TRADING, SALVAGING AND VALUING OF GREY ELECTRONICS AND E-SCRAP IN BANGLADESH

by

© **Mostaem Billah**

A thesis submitted to the
School of Graduate Studies in
partial fulfillment of the requirements for the degree of

Master of Arts

Department of Geography
Faculty of Arts
Memorial University of Newfoundland

July 2012

St. John's Newfoundland

ABSTRACT

The rapid advancement of product development and the continuous decrease in the useful lifespan of electronic goods have accelerated the amount of obsolete electronic equipment which is known as electronic waste (e-waste) around the world. Yet, the status of these electronics as waste is found to be non-essential. The present study examines ongoing transformations of e-waste into commodities in Bangladesh and reconceptualizes e-waste as 'grey electronics and e-scrap'. An intra-regional trade of grey electronics and e-scrap occurs in Asia where Bangladesh is an indispensable receiver mainly from China, Singapore and South Korea. The thesis identifies the main conduits through which grey electronics and e-scrap move in and out of Bangladesh. These conduits include reselling, repairing, refurbishing, remanufacturing, dismantling and smelting, all of which play a key role in capturing and creating value of grey electronics and e-scrap. As grey electronics and e-scrap undergo more processing through these conduits they become more profitable. Thus, a substantial economic activity is found to revolve around the geographies of trading, salvaging and material recovery of grey electronics and e-scrap in Dhaka, Bangladesh.

ACKNOWLEDGMENT

I would like to express the greatest thanks and appreciation to my supervisor Dr. Josh Lepawsky for his support and guidance throughout my graduate program. His patience, kindness and friendship made my work easy and enjoyable. I am extremely grateful to Dr. Kelly Vodden and Dr. Charles Mather for serving in my committee, and also for providing me with valuable feedback in my dissertation.

I am indebted to the Department of Geography at Memorial University of Newfoundland for providing me a Merit Scholarship and also acknowledge my gratitude Social Science Humanities Research Council Canada (SSHRC) for their generous financial support for my fieldwork in Bangladesh.

I would like to express my appreciation to the professors in the Department of Geography and thanks to Professor Dr. Roger White and Dr. Arn Keeling from whom I have learnt about the theory and methods in geography. I also wish to thank fellow graduate students, departmental staff and e-team members Chris McNabb for their friendship and support.

There are other people whom I like to thank for helping me during my research. First of all I would like to thank all the importers/wholesalers, brokers, resellers, middlemen, dismantlers and smelters who were kind enough to share their time and experience with me during fieldwork; without them this research would not have been possible.

I am extremely grateful to my mother, parents-in-laws, brothers, sister and brother-in-laws for their support, encouragement and prayers throughout the years. Finally, I would like to express my deepest gratitude and love to my wife Angela for all the sacrifices she made and for believing in me. Her love, cooking, support and prayers made this journey possible. Lastly, but not the least to my precious little angel son- Omair, I love both of you and thank you for being my source of everyday inspiration and joy to my life.

TABLE OF CONTENTS

CHAPTER THREE: SITUATING BANGLADESH IN THE GLOBAL TRADE AND TRAFFIC NETWORKS OF GREY ELECTRONICS AND E-SCRAP

CHAPTER FOUR: CAPTURING AND CREATING VALUE FROM GREY ELECTRONICS AND E-SCRAP IN BANGLADESH

CHAPTER FIVE: CONCLUSION

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS USED

3BL: Triple Bottom Line

BAN: Basel Action Network

Basel Ban: Amendment to the Basel Convention

BC: Bangladesh Customs

BCC: Bangladesh Computer Council

BCS: Bangladesh Computer Samity

BDT: Bangladeshi Taka

BIPO: Bangladesh Import Policy Order

CBA: Cost Benefit Analysis

CCOAB: Cyber Café Owners Association of Bangladesh

CND: Canadian Dollar

CPU: Central Processing Unit

CRT: Cathode Ray Tubes

EEA: European Environment Agency

ENGO: Environmental Non-Governmental Organization

EOL: End-of-Life

ESDO: Environment and Social Development Organization

EU: European Union

GCC: Global Commodity Chain

GDP: Gross Domestic Product

GOB: Government of Bangladesh

GPN: Global Production Network

GVC: Global Value Chain

HSC: Harmonized System Code

HTS: Harmonized Tariff System

IC: Integrated Circuit

ICT: Information Communication Technology

IT: Information Technology

IMF: International Monetary Fund

LCA: Life Cycle Analysis

LCD: Liquid Crystal Display

MOSICT: Ministry of Science and Information Communication Technology

NBR: National Board of Revenue

NGO: Non-Governmental Organization

OCBA: Old Computer Businesses Associations

ODSBA: Old Dhaka Scrap Buyer Association

OECD: Organization for Economic Co-operation and Development

PC: Personal Computer

PCB: Printed Circuit Board

PET: Polyethylene Terephthalate

PSI: Pre-shipment Inspection

PWB: Printed Wired Board

RAM: Random Access Memory

SAARC: South Asian Association for Regional Cooperation

SGD: Singapore Dollars

StEP: Solving the E-waste Problem

SVTC: Silicon Valley Toxics Coalition

UNDP: United Nation Development Programme

UNEP: United Nation Environment Programme

USD: United States Dollar

USEPA: United States Environmental Protection Agency

USGAO: United States Government Accountability Office

VAT: Value Added Tax

WB: World Bank

WCE: World Computer Exchange

WEEE: Waste Electrical and Electronic Equipment

WHO: World Health Organization

Dedicated to

My beloved wife ANGELA and my little prince OMAIR

CHAPTER ONE

Introduction

1.1 BACKGROUND OF STUDY

The development of information communication technology (ICT) has been accompanied by a dramatic increase in the production and consumption of electrical and electronic devices. In today's world, electronics are the world's largest and fastest growing manufacturing industry (Grossman, 2006). At the end of 2008, nearly a billion of personal computer (PC) was installed, a figure that could double by 2014 (ITU, 2009). The massive increase in the use of computers and other electronic products has both positively and negatively revolutionized our lives (Mundada *et al.*, 2004). On the other hand, the rapid advancement of product development together with a continuous decrease in the useful lifespan of electronic goods has accelerated in recent years (Babbitt *et al.*, 2009). As a result, the quantity of such devices that are being disposed of is growing throughout the world.[1] This has created a large amount of obsolete electronic equipment also referred to as electronic-waste (e-waste).[2] It is believed that e-waste is one of the

---

[1] In the United States alone some 63 million computers are thrown-away every year (National Safety Council, 1999). Although these computers may still be operating properly and can possibly be reused or upgraded, consumers often opt to dispose them for the latest available device in the market. Some consumers may find it cheaper to replace their old computer with new ones instead of upgrading their current one (Iles, 2004).

[2] Electronic waste is defined as an 'electrically powered appliance', ranging from large household devices such as refrigerators, air conditioners, personal stereos, to consumer electronics that have been discarded by their users (BAN, 2002) or no longer serves the owner its original purpose (Sinha, 2004).

fastest growing waste streams in the world, generating approximately 40 million tons of waste annually (UNEP, 2009; Huisman *et al.,* 2008).

