reliance on middlemen to sell their extracted valuable materials to local and international buyers had a significant impact on their profit margins. E-scrapppers avoided dealing through them if they could help it. Selling via middlemen was a personal preference based on individual aspirations and the type of client serviced. This could also signify that the type of transactions depended on the quality of the social network.

#### 4.2. *Unionised e-scrapppers*

Data analysis revealed that unionised e-scrapppers occurred in most cases in well-established locations, such as market places. For example, at Owode Market in Lagos State, Nigeria, high demand for certain parts of electronic devices led to the formation of e-scrappping groups within the marketplace. Large e-waste devices, such as refrigerators and alternators, are popular e-scrappping items. Unlike the independent e-scrapppers, the association is registered with the government and there is no free entry or exit. The association requires a membership fee that must be paid up front. Kayode, a 35-year-old male e-scrapper at Owode Market, Lagos State, Nigeria attested to this during the interview. He has been e-scrappping for over 11 years. He taught technical science at a secondary school in Nigeria before becoming an e-scrapper. Kayode was not about to quit because he enjoyed what he did (see interview transcript with Kayode).

#### **Vignette 7: Apprenticeship and regulated entry**

**Interviewer:** 'So, how did you get into this business?'

**Kayode:** 'Emmm... my brother taught me. *(he looks thoughtfully at the interviewer and continues)* I was a teacher before I got into this business.'

**Interviewer:** 'And what did you teach?'

**Kayode:** 'I taught technical science at a secondary school.'

**Interviewer:** 'O really that is interesting, and does this make it easy for you?'

**Kayode:** *(smiles)* 'Oh...no...I face the same challenges as everyone here *(pauses to pick up a piece of DVD scrap)*. You see, for example, to get into this business you need to become a member of the association.'

**Interviewer:** 'So there is no free entry?'

**Kayode:** *(laughs a little)* 'No, not at all...you have to pay 20,000 naira to be a member.'

**Interviewer:** 'Wow, that is a lot of money.'

**Kayode:** 'Yes, it is *(smiles)* but it is worth it.'

Kayode further explained that the headquarters of the association was at Apapa, Lagos State and that the 20,000 naira (Nigerian currency) membership fees helped provide stability and protection for the members. Stability for the e-scrapppers meant they were recognised as legal entities; therefore, they had access to a permanent workspace which was often scarce. Additionally, the members were also protected against exploitation from buyers, specifically in terms of pricing. The presence of the association prevents companies from taking advantage of members. Since entry was regulated, it also ensured that purchase prices for e-waste and the quality of extracted valuable materials was regulated. The quality regulation is important because the monetary value of the extracts is dependent on its quality. Thus, this regulation provides a level playing field for the e-scrapppers involved. The association also ensures that buyers and sellers get a fair price for extracted materials and that all members operate on a recommended price across the board. When an e-scrapper supplies second-rate extracts, a fine could be imposed, as confirmed by Kayode:

‘The way we work here is very regulated. When we sell poor products, we can receive big fines. We must make sure that the extracts are good quality. For example, I am sending this copper to the customer; there should be no plastic in it. They are very strict.’

It is inferred that the payment of fines is enforced to lend credibility to the e-scrapppers’ operations and differentiate them from other informal recyclers in the sector. Continuous membership was highly dependent on obeying the rules. The association also assisted in the social welfare of its members, such as health-related issues or monetarily.

The unionised e-scrapppers operate in a hierarchical format with officials, such as the chairman, treasurer and secretary, elected by the e-scrapppers periodically. This legality has also made tax collection easy for the government agencies. The association officials have worked closely with the environmental agencies and relayed relevant information to the e-scrapppers. It was observed during the fieldwork that the presence of the association as an organisation makes it easier for the e-scrapppers to acquire e-waste supplies from local and international buyers. Perhaps this is because local and international buyers perceived the unionised e-scrapppers as professionals duly recognised by the government.

Like the independent e-scrapppers, unionised e-scrapppers also practised workplace sharing and rotation. This provided workspace for many of the e-scrapppers who would otherwise not have been admissible. The use of middlemen or agents was also practised, but unlike their counterparts, the agents were regulated and price negotiation was carried out by the associations. However, the e-scrapppers were not restrained from selling directly to buyers as long as the pricing was within the limits specified by the association.

An interesting observation during the interview at Owode Market was that independent and unionised e-scrapppers co-existed. In most cases, their workspaces are situated separately although it may be in the same location, which raises the following question: if the associations were strict about mem-

bership, how can independent e-scrapppers exist alongside them? A 48-year-old male e-scrappper, Mr. Fineboy shed more light on this:

‘You see, this market is originally for auto spare parts. E-scrapppers started here as squatters but because there was demand for what we do, the market officials let us stay here. But to be a member of the association is not a compulsory thing here. The association has benefits but it is not compulsory for everyone. It is by choice.’