E-waste is not confined to a single country. It is commonly traded across national boundaries (Lepawsky and McNabb, 2010). In recent years, a significant international transboundary movement has involved used and end-of-life personal computers and accessories. The transboundary movement of these goods is expected to increase significantly as more and more countries are producing and consuming electrical and electronic equipment (UNEP, 2009). Moreover, countries are tightening their control over acceptable disposal methods, adopting processes to recover valuable constituent materials and seeking to use safe practices to deal with hazardous elements in e-waste (Hicks *et al.*, 2005; Widmer *et al.,* 2005, p.1). Many developing countries at present are undergoing rapid advancement in ICT through the use of computers. A significant number of these ICT users including internet service users rely on secondhand equipment imported from developed countries, primarily from Europe and North America (Nnorom and Osibanjo, 2008).[3] In addition to the direct use of these imported secondhand computers in the ICT industry, they are often used for the profitable extraction of valuable metals (e.g., aluminum, copper, gold, silver, platinum) and other

[3] The developed and richer countries in the Northern Hemisphere in the present thesis have been referred as 'the North', where as the less-prosperous and poorer countries situated in South of 'the North' are referred as 'developing' or 'the South'. However, some sociologists and economists object to this distinction because it implies that the differences between the developed and the developing worlds are primarily due to geography, rather than to powerful historical, economic, political, and cultural forces (Miller and Torr, 2003).

materials (e.g., plastic, glass) obtained from the dismantling of computer cases, frames, wires, cables and other components. The rising value of these extracted materials can make recycling economically lucrative and crucial in providing a source of material useful for the manufacture of new products (UNEP, 2009, p. 8). Even though some of these used electronic goods are classified as 'waste' in the developed countries, they may constitute resources necessary for the livelihood of the poor in developing countries (Grant and Oteng-Ababio, 2012; Oteng-Ababio, 2012; Toxics Link India, 2003, p. 3). Thus, secondhand/rubbish electronics production and consumption have generally been considered as marginalized activities in economic geography and require extensive study (Lepawsky and Billah, 2011; Lepawsky and Mather, 2011; Gregson *et al.,* 2010a; Brook, 2010, 2011; Gregson and Crewe, 2003; Hansen, 2000).

Bangladesh is one such country where e-waste does not end up in dumpsites as a waste; rather it is treated as a commodity of value while moving within different conduits (Gregson *et al.,* 2007b). My previous research on 'Economic Significance and Environmental Impact of Ship Breaking of Bangladesh' revealed that a significant amount of e-waste enters Bangladesh from abroad (Billah, 1999). The ship breaking industry is an important source of raw materials in Bangladesh. Between 80 to 90 percent of a ship is recovered which is used in different industries of the country (Gregson *et al.,* 2010a; Amin and Billah, 2007). For example, recovered iron is used in the re-rolling and construction industry. Besides, metals and materials in almost every discarded ship comes with a huge amount of used computers both functioning and non-functioning. A recent report

confirmed that the ship breaking yards alone generate about 2.5 million metric tons of e-waste in Bangladesh (ESDO, 2010, p. 7). This e-waste finds its way to the premises of resellers, repairers, refurbishers, remanufacturers, dismantlers, smelters and other production sites where value is either captured or created.

The capture and creation of value from e-waste in Bangladesh is the main focus of the present study. My fieldwork in Bangladesh suggests that the notion of e-waste being a waste ready for disposal is highly problematic since very few objects and materials entering Bangladesh under the label of 'e-waste' could be classified as waste only. For example, the present study indicates that the fate of personal computers (and PC scraps) entering Bangladesh as 'e-waste' may be divided into five categories – used, refurbished, reconditioned, components, and e-scrap - based on how they are sold to consumers in the local market. The first three categories involve selling the PC in its entirety. Used refers to computers that have been used by one or more people and are sold without any repair or enhancements i.e., the computer is sold as it was imported. It should be noted that used whole computers may be distinguished into two further categories based on whether spare parts and accessories of the PC are available in the market. Refurbished computers are old and used computers that are cleaned and made attractive with new covers, while reconditioned are ones thoroughly repaired to function in good condition. Components refer to parts of a computer that are sold separately, usually since the full computer is not functional. For example, selling the monitor only from a PC that has a bad CPU would fall into this category. Lastly PCs and PC parts (and accessories) that cannot be profitably sold as any of

the first four categories are often sold to firms that specialize in extracting valuable materials from the PC, such as printed circuit boards (PCBs), cathode ray tube (CRTs) monitors and random access memory chips (RAMs). These latter examples fall under the e-scrap category. Thus, as 'e-waste' does not belong to any essential category of waste in Bangladesh, it will be denoted as grey electronics and e-scrap throughout the present thesis.

In Bangladesh, grey electronics and e-scrap is not perceived the way it is looked upon in the North. These are generally considered as environmental problem rather than a beneficial resource due to worldwide media attention on its disposal through informal recycling practices. But in the Global South, international trade of grey electronics and e-scrap has been fuelled by the growing economic activities, consumption and disposal of grey electronics and e-scrap. For instance, in Bangladesh, Dhaka has a very active and successful private collection system, where almost all of the valuable parts and materials from grey electronics and e-scrap are extracted manually and recycled.[4] As a result, less of the negative environmental effects from grey electronics and e-scrap are evident in Dhaka, which will be discussed in-depth in chapter 4.

Access to computers is very important in Bangladesh. The country has recently entered the world of Information Technology (IT). The Prime Minister of the current government in the 9th parliamentary election 2008 came up with the

[4] For example, in Dhaka almost 3000 tons per day waste generated, 44 percent collection rate of solid waste among these 475 tons per day recycled which is almost 20 percent recycled (Waste Concern, 2005; JICA, 2005).

proposal to transform the country into 'Digital Bangladesh' by 2021. The government has targeted to increase its present level of computer penetration from 1 computer per 100 people to 1 computer per 50 people by 2012 (MOSICT, 2004).[5] Some recent policy changes toward Bangladesh becoming 'digital' are the current government's tax and VAT (value-added tax) changes, regulations favoring ICT and donation of computers to education and health institutions of rural areas of the country (Digital Bangladesh, 2010). The idea is to generate popular support for the country going towards digital development (Digital Bangladesh, 2010).

In a country like Bangladesh especially where over 50 percent of the people in are living below the poverty line (GOB, 2004), grey electronics and e-scrap are providing facilities in getting access to information technology and increasing computer literacy for both urban and rural population. Although there is a demand for those facilities, the demand cannot trigger the buying capacity as brand new ICT gadgets (e.g., laptop, mobile) are economically out of reach for most Bangladeshis and considered to be luxury products and symbols of privilege (see Hossain, 2010, p. 2). A new computer that is priced at US $1000 can be purchased by people earning an average salary after a month of work in the USA, 10 months of work in Romania or at least the cumulative average salary of 48 months of work in Bangladesh assuming all earned money will be invested in the computer (Dragulanescu, 2002). This demonstrates why an average Bangladeshi cannot

---

[5] This initiative falls under government's development strategy on 'Access to Information' (A2I), transition towards 'Digital Bangladesh' by 2021.

afford a new computer. As a result, Bangladeshis earning in the low and middle-income brackets purchase old and refurbished computers which are comparatively inexpensive. This means that there is a demand for more working computers – old or new and to meet this demand Bangladesh imports tons of grey electronics and e-scrap every year from abroad.

Throughout the present thesis I argue that repairing, refurbishing, repurposing and reproduction of grey electronics and e-scrap are important sectors of transnational profitable economic activity that depend upon connections between different types of actors, who have more or less powerfully embedded roles in international networks. To better understand the trade network of grey electronics and e-scrap and to realize how value is created and captured in its commodity/value chains, as they enters Bangladesh, there appears three major research questions that are posed to be investigated in the present study. These questions are as follows:

Question 1: How much and what kind of grey electronics and e-scrap are imported into Bangladesh? And where do they come from?

Question 2: By whom and under what conditions grey electronics and e-scrap are being processed in Bangladesh and why?

Question 3: How do grey electronics and e-scrap that are disposed of as 'waste' in one country (e.g., Canada) come to have 'value' elsewhere (e.g., Bangladesh) and why?

The remainder of this chapter will discuss the methodology used in this study, highlight the organization of the thesis.

1.2 METHODOLOGICAL AND INVESTIGATIVE APPROACHES

There are neither any published data nor any empirical studies on the trade of electronic waste in Bangladesh. Only a few scholarly works have mentioned Bangladesh as a recipient (importer) of e-waste from developed countries (Ansari *et al.,* 2010; GAO, 2008; Jain, 2006; Ladou and Lovegrove, 2008; Grossman, 2006; Slade, 2006). Recent studies by local NGOs estimate that Bangladesh has approximately 2.8 million metric tons (mmt) of 'e-waste' (ESDO, 2010, p.7). The limitation of these figures is that it is not clearly explained how the numbers were acquired. As a result, the questions of how much e-waste is imported to Bangladesh, in what conditions are they received and from where it originates are difficult to answer as the available data on the grey electronics and e-scrap trade are either partial or absent (UNEP, 2009, p.1).

Three major reasons for this lack of data can be identified. First, no confirmed formal statistical data are available on how substantial are the imports of grey electronics and e-scrap. Secondly, existing statistics only reflect the licit trade of grey electronics and e-scrap (BAN, 2005) disregarding illicit trafficking. This is because most of such trade is camouflaged and carried out under the pretext of acquiring 'reusable' apparatus or 'donations' from developed countries. Lastly, the government trade statistics of Bangladesh do not distinguish between imports

of new and old computers. A probable reason is that the Customs of Bangladesh, like other countries, does not have a separate Harmonized System (HS) Code for grey electronics and e-scrap.[6] Grey electronics and e-scrap enters Bangladesh under the HS code of new computers (e.g., 8471.30.00 portable automatic data processing machines, consisting of at least a CPU, a keyboard and a display; 8471.41.00 CPU and an input output unit, whether or not combined). Therefore it is difficult to track what share of imports is electronic waste. For these reasons, the present study draws on empirical findings collected through non-participant observations, in-depth semi-structured interviews, and questionnaire surveys from the different levels of traders of grey electronics and e-scrap in Dhaka city.

A combination of both qualitative and quantitative methods was used. Qualitative methods, particularly those that are ethnographic in nature, are considered to be the key insight of the present study. This method is increasingly being used by human geographers in order to gain a deeper insight into the processes and practices of our social life (Limb and Dwyer, 2001, p. 1). To date, studies regarding grey electronics and e-scrap have involved a mixed range of methods, from highly quantitative for mapping trade flows (Lepawsky and McNabb, 2010; Yu *et al.*, 2010; Yang and Williams, 2009) to in-depth interviews, questionnaire survey and non-participant observation (Lepawsky and Billah, 2011). In order to fully explore the distinctive nature of the trade, and follow the movement of grey electronics and e-scrap when it enters Bangladesh qualitative methods were

[6] HS Code is a six to ten digit internationally standardized system of names and numbers for classifying, tracking, recording and monitoring controlled traded products (GOB, 2006).

required. There is no standardized way of 'doing' qualitative research on post-consumption disposal practices, however the 'follow-the-thing' method allows the researcher to "trace the social relations and material linkages that this movement creates and within which the value of commodities emerges" (Foster, 2006, p. 285). This thesis uses the 'follow-the-thing' methodology to study how economic activities capture and create value from grey electronics and e-scrap after it enters Bangladesh. The findings of this thesis are based on the fieldwork I carried out in Dhaka, Bangladesh (2008 and 2009), where I followed grey electronics and e-scrap as far as they were recognizable as such and stopped once it entered a new round of production where there was no trace of its origin in electronics.

Fieldwork in Dhaka, Bangladesh, was conducted in two periods. The first period was from May 2008 to September 2008 and the second from June 2009 to September 2009. In the first period of fieldwork, 33 in-depth interviews and 63 questionnaire surveys with grey electronics and e-scrap related business owners were conducted. The second phase of the fieldwork in 2009 involved follow-up interviews with the respondents who participated in the first phase. Non-participant observations and in-depth semi-structured interviews were used to gather information about trade networks, commodity networks and the value chain. As trust relationships with the respondents were already built in 2008, an additional 25 new interviews were conducted in different sites with respondents which were referred to by the previous respondents. In total 58 interviews and 63 semi-structured questionnaires were administered. The surveys and interviews were accompanied by extensive documentation using photography.

In the first field work season in 2008, four months were spent in identifying key actors who are involved in this trade, observing their activities and also searching for locations where the handling of e-waste activities and their accessories were taken place. During this period two things became apparent of the grey electronics and e-scrap industry in Bangladesh. First, the notion of e-waste is not useful as respondents do not think about these objects and materials as waste. And secondly, these grey electronic objects and materials are moving in a highly organized and stratified industry consisting of importers, brokers, wholesalers, repairers, resellers, refurbishers, dismantlers and smelters all operating primarily in the informal sector.

1.2.1 In-depth Interviews

The 58 individuals who were interviewed included government officials (Customs, National Board of Revenue, Port Authority, Commerce Ministry and Computer Council), computer association members in the city, journalist, brokers, importers, repairers, *bhangaries* and smelters.[7] Among the 58 respondents three business people and their associates (agents, labors and brokers) involved in *bhangari* business of computer waste were repeatedly interviewed over four months to better understand what happens to the grey electronics and e-scrap once they enter their premises, and how they are treated and embedded with other industry as a new product. All the interviews were conducted to obtain information about the grey electronics and e-scrap related activities carried out by

[7] *Bhangari* is a Bengali word that refers to shops of old discarded materials. Most of these shops sort, clean, and sell the recovered materials.

them, and the respondents' experiences, opinions and feelings concerning these activities. As some of the interviewees were contacted through personal connections, it was comparatively easy to establish a rapport with the participants building a trusted relationship which allowed repeated contact with the interviewees (Crang and Cook, 2007). Personal connections through collegues, friends and relatives allowed me to give respondents an instant sense of trust that the information I was gathering would not negatively effect their lives, as they could know my whereabouts and intentions through the person who introduced us. Connections of such nature has allowed them to behave informally with me which was advantageous for the present study. It has provided in-depth insights of the respondents which may have not be captured easily through a formal interview with a stranger. Building a trusted relationship meant convincing potential participants to express themselves freely making sure they understood that I was not a journalist with the intention of exposing things they told me in confidence.

To ensure this, before conducting any interview I explained to my participants precisely how I would use the information collected for research and possible publication purposes. I assured them that they could end the interview at any time they wanted to, and could refuse to answer any uncomfortable questions. To ensure the anonymity of the participants I did not record any personal names or items related to the participants that could reveal their identity. I made use of pseudonyms in recording data. In short, it was made understood that I would not

disclose their personal identity or the location of their business. This has been practiced throughout the study as promised.

The interviews were semi-structured. The questions were set in advance, though the order of the questions was decided during the course of the interview. The reason for choosing semi-structured interviews was to allow flexibility in adjusting the questions to each of the informants as deemed necessary. The interviews were also kept open ended to allow for the possibility of obtaining other relevant information that could be of interest to the study (Hay, 2000). The conversations were noted in a diary and also recorded; the meetings with the interviewees were scheduled at a mutually convenient time and place. Each interview lasted between one to four hours. It was usually held at the respondent's office, place of work or market place. It is worth mentioning that some of the participants were visited and interviewed more than twice as way of triangulating certain information (see table 1.1) acquired from other participants to ensure the reliability of the qualitative results (Valentine, 2001) .

Table 1.1: Respondents Nature from Interviews and Surveys (N=121)

Respondent Types	Interviews Respondents (N=58)		Surveys Respondents (N=63)	
	Numbers	Percentage	Numbers	Percentage
Importers/wholesalers	22	37	8	13
Brokers	3	5	0	0
Relsalers (repairers, refrubishers, remanufactures)	24	40	52	83
Dismatlers (*bhangaries*)	8	13	2	3
Smelters	3	5	1	2
Total	**58**	**100**	**63**	**100**

Source: Fieldwork 2008 and 2009.

1.2.2 Questionnaire Surveys

In the absence of formal statistical data about grey electronics and e-scrap in general and on 'e-waste' trade specifically, the questionnaire survey was intended to overcome this limitation (Lepawsky and McNabb, 2010) and go beyond the lack of grey electronics trade statistics. The respondents of the semi-structured questionnaire include importers, wholesalers, retailers, resellers, repairers, dismantlers and smelters. Retailers, resellers and repairers were easy to find as they are located in commercial areas in Dhaka. The survey respondents were chosen from three such commercial areas of Dhaka city. The first area is well-known for its famous secondhand computer market which is located in Elephant Road and its surrounding area. The second area is in Mothijhel Commercial Area, also known as Dhaka city's Central Buinsess District (CBD). And the third can

not be disclosed here as promised to the interviewees. Dismantlers and smelters mostly occupy the third area. These areas like the others are clustered with old, used and repair stores that deal with similar kinds of products; also specillization were identified. For instance, the first area is comprised of stores that deal with personal computers, the second area is known for dealing with printers and laptops and the third for cell phones and televisions.