Sharing workspaces also made swapping of e-waste parts very possible. Replacing damaged parts with working ones from devices that have been turned in by consumers, especially to repairers, also provided a sales channel for the e-scrapppers. This method ensures that even though a device is not working, some of its parts may still be beneficial for another device which could then be refurbished and reintroduced into the consumption market. It can be inferred that the presence of the Owode Market officials had a significant influence on the formation of the association. A striking observation is the similarity between the independent and unionised e-scrapppers. Each had a form of organisational structure that provided sustainability to their operations. The biggest threat they faced was eviction by the relevant government agencies. As long as they could organise themselves, they were in the clear. This eliminates the notion that e-scrapppers are disorganised and incapable of any type of formality.

#### **5.0. Discussion and conclusion**

In the sustainable management discourses, especially among academics, informal recyclers, especially e-scrapppers, are easily characterised as unorganised nomads devoid of any legality or organisational structure in the society. They have been generally perceived as scavengers acting independently and in conflict with existing environmental regulations and their respective agencies. However, the analytical application of the new materialism and open system theories in this study has proved that e-scrapppers are not only organised, but that they are also recognised as legal entities provided they meet certain governmental requirements. Hence, there is a need to rethink their perceived status within e-waste management and academic discussions. By investigating the structural and operational framework of informal recyclers through the example of e-scrapppers in Nigeria, this study has been able to present a new way of thinking about informal recyclers in general, and especially Nigerian e-scrapppers in particular. As reflected in the vignettes, the process of e-scrappping depends on a number of assemblages. The ability of e-waste to exert itself as valuable and the ability of e-scrapppers to recognise this value is a prerequisite for continuous e-scrappping. Technical extraction skills acquired through the apprenticeship model are an interesting and sustainable channel of knowledge and information transfer because they afford uniformity in e-scrappping operations. Importantly, the apprenticeship model also provides the social networks and financial links that e-scrapppers require to remain in business. Additionally, the presence of an active social network ensures that e-scrapppers carry out their activities under informed conditions. They co-exist and negotiate their shared spaces by being proactive in their arrangements.



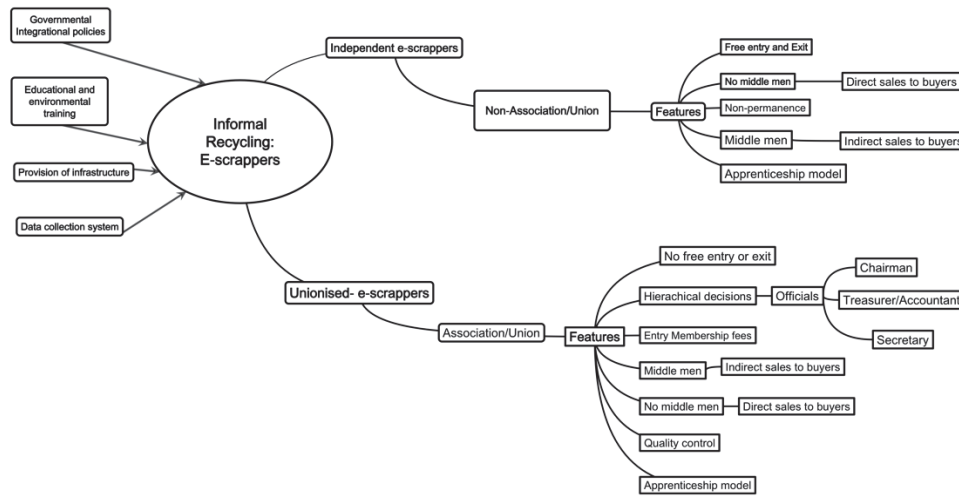
Apart from environmental regulations, e-waste acquisition and general e-scraping activities by independent, e-scrapers are not regulated. This implies that e-scrapers have direct access to buyers. However, depending on the location of the e-scrapper, the presence of middlemen may help to gain access to buyers who are usually local and international manufacturers. This reflects the influence of external and internal factors in the activities of the e-scrapers, thus exemplifying the open systems theory.

From the responses during fieldwork, it is evident that e-scrapers, whether independent or unionised, operate under a structured, organised environment. The perception that e-scrapers are unregulated and not recognised by relevant government agencies is thus addressed in this article. In acknowledging that e-scrapers are important and valuable actors in the collective process that is responsible for a large part of the world's e-waste management, the actions and the socio-economic relationships of this social group are important for understanding the organisational and operational framework that motivates this industry. The data analysis reveals that unionised e-scrapers are individuals who operate with a hierarchical decision-making structure that is similar to that of formal institutions.