The importers, wholesalers, brokers, dismantlers and smelters were more difficult to locate. Respondents were selected through 'snowball sampling' method, which is suitable for studies involving difficult-to-find respondents (Bernard, 2002, p. 185) and where the total size and location of the potential population is not known in advance. As a result the sample size does not proportionally reflect the total population distribution, and ended at 63 respondents where it reached to the "point of theoretical saturation" (Crang and Cook, 2007, p. 12) as similar information was being obtained repeatedly.

Two different sets of questionnaires were prepared to conduct the survey. The first one was to gather information from importers, wholesalers, and resellers (Questionnaire A in Appendix 1). The questions were aimed to identify the categories, related costs and amount of grey electronics and e-scrap of the imports; and the source country, trade route and procurement procedures of importation and the volume and price of the products of the trade. The second set was intended for the dismantlers and smelters (Questionnaire B in Appendix 1). Besides seeking similar information as of the first set of questionnaires, this set

aimed to find out how much profit is earned in breaking or dismantling grey electronics and e-scrap, and where the salvaged objects and materials end up.

1.2.3 Non- Participant Observation

I used non-participant observations and in-depth interviews where and when found appropriate to collect data for this study. Non-participant observation means that the researcher is present in the situation where the study takes place, and observes people and activities they are involved in. This method as suggested by Clark *et al.,* (2009) is suitable for generating basic information about how people relate to each other and the organization of their activities. For instance, while interviewing the owner of a secondhand store, I observed a *Tokai* (a 10 year old a boy) collecting obsolete, discarded printed circuit boards (PCBs) and residuals of computer accessories nearby. [8] I asked him what he would do with PCBs and residuals and he explained that his boss would recover materials from them. When I wanted to get in touch with his boss, the little boy connected him to me using a mobile phone. After explaining to his boss that my intentions were research, and I was not a journalist, nor an environmentalist, I was invited to the *bhangari*, where I was able to observe, learn and interview many other workers in this industry.

---

[8] *Tokia* is a Bengali word which means a person who makes money or a living by extracting/ collecting valuable materials from along the road side or waste heap and selling them.

Non-participant observation occurred both inside and out of the working places. Activities observed were often dependent upon the participant's workload and schedule. Activities ranged from daily trade of grey electronics and e-scrap to dismantling and smelting of parts and pieces. As is evident, these methods have taken place in a number of different spaces, across different types of businesses, although the market place has been the base from which the ethnography has extended. Meetings during the first times revolved around standard techniques such as observations, but later participants were more eager for me to get involved in participatory activities. During the period of my fieldwork, I spent long hours in warehouses and other workspaces learning about and occasionally practicing the grey electronic and e-scrap trade.

1.2.4 Secondary Data

I also used secondary data to gain background information about the formal and informal secondhand computer business system and the informal recovery processing systems in the city of Dhaka, Bangladesh. Most of the secondary data consists of background information of the industry and of where the grey electronics and e-scrap related businesses are located which have been collected from the daily newspapers namely, – 'The Daily Star', 'The Independent', 'The New Age', 'Prothom Alo' and 'Ittefaq'. I also conducted searches of other daily/monthly computer related magazines, papers, published reports and books of local non-governmental organizations related to documenting or studying electronics waste and its disposal. These materials provided some basic

information that has helped to analyze the industry characteristics of sales and trade.

1.3 ORGANIZATION OF STUDY

The remainder of the thesis is divided into four Chapters. Chapter Two is a critical literature review of electronic waste studies. The chapter is devoted to literature on the basis of current and relevant studies of e-waste and covers three main issues – (1) rethinking e-waste as grey electronics and e-scrap, (2) theorizing the geographies of waste and value, and (3) theoretical frameworks: global value chains (GVCs), global production networks (GPNs), and conduits theory. It addresses these literatures with respect to Marx's labour theory of value to understanding conduits theory firmly.

Chapter Three situates Bangladesh in the global networks of grey electronics and e-scrap. The chapter begins with a brief description of the transnational flow of grey electronics and e-scrap narrowing down to Bangladesh. A detailed description of how grey electronics and e-scrap enters the country, where it comes from and through which routes it enters the country, is presented in this chapter. The chapter also discusses the different types of grey electronics and e-scrap (i.e., whether they are ready to be consumed as used, refurbished, reconditioned etc.) that Bangladesh receives and notes which countries are considered to be competitors in importing grey electronics and e-scrap.

Chapter Four comprises three sections. The first section examines the conduits through which grey electronics and e-scrap moves once it enters Bangladesh. This includes the detailed descriptions of the processes that grey electronics and e-scrap undergoes, for instance, repair, refurbishment, disassembling and recovering parts and materials. The second section talks about the formation of the grey electronic and e-scrap commodity chain in Dhaka city. And the last section illustrates how the value of grey electronics and e-scrap is captured and created in Dhaka.

Chapter Five summarises the key findings of the research, discusses concluding remarks, and suggests further research.

CHAPTER TWO

Theoretical Background: A Critical Review of the Literature

2.1 INTRODUCTION

This chapter will review existing literature on the relevant areas of the present thesis. This will allow me to develop a framework of research in the grey electronics and e-scrap area and identify remaining unanswered questions. Prior related work can be classified into three main bodies of scholarly literature relevant to the present study. The first body of literature focuses on the rethinking of e-waste as grey electronics and e-scrap. The second body is concerned with theorizing the geographies of waste and value and the third stream provides a solid theoretical framework which consists of Global Value Chain (GVC), Global Production Network (GPN), conduits theory and Marxian labour theory of value. Though I have organized the literature into three separate sections, the three themes are interrelated and interconnected. This will be evident in the sub-sections below. The rationale behind choosing these three themes is to create a conceptual framework upon which I can build my research.

2.2 FROM E-WASTE TO GREY ELECTRONICS AND E-SCRAP

There is no universal definition for electronic waste as e-waste has different definitions to different people in different places (Terazono *et al.,* 2006). For instance, a

secondhand electronic item for one person might be considered to be e-waste for another person in a different place. Terazono *et al.,* (2006) argue that when 'e-waste' is defined the secondhand usage of it is often ignored. They suggest alternative expressions of e-waste, like 'discarded consumer electronics'. Also the term 'life span' of electronics is not consistent in literature as some products dispose faster than others (Babbitt *et al.,* 2009).

A large body of existing literature shows the importance of e-waste; and raised a wide range of issues. These issues can broadly be categorized under four themes - social and environmental justice, environmental toxicology and occupational health, economic, and e-waste management. The first category - social and environmental justice – is the focus of Environmental Non-governmental organizations (ENGOs), researchers and academics. The main focus of ENGOs (such as Basel Action Network 2002a-b, 2005; Greenpeace International, 2005, 2008a, 2008b; and Toxic Link India, 2003, 2004, 2007) is to expose the conditions of the people and places in the dumpsites of developing countries such as Nigeria, Ghana, China and India. These activist groups claim that 50 to 80 percent of 'e-waste' that is collected for domestic recycling in North America ends up in poor developing nations of Asia and Africa. Some have demonized the global movement of grey electronics and e-scrap as an attempt by developed countries to avoid dealing with domestic waste processing locally. The debate has focused largely on the dumping of grey electronics and e-scrap at disposal sites in developing countries. The arguments are mostly centered on the inappropriate

handling of grey electronics and e-scrap that is considered to be harmful to the environment (Greenpeace International, 2005, 2008; BAN, 2002a, 2005; Toxic Link India, 2003). Studies and reports by ENGOs often support the pollution haven hypothesis (Clapp, 2002) which points out that poorer regions or countries are disproportionately affected by toxic waste (Iles, 2004; Pellow, 2007; Smith *et al.,* 2006). However, in the absence of any comprehensive global data on how grey electronics and e-scrap are handled and disposed of in the countries where they are supposedly dumped, it is difficult to get a clear picture of the veracity of the ENGOs' claims. For instance, the dominant ENGO storyline about e-waste fails to acknowledge the fact that the informal recycling and recovery industry creates jobs and economic opportunities for the poor. For example, Kulke and Staffeld (2009) found in Dhaka that a large number of people are engaged in the informal sector of the plastic recycling and processing industry. My research reveals similar patterns of a large number of people directly involved in this industry, which I discuss in detail in Chapter 4.