As shown through the vignettes, even though the unionised e-scrapers may be independent e-scrapers who belong to an association, their operations are governed by the rules and regulations of the union. This implies they are not as 'independent' in their operations as their counterparts (independent e-scrapers). The analysis in vignette 7 shows this. Additionally, due to the use of basic tools, e-scrapers recycle e-waste in small quantities and offer different types of quality extracts. While this may not be seen by economists as scalable, their sheer population forms an assemblage which ensures scalability, making it easy for them to remain competitors in the management of e-waste. E-scraping can also be capital-intensive if one wishes to take it on a larger scale, particularly in the area of importing electronics and exporting extracted materials; however, acquiring e-waste in smaller quantities makes barrier to entry easy. All interviewed respondents believed that e-waste is sustainable and should be properly recognised by the government and that the informal recycling sector will continue to grow as long as economic, social and political factors conform.

### **5.1. *Proposed operational framework***

Recognising that the informal sector already has a strong presence in the e-waste management arena, it is only appropriate that it should be incorporated formally. Therefore, to advance sustainable e-waste management strategies, I propose an operational framework for policymakers and interested researchers based on the assemblages in Figure 2 and the operational system of the e-scrapers derived from the vignettes (see Figure 5).



**Figure 5:** Proposed operational framework  
Source: Omokaro

Figure 5 shows the proposed operational framework for addressing e-waste management in Nigeria. I propose that providing and implementing integrational policies will equip the e-scrappers with standardised legal security both locally and internationally. It is also imperative that to ensure sustainable e-waste management, the provision of a suitable working infrastructure and regular training on environmental precautions during e-scraping will help to protect e-scrappers and the environment. The implementation of an effective data collection system will help to measure the effectiveness and efficiency of the e-scrappers' e-waste management processes. By aggregating the movement of e-waste within and outside Nigeria, the system will also help to provide an accurate volume of imported e-waste and locally generated e-waste.

As seen from the vignettes, it is very possible for the informal and formal recycling sector to work collaboratively, providing support for one another in terms of technological advancements and technical skills. It should be noted that there is no one-size-fits-all solution for managing e-waste around the world. Recognising the cultural differences, social perception and consumption habits of a country is key to managing e-waste effectively. Additionally, the formal sector also has a thing or two to learn from the informal recyclers. For example, approaching e-waste at micro levels has been very successful for e-scrappers. Re-working machinery at the formal recycling centres to handle e-waste at micro levels will solve the complaints about a low volume of e-waste. Even though it is important to prevent the transboundary movement of e-waste, it time that the national government in Nigeria realises that internally generated e-waste is increasing at a rapid rate.

Although this study has been able to capture the organisational and operational activities of Nigerian e-scrappers, access to the associations' records would have provided deeper insights into the internal and external relationships. For example, further investigation is needed in quantifying the population

of the unionised and independent e-scrapppers as well as the amount of e-scrappping extracts. Based on the results, it is recommended that recognising e-scrapppers as valuable participants in sustainable e-waste management and keying into the existing organisational structure is very important.

## References

- Balde, C.P., F. Wang, R. Kuehr, and J. Huisman. 2015. "The Global E-waste Monitor – 2014." *United Nations University* 80.
- Barad, Karen. 2007. *Meeting the Universe Halfway: Quantum physics*. London: Duke University Press.
- Bastedo, Michael N. 2006. "Open Systems Theory." In *Encyclopedia of Educational Leadership and Administration*, edited by Fenwick W English, 1264. Thousand Oaks, CA: SAGE.
- Bennett, Jane. 2010. *Vibrant Matter: A Political Ecology of Things*. Durham and London: Duke University Press.
- Bhat, Viraja, and Yogesh Patil. 2014. "E-waste Consciousness and Disposal Practices among Residents of Pune City." *Procedia – Social and Behavioral Sciences* 133: 491–498.
- Brigden, K., I. Labanska, M. Allsopp, and D. Santillo. 2005. *Recycling of Electronic Waste in China and India: Workplace and Environmental Contamination*. Report, Greenpeace, Amsterdam: Greenpeace International.
- Chi, Xinwen, Martin Streicher-Porte, Mark Y. L. Wang, and Markus A. Reuter. 2010. "Informal Electronic Waste Recycling: A Sector Review with Special Focus on China." *Waste Management* 31: 731–742.
- Deleuze, G., and F. Guattari. 1988. *A Thousand Plateaus: Capitalism and Schizophrenia*. London: University of Minnesota Press.
- Fox, Nick J., and Pam Alldred. 2015. "New Materialist Social Inquiry: Designs, Methods and the Research-Assemblage." *International Journal of Social Research Methodology* 18 (4): 399–414.
- Heath, Christian, Jon Hindmarsh, and Paul Luff. 2010. *Video in Qualitative Research: Analysing Social Interaction in Everyday Life*. London: SAGE.
- Jarzabkowski, P., and S. Kaplan. 2014. "Strategy Tools-in-Use: A Framework for Understanding 'Technologies of Rationality' in Practice." *Strategic Management Journal* 36 (4): 537–558.
- Knoblauch, Hubert, René Tuma, and Bernt Schnettler. 2015. *Videography: Introduction to Interpretive Videoanalysis of Social Situations*. Oxford: PL Academic Research.
- Kreibe, Siegfried. 2013. "Current and New Electronic Waste Recycling Technologies." In *E-waste Management: From Waste to Resource*, by Klaus Hieronymi, Ramzy Kahhat and Eric Williams, 25–48. London: Routledge: Taylor and Francis.
- Lepawsky, Josh. 2015. "Electronic Waste." *International Encyclopedia of the Social & Behavioral Sciences*. Elsevier. 364–373.