The second strand of the literature focuses on environmental toxicology and occupational health. This literature argues that particular ways of recycling e-waste emit toxic substances that contaminate human health and the environment (Chen *et al.,* 2011; Li *et al*., 2011; Sepúlveda *et al.,* 2010; Tang *et al*., 2010; Wu *et al.,* 2010; Xing *et al.,* 2009; Leung *et al*., 2008; Li *et al*., 2008; Li *et al*., 2007; Deng *et al.,* 2006; Fan *et al.,* 2005; Qiu *et al.,* 2004; Schmidt, 2002). Research analyzing freshwater sources, human hair, breast milk, sediment, soil, air and dust samples from e-waste recycling

and dismantling sites detects that the human exposure levels of toxic chemicals (e.g., polychlorinated dibenzo-p-dioxins and polycyclic aromatic hydrocarbons) are comparatively higher than the standard of the World Health Organization (WHO) guidelines (Chen *et al.,* 2011; Li *et al.,* 2011; Wang *et al.,* 2011; Chen *et al.,* 2009; Wang *et al.,* 2009; Xing *et al.,* 2009; Huo *et al.,* 2007; Wong *et al.,* 2007a–c; Wang and Guo, 2006; Deng *et al.*, 2006; Leung *et al.,* 2006; Yu *et al.,* 2006). What is absent in the literature is that e-waste is also processed with hand-made tools in some cases (also known as *bhati* in Bangladesh) that potentially produces less environment and human health hazards compared to extraction methods like acid baths and open burning. The above literature so far has not considered the economic aspects (e.g., job creation) of the informal sectors. Though some researchers have acknowledged these limitations, the main focus has mostly been on the problem of environmental and health hazards.

A third body of literature on e-waste broaches the issues of e-waste as an economic commodity, rather than an environmental problem. This is because, e-waste is being exported and imported by countries for mere economic reasons. For instance, in Peru end-of-life PCs are imported from USA to be sold in the reuse market. 87-88% of imported used computers had a price higher than the ideal recycle value of constituent materials (Kahhat and Williams, 2009). As a result, confusion arises as to whether one should recognize the end-of-life PCs as 'waste' or as a 'commodity' (Kahhat and Williams, 2009). Again, cast-off printed circuit boards (PCBs) are being exported from

Peru to European countries for the recovery of precious metals. This opposes the pollution haven hypothesis and the dominant ENGO storyline about e-waste. As a result, e-waste can be viewed not only as an environmental problem but also (in contrast) as an opportunity with social and economic benefits for developing nations (Williams *et al.,* 2008). Recent literature by Grant and Oteng-Ababio (2012) shows that used computer imports to Ghana have increased from $22.7 to $59 million between 2004 to 2009 which implies that grey electronics and e-scrap carry a market value. Although, the government has import duties on used computers by 25 percent to prevent such trade (Oteng-Ababio, 2010b), the tightness of trade regulations and increased tariffs create an incentive to understate exports and lead into smuggling (Kahhat and Williams, 2009). These studies emphasize that informal economic activities involving the e-waste trade emerge as strategies of survival and livelihood (cf. Oteng-Ababio, 2012). My argument is in accord with these studies.

Recently there has been increasing attention by ENGOs, academics, the public and policymakers on the trade of grey electronics and e-scrap across national boundaries (BAN, 2002a and 2005). Some scholars point out that the 'e-waste' trade, as long as the grey electronics and e-scrap is being reused, may actually be more beneficial than harmful (UNEP, 2009; Kahhat and Williams, 2009). For instance, on several occasions, grey electronics and e-scrap has been found to be exported to developing countries under the banner of the global challenge to 'bridge the digital divide' which is an initiative of the program – 'computers for schools' (James, 2001; James, 2002).

The trade makes possible access to technology which has become an integral part of peoples' daily lives. For instance, the increased accessibility of electronic equipment for low-income people in Accra, Ghana can facilitate economic development of the country (Grant and Oteng-Ababio, 2012). Despite the problem of 'e-waste', its appropriate disposal practice using environmentally sound systems in various parts of the globe, presents various socioeconomic prospects that can stimulate entrepreneurship, employment and enhancement of livelihoods. Besides that, inexpensive access to information and communication technologies means it can also be considered an important facilitator of economic development.

The fourth major topic of interest in the literature deals with e-waste as a waste management problem and the responsibility of producers for the collection and recycling of post-consumer products (e.g., Kahhat *et al.,* 2008a, Kahhat *et al.,* 2008b). Studies show that pollution occurs from manufacturing to disposal of electronic products. For instance, semiconductor manufacturing locations discharge contaminated water into local rivers (Grossman, 2006). Some authors focus on the different waste-disposal options ranging from conventional and primary disposal method of landfill (Grossman, 2006; Terazono *et al.,* 2006; Gibson and Tierney, 2006; King *et al.,* 2006; Kang and Schoenung, 2005; Basel Action Network, 2002a,b) to electronic producers designing environment friendly products and practicing take-back systems that reduce toxics at the point of production (Basel Action Network, 2002a; Silicon Valley Toxics Coalition, 2001; Greenpeace, 2005).

Some of economic and environmental valuation literatures deal with waste prevention and minimization through designing, to ensure minimal end-of-life waste, which means to have no or less waste. The literature shows that some of the methods preferred to estimate the worth or value of products are cost benefit analysis (CBA), triple bottom line (3BL) and life cycle analysis (LCA). A major limitation of CBA is said to be that the method has no scope for social judgment. Thus, CBA considers the economic state of the product ignoring its social life. The 3BL method is thought to go further than CBA by explicitly acknowledging social, economic and environmental benefits for the sustainable development of products. However, 3BL has been shown to have important limits too. For example, it presumes that a meaningful system of credits and debits can be devised for accounting purposes in each of three registers: economy, environment, and society. Yet, there is little agreement about what such a system should look like (see Alexander, 2005). Over the last decade LCA, like CBA and 3BL, has emerged as an important tool for the environmental management of production systems. The way LCA works is to measure the environmental performance of products over their life cycle, from 'cradle' (where the raw materials are extracted) to 'grave' (where the product is finally disposed of). Though, LCA technique continues to play an important role for product stewardship and pollution prevention, it has many of the same problems as that of CBL and 3BL (see Alexander, 2005). The LCA method, for example, typically sees waste as a linear end of the production and consumption process. Through traditional waste management thinking 'cradle to grave' provides an inventory of a product's environmental impacts over time at every stage in its 'life'

from origin to final disposal. This is often expressed in quantitative analysis (like CBA and 3BL) in terms of energy consumed, raw materials consumption, and pollutants released along the entire life cycle of a production system, from the extraction of natural resources to the final disposal of wastes. The disadvantage is that LCA in turn does not incorporate social and economic costs/benefits theoretically into its model, and is therefore of limited use in any analysis that addresses these domains.

There seems to be no global consensus on what 'environmentally sound management' of e-waste is. Different nations have different domestic environmental standards and regulations. One thing that is common in the above mentioned literature is that the end point of the production-consumption-disposal chain is always assumed to be 'waste'. Such conceptualizations are not complete as none have indicated the value outcome that was visible in Bangladesh during my fieldwork.

As mentioned in chapter 1, my fieldwork in Bangladesh suggests that the notion of e-waste being a waste ready for disposal is highly problematic since very few objects and materials entering Bangladesh under the label of 'e-waste' were actually practiced as waste. Further, e-waste is a mine of precious metals and materials which become feedstock to several production sites, saving energy and resources that would have been used to extract virgin materials and metals. It should be noted that the deliberate use of the phrase 'grey electronics and e-scrap' instead of 'e-waste' is motivated by the fact that used and scrap electronics entering Bangladesh under the label of 'e-waste' is

far from being considered 'waste'. The practices of converting the so-called 'e-waste' into valuable consumable products and also primary inputs in other production chains will be discussed in Chapter 3.

Thus, in the context of Bangladesh the term 'e-waste' signifies a provisional status for imported electronic commodities before they are sold to individuals and firms as objects of value. Since e-waste is not treated as a waste once it enters Bangladesh the term 'grey electronics and e-scrap' will be used throughout my work to signify the potential value that 'e-waste' carries in Bangladesh. Instead of ending up in dumpsites, 'e-waste' usually winds up in production sites as explained in Chapter 4. The notion of waste and value thus needs to be thought of quite differently. To do so I turn to literature on the geographies of waste and value in the next section.

2.3 THEORIZING GEOGRAPHIES OF WASTE AND VALUE

To understand how the waste of one country is viewed as valuable in Bangladesh, it is important to understand how the commodity chain works. A commodity chain is "a network of labour and production processes whose end result is a finished commodity" (Hopkins and Wallerstein, 1986, p. 159). It examines a "series of relations through which an item passes, from extraction to conversion, exchange, transport, distribution and final use" (Ribot, 1998, p.307). This concept has been widely used to understand

the production of commodities as diverse as automobiles, clothing and toys (see also Dicken, 1998), electronics (Kenny and Florida, 1994), cocaine (Wilson and Zambrano, 1994), footwear (Schmitz, 1999), cut flowers (Hughes, 2000), and agro-foods (Winter, 2003) such as papaya (Cook, 2004). The problem of the commodity chain literature is that, the concept of a chain is too linear and too narrowly focused on production in the South for consumption in the North. The drawback of these literatures is that they typically assume the starting point is the consumption (usefulness of the object) and the ending point is disposal (object discarded). However, in reality, the material of the object does not disappear after the object is being disposed. It may change appearance when the discarded object passes through different conduits, but it never ceases to exist. As this material sometimes moves back into production, waste may have life after disposal. Therefore, disposal are not the necessary endpoint of final consumption and activity. Rather disposal includes "themes of movement, transformation, incompleteness, and return" that cannot be excluded from social interactions (Hetherington, 2004, p. 157).

Some literature has overcome the problem of linearity. For instance, a recent study shows that commodity circuits/chains have neither inherent beginning nor ending, and argues that these commodity chains go beyond linearity (Lepawsky and Mather, 2011). Appadurai (1986) explains the 'social life of things' of objects/goods having 'biographies' that carry specific meanings of value. He examines the 'unevenness' of power of the different actors within these socio-economic, cultural and political

contexts along the commodity chain. Within these contexts Leslie and Reimer (1999), show that power, gender and space are important in analyzing the idea of 'embeddedness' along the commodity chain. The present study confirms that in the context of grey electronics and e-scrap in Bangladesh the production-consumption-disposal chain is non-linear.

Waste is often portrayed as the end-point of the production-consumption-disposal chain, although there might be different opinions of how this is to be classified. Recent literature rethinks the notion of waste, dirt and disposal as a symbol and indication of social ordering practices (e.g., Drackner, 2005, Hudson, 2008, O'Brien, 1999, Shove, 2003). Key ideas here are - one man's waste may be another man's livelihood or as Susan Strasser (1999) puts it, "what counts as trash depends on who's counting"; Mary Douglas's (1966) famous notion "Dirt then, is never a unique, isolated event. Where there is dirt there is system (p.35)" and Thompson's rubbish theory (Thompson, 1979).

Douglas's proposition explains that the value of most objects, even dirt, is highly context specific i.e., it is dependent on social norms, culture and different points of view. On the other hand Thompson (1979) states that an object that is thrown away as something with zero value for person X may very well be of significant value to person Y. He defines rubbish as objects with zero value and points out that the moment an object loses its use value, it becomes rubbish. However, a rubbish object may cease to be rubbish (i.e., its value may become more than zero) if it is revalued under a different

context. The rubbish theory thus suggests valuing any object, including waste, as context dependent instead of assuming (1) objects continually lose value over time and (2) once an object's value goes to zero it can never regain any value in a different context.

One limitation of Thompson's rubbish theory is that he develops rubbish theory in relation to whole objects (Gregson *et al.,* 2010a). He does not consider the re-valuing of objects through their disassembly into materials and components, which can turn an end-of-life object into multiple objects and materials of value (Gregson *et al.,* 2010a, 2010b). For instance, the ship breaking industry in Bangladesh imports old broken ships from European countries. These old ships are dismantled by Bangladeshi labor to capture and create value from their recovered materials (e.g., iron and steel) and parts (e.g., furniture) are traded in the local market (Gregson *et al.,* 2010a). Objects as a whole may lose their value and become waste for a short time, but they can also be returned to value once they are dissembled into their constituent components and materials. This study draws a valuable lesson from ship breaking as "things are but temporary configurations of material" (Gregson *et al*., 2010a, p.846), which can potentially be endlessly reassembled value. The existence of an international trade and traffic of grey electronics and e-scrap suggests that some form of value exists or is created after initial disposal (see Lepawsky and McNabb, 2010). Both waste and value are highly situated phenomena determined by geographic differences and mobility.

Like the ship breaking industry, material obtained from e-waste exported by North America and Europe returns to those markets as parts of new products (Weidenhamer and Clement, 2007a, b, c). During my fieldwork in Bangladesh similar practices were evident for grey electronics and e-scrap which is described in detail in Chapter 4. A new chain begins at the disposal phase as this chain is an "open–ended web of potential connectivity" (Gregson *et al.,* 2007b, p.198). Wherever ridding (Gregson, 2005; Gregson, 2007) is practiced, there is the potentiality of grey electronics and e-scrap to find a new life. As Gregson *et al*., (2007b) show it is a misconception that the North can easily be called a throwaway society. Their ethnographic study in the UK reveals that people spend a great deal of effort not to waste things. Rather than simply throwing things away, people engage in ridding practices, which move things along as part of a rich performance of personal and household identity construed as 'doing the right thing' (see Gregson *et al*., 2007a). The study further shows that 76 percent of electronic items moved along by such UK households do not enter the waste stream but rather find new life through different conduits (Gregson *et al.,* 2007b). Similar ridding practice exists in the grey electronics and e-scrap industry in Bangladesh. Thus, waste of one place (e.g., Canada) can come to have value elsewhere (e.g., Bangladesh).

2.4 THEORETICAL FRAMEWORKS: GVC, GPN, CONDUITS THEORY AND MARXIAN LABOUR THEORY OF VALUE

The network-based framework 'global production networks' (GPN) has been developed as a critique to the global chain approaches (e.g., global commodity chains, value chains or supply chains) (Dicken *et al.,* 2001; Henderson *et al.,* 2002). The framework "reveals the multiactor and multi-scalar characteristics of transnational production systems through intersecting notions of power, value and embeddedness" (Coe *et al.,* 2008a, p, 267). According to the GPN literature, the chain approaches are too linear and do not reflect reality properly because they miss, among other things, the 'intra-firm' governance in the chain and neglect 'extra-firm' networks at various scales (Hess and Yeung, 2006; Coe *et al*., 2008a; Coe *et al.,* 2008b; Gibbon *et al*., 2008; Nadvi, 2008; Palpacuer, 2008). Though, the global value chain (GVC) and global production network (GPN) frameworks have been adopted by many studies during the past decade, to understand the two approaches and to situate the present discussion of value theory in GVCs and GPNs, I will begin with a brief review of the two approaches.

Both frameworks typically look at economic activities within a single sector (e.g., Gereffi 2002; Dolan, 2007; Gereffi and Frederick, 2010) and assume 100 per cent of the value of a commodity chain is captured by the time the given product is purchased by an end consumer. For instance, using the GVC framework, the price paid by a customer for the final product, reflects the total value added in every step of the

production process by everyone involved (Dedrick *et al.*, 2010). Thus, in the production of video games "the manufacturer is able to capture 20% of the total retail value of a console game; developer and publisher (combined), 40%; distributor, 10% and retailer, 30%" (Johns, 2006, p. 163). Although both the frameworks may seem identical, their conceptualization of value is different. In the GVC approach, value is understood by taking advantage of, or creating, barriers to entry. Whereas, the GPN approach highlights the creation, enrichment and capture of value (Coe *et al.,* 2004, p. 473) by realizing 'economic rent' (Henderson *et al.,* 2002, p. 448). A major drawback of the GPN approach is that it ignores consumption and needs "to find ways of integrating the role of consumption more fully" (Coe *et al*., 2008b, p.286).