- McLaughlin, Milbrey W., and Joan E. Talbert. 2001. *High School Teaching in Context*. Chicago: University of Chicago Press.
- Michaud, Valérie. 2014. "Mediating the Paradoxes of Organizational Governance through Numbers." *Organization Studies* 35 (1): 75–101.
- Miles, Mathew B., Michael A. Huberman, and Johnny Saldana. 2014. *Qualitative Data Analysis: A Methods Sourcebook*. Thousand Oaks, CA: SAGE.
- Murphy, Susan Fredholm, Gregory Jeremy, and Kirchain Randolph. 2013. "Evaluating the performance of recycling systems: Examples of North American and European Electronics Recycling Systems." In *E-waste Management: From Waste to Resource*, edited by Hieronymi Klaus, Kahhat Ramzy and Williams Eric, 115. London & New York: Routledge Taylor & Francis.
- Nnorom, Innocent Chidi, and Osibanjo B. Oladele. 2007. "Electronic Waste (E-waste): Material flows and Management Practices in Nigeria." *Waste Management* 28: 1472–1479.
- Omokaro Ideho, Benedicta. 2016. "Building capabilities among E-scrapers in Informal Electronic Waste Management: The Case of the Nigerian E-scrapers." *Environmental Sociology Journal* 2: 180–191. doi:10.1080/23251042.2016.1155791.
- Perkins, Devin N., Marie-Noel Brune Drisse, Tapiwa Nxele, and Peter D. Sly. 2014. "E-waste: A Global Hazard." *Annals of Global Health* 80 (4): 286–295.
- Piven, Ben. 2011. "Environment: Q&A: E-waste goes to post-recycling afterlife." *Aljazeera*, 17 June. Accessed 13 November 2015. <http://www.aljazeera.com/indepth/features/2011/06/2011615214124394643.html>.
- Puckett, Jim, Olayemi Adesanya, Leonard Davis, and Yemi Saidu. 2005. *The Digital Dump: Exporting Reuse and Abuse to Africa*. Report, Seattle: The Basel Action Network.
- Scott, Richard W. 2002. *Organizations: Rational, Natural, and Open Systems*. Upper Saddle River, NJ: Prentice Hall.
- Songa, Qingbin, Zhishi Wanga, and Jinhui Lib. 2013. "Sustainability Evaluation of E-waste Treatment Based on Emergy Analysis and the LCA Method: A Case Study of a Trial Project in Macau." *Ecological Indicators* 30: 138–147.
- Step Initiative. 2014. *What is E-waste?* 3 June. Accessed October 3, 2015. <http://www.step-initiative.org/what-is-ewaste.html>.
- The Economist. 2014. *Where Gadgets Go to Die*. 21st July. Accessed January 16, 2016. <http://www.economist.com/blogs/babbage/2014/07/difference-engine-1>.
- Tuma, René, Hubert Knoblauch, and Bernt Schnettler. 2014. "Video Analysis and Videography." In *The Sage Handbook of Qualitative Data Analysis*, edited by Uwe Flick, 435. London: SAGE.
- UNICEF. 2013. *UNICEF Annual Report 2013 – Nigeria*. Report, Nigeria: UNICEF.
- UNODC. 2013. "Transnational Organized Crime in East Asia and the Pacific." *United Nations Office on Drugs and Crime* 192.

- Wang, Feng, Jaco Huisman, Ab Stevels, and Cornelis Peter Baldé. 2013. "Enhancing e-waste estimates: Improving data quality by multivariate Input-Output Analysis." *Waste Management* 33 (11): 2397-2407.
- Wang, Feng, Jaco Huisman, Christina E. M. Meskers, Mathias Schluerp, Ab Stevels, and Christian Hagelüken. 2012. "The Best-of-2-Worlds Philosophy: Developing Local Dismantling and Global Infrastructure Network for Sustainable E-Waste Treatment in Emerging Economies." *Waste Management* 32: 2134-2146.
- Wiener, Norbert. 1954. *The Human Use of Human Beings: Cybernetics and Society*. Garden City, NY: Doubleday Anchor.