The conceptions of adding value with GVCs are based on a straight objectivist notion of value, in particular a combination of the "Marxian notion of surplus value and more orthodox ones associated with economic rent" (Henderson *et al.,* 2002, p.448). GPN also places greater emphasis on value creation. Lepawsky and Billah (2011) pointed out in their study that it is surprising that the concept of value offered by the "GPN framework has remained largely uncontroversial given that orthodox theories of rent and Marxian labour theory of value are incompatible with one another" (p.136; see also Starosta 2010a, 2010b; Glassman 2011).

Although the GVC and GPN frameworks have mentioned issues like recycling, waste, final disposal (Kaplinsky and Morris, 2001, p. 4) and pollution (Coe *et al*., 2008b, p.

274), the literature has largely ignored these issues. A growing number of recent studies, however, have drawn on GVC and GPN approaches to study post consumption proceses through ethnographic fieldwork. For example ethnographic fieldwork has been used in tracing the global flow of rubbish electronics (Lepawsky and Billah, 2011), used cars (Brooks, 2012; Brooks, 2011), ship breaking (Gregson *et al.,* 2010a), and secondhand-clothes (Norris, 2010; Hansen, 2004). To overcome both the theoretical and the methodological shortcomings of the GVC and GPN framework (Lepawsky and Mather, 2011, Lepawsky and Billah, 2011, Gregson *et al.,* 2010a; Lane *et al.,* 2009), the concept of conduits is adopted here.

The conduit theory of Gregson *et al*., (2007b) looks beyond the economic activities after consumption. Unlike GVC and GPN, conduit theory examines post-consumption practices that are about all kinds of value capture and creation, not strictly economic ones. Thus, sentimental value, love relations and care are highlighted for their role in motivating secondhand circulation. As discussed earlier, GVC and GPN generally assume that 100 percent of value is accounted at the time of final purchase or final consumption of a product. According to Gregson *et al.,* (2007a, 2007b) a significant proportion of discarded objects are diverted to reuse rather than simply waste, where objects are revalued. The decision to get rid of something and the conduits through which it is disposed of, reveals the identities, practices and social relations that make up a wider range of value (e.g., emotional, sentimental, care). This analysis highlights how disposal through a certain conduit is not an endpoint of the consumption process,

rather disposal is a possible rekindling of value creation and capture that may include but also exceed 'the economic'.

Though the conduit theory allows a better understanding of waste and value (Gregson *et al.,* 2007a, b) there are a few drawbacks. According to Gregson *et al.,* the materials designated as waste is disposed to the waste stream via bins, or hand-me-downs (handed around to friends or family). But in my empirical study in Dhaka there is more than hand-me-downs in the grey electronics and e-scarp industry. Labor power opposes hand-me-down economics and goes beyond handed around (e.g., hand-me-up, hand-me-forward), that can be traced to production sites that are connected to broader economics. It is the additional labor time involved in the process that plays a key role for placing, arranging, disposing and transforming grey electronics and e-scrap into a source of value which will be discussed in details in Chapter 4.

Marx's labour theory of value and uneven labour power relations between the different actors clearly fits into the theoretical and analytical framework of the present study to understand how labour creates and captures value from grey electronics and e-scrap in Dhaka. One of the major ideas in the present study is that by employing new rounds of labor, refurbishers, remanufacturers, dismantlers and smelters create value and bring the disposed object to a working standard or a new use or become a feedstock to a new production site. Value capture and creation processes occur within the networks of

conduits after the disposal phase. According to Marx, the value of an object is a result of the labor applied to produce it. The more surplus labor goes into an object, the more it gains value. On the labour theory of value labour time is the key to understanding labour power (see Marx, 1999). The use-value of grey electronics and e-scrap is a product of the labour that was initially embodied in the electronics when it was first sold as a new commodity. Being discarded means being devalued and when the used-electronics no longer have exchange-value they drop out of the commodity form. New labour-time is required to realize the use-value still embodied in used-electronics and to instill used-electronics with exchange-value. When these processes occur, 'e-waste' is reproduced as a commodity when sold in a different social economic context. These processes will be discussed more in chapter 4.

CHAPTER THREE

Situating Bangladesh in the Global Trade and Traffic Networks of Grey Electronics and E-Scrap

3.1 INTRODUCTION

The present chapter attempts to answer the research question: *How much and what kind of grey electronics and e-scrap are imported into Bangladesh? And where do they come from?* The chapter begins with a brief description of where Bangladesh is situated in the global network of grey electronics and e-scrap. The source countries from which grey electronics and e-scrap are imported to Bangladesh, what trade routes are used, how the trade is organized, and which trading systems are more convenient for importers are also elaborated here. As stated in earlier chapters, the limitation in the present study is the availability of national, regional and global quantitative trade data and inconsistencies for understanding the movement of grey electronics and e-scrap trade of Bangladesh. However, to overcome this limitation, in this chapter I will try to present the current trade pattern of grey electronics and e-scrap in Bangladesh using field surveys and in-depth interviews. The present chapter begins by considering the domestic demand of grey electronics and e-scrap and how it becomes a 'new' commodity to individuals, middlemen and global traders. In addition, the chapter describes how amidst the global tightening of environmental legislation, illegal trade is

occurring. Moreover, the chapter ends with a discussion on possible motivating factors for grey electronic and e-scrap trade.

3.2 TRADE AND TRAFFIC OF GREY ELECTRONICS AND E-SCRAP IN BANGLADESH

In the last decade, ENGOs, researches, newspaper and popular media pointed out that mountain amount of 'e-waste' that is being generated around the globe and its negative consequences on the environment and human health in Asia and Africa. The complexity associated with grey electronics and e-scrap trade also pertains to the South becoming the dumping ground for North. However, the trans-boundary trade in grey electronics and e-scrap is not a new phenomenon, as it has reached a distinctive scale. Recent literature suggests that the movement of grey electronics and e-scrap is not only in one direction (i.e., North to South). In the case of Bangladesh it is a more complex story (Lepawsky and Billah, 2011; Lepawsky and McNabb, 2010). In Dhaka, this movement of the trade contributes to a series of practices, including economic activities, providing access of technology, job creation and also supply of cheap technology to millions of Bangladesh's poor and middle class people, which will be discussed in details in chapter 4.

The Basel Convention is the key international regulation intended to govern transboundary movements of hazardous waste, including the global movement of 'e-waste'. To address the environmental risks, the Basel Convention has banned the exportation of hazardous and recyclable waste for final disposal and recycling

from Annex VII countries (EU[1], OECD[2] members and Liechtenstein) to non-Annex VII countries (all other signatory parties to the convention, including Bangladesh). This would technically end any grey electronics and e-scrap movement from developed to developing countries (e.g., from the Canada to Bangladesh), as grey electronics and e-scrap exported for reuse, recycling, and recovery would be prohibited. However, there seems to be several loopholes in the Basel Convention that enable traders to move it out to and within Bangladesh. For instance, the transboundary movement of grey electronics between non-Annex VII countries (e.g., China and Bangladesh) is not banned under the Basel Convention. As a result, the trade of grey electronics and e-scrap among developing countries remains a significant feature of its international trade and traffic today (see also Lepawsky and McNabb, 2010). The convention also does not regulate movement of grey electronics and e-scrap from developed countries to Bangladesh under the guise of donation. For instance, among the Annex VII countries UK, USA, Canada, Japan and Australia send grey electronics and e-scrap in the form of charitable donations to Bangladesh. My field work reveals that USA and Japan (i.e., Annex VII countries) send about 700 old computers and laptops in the rural schools as charitable donations. This is similar to the clothing industry, as secondhand commodities are sold and flows to charity shops and yard sales where the reason behind several people purchasing secondhand goods is beyond financial necessity, highlighting how secondhand exchange can be about fun, fashion and socialization (Gregson and Crewe, 1997; 2003).

---

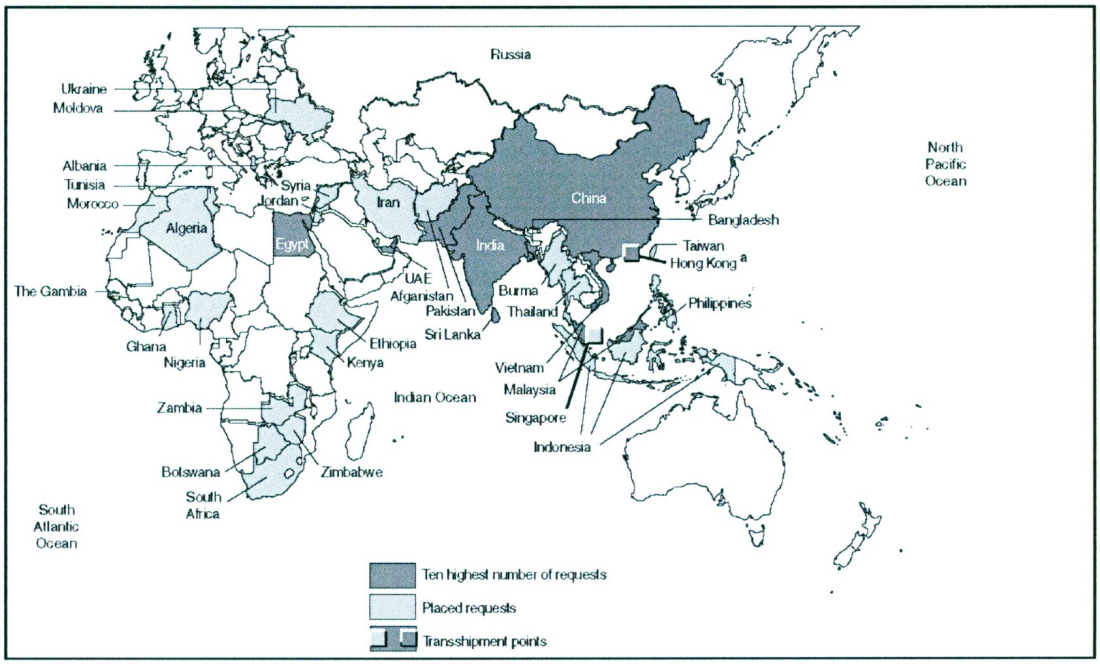
[1] EU stands for European Union

[2] OECD stands for Organization of Economic Cooperation and Development

3.2.1 Domestic Market Demand in Bangladesh

In Bangladesh a new economic sector has emerged that revolves around the geographies of trading, salvaging and material recovery of grey electronics and e-scrap. In recent years, there has been an increase in the demand for grey electronics and e-scrap in the country. A study conducted by the United States Government Accountability Office (here after USGAO, 2008) shows that the demand is intense in the developing nations, particularly in the Central and South Asian region. It further reveals that Bangladesh is one of the top ten countries that placed requests for CRTs (i.e., computer monitors or televisions) on two e-commerce websites (Figure 3.1). Other studies state that many Asian countries are trading grey electronics and e-scrap with one another based on this demand. For instance, 96 percent of grey electronics (e.g., used home appliances, televisions and computers) discarded in Japan are being exported to China, Philippines and Hong Kong for reuse and material recovery (Yoshida, 2011; Shinkuma and Huong, 2009; Yoshida and Terazono, 2010).

Figure 3.1: Developing Countries Requesting CRTs on Two Internet E-commerce Web Sites, February to May 2008



Source: US GAO, 2008

Since Bangladesh does not manufacture computers nor can afford to import brand new computers, to meet the domestic demand the country imports a mix of new computers and grey electronics and e-scrap. Interviews with importers revealed that, many other developing countries including India and Malaysia have similar demands to Bangladesh. As a result they compete with Bangladesh in the global grey electronics and e-scrap market.

When asked why the 63 interviewees were buying used, refurbished, or reconditioned computers instead of new ones, 61 percent responded that new computers were much more expensive. This reflects that cost consideration is the prime reason behind purchasing and using grey computers. Table 3.1 shows the

price of new computers, used computers, refurbished computers and reconditioned computers based on the questionnaire survey (2008).

Table 3.1: Retail price of computer in Bangladesh

Types of Computer		Minimum Price(BDT)	Maximum Price(BDT)	Avg. (BDT)	Avg. (CND)
New Computer	Brand New*	19, 000	125,000	49,500	853.00
Computers imported from abroad where they are called 'E-Waste'	Used: Accessories and replacement parts currently unavailable	1,000	10,000	4,575	79.00
	Used: Accessories and replacement parts currently available	2,500	13,000	6,920	119.00
	Refurbished / Reconditioned	3,250	15,000	9,125	157.00

*Source: Questionnaire Survey, 2008 (n=63) *This does not include clones.*

It is clear from Table 3.1 that the price difference between new computers and grey electronics and e-scrap is very significant. There are also price differences among used, refurbished/reconditioned computers. The average price of a new computer is about CND 850, which can buy 7-10 used or 5 refurbished/reconditioned computers. Besides individuals, many cyber cafes, printing presses and student coaching centers purchase these grey electronics, thereby making computers accessible to people who cannot afford a computer and

providing the opportunity to reach out to the world through browsing and learning net surfing at these places.[3] In Dhaka, there are almost 1200 cyber café according to the 'Cyber Café Owners Association of Bangladesh' (CCOAB). One benefit from using old computers in these cafés is that as the cafés use dial-up internet connections, computers with high configuration are not mandatory. Computers of earlier versions do the job, as a result, the investment cost of such establishments are low. As customers pay according to the time they spend using the internet in the cyber cafes, the owner gets more money from the customers as dial-up connections take more time in downloading information from the world wide web (cf. Mwesige, 2004, p.89). Thus, the grey electronics and e-scrap industry in Bangladesh makes it possible for individuals to save money as well as purchase and upgrade computer technology that would otherwise be unaffordable to them. To understand from where, why and how does grey electronics and e-scrap enter Bangladesh, the following sections present a detailed description of the source countries, the network formation, the trade systems and the illicit trade of grey electronics and e-scrap in Bangladesh.

3.2.2 Source Countries

Traders identified the top five countries from which the highest amount of grey electronics and e-scrap in terms of shipments are imported to Bangladesh. These are China, Singapore, South Korea, Taiwan and Malaysia (see Table 3.2). It is estimated that approximately 80 percent of shipments are predominantly imported

[3] Cyber café - also known as internet café. A place where one pays to browse the internet.

from China, Singapore and South Korea, while the remaining 20 percent is imported from the EU, Australia, Japan and North America. This is similar to previous studies that show that a significant percentage of trade occurs intra-regionally between developing countries (see Lepawsky and McNabb, 2010; Yu *et al.,* 2011). According to interviews, the reason behind China ranking first is that Bangladeshi importers are interested in Chinese grey electronics and e-scrap because China offers a wide range of products and prices. China's lack of trade related procedural burdens and speedy shipment also attracts Bangladeshi importers, according to interviews. For example, an import with all formalities completed from China usually takes three weeks by ship to reach Bangladesh, whereas the nearest country, India, with whom Bangladesh shares borders on three sides, takes at least five weeks.

Interviews reveal that since no legal barriers exist for trading grey electronics and e-scrap between non-Annex VII countries, there is a substantial amount of trade between the non-Annex VII countries and Bangladesh (74 percent of the respondents). Thus, the transboundary movements of grey electronics and e-scrap between Bangladesh and non-Annex VII countries surpass those from Annex VII countries. The same trend can be observed in the Asian region (see Lepawsky and McNabb, 2010; Yu *et al.,* 2011). Thus, it can be said that the trade that occurs is more intra-regional than inter-regional. This is similar to the recent study of Lepawsky and McNabb, (2010) which shows that globally "the trade in e-waste is highly regionalized, with intra-regional trade accounting for most of the total trade flows" (p.177). According to the traders, one big advantage is that the intra-

regional trade enables Bangladeshi traders to check whether the to-be-imported grey electronics and e-scrap are functional or not before shipment as a business trip to these countries is possible for a trader to make at limited cost and difficulty. For instance, applying for a visa to visit Singapore or China for a business trip is comparatively easier than for the USA or Canada.

Singapore, Hong Kong and Dubai are transshipment points of the trade between the source countries and Bangladesh. These three Asian nations provide warehousing and/or store-front facilities. For example, grey electronics and e-scrap travelling from China to Bangladesh are warehoused in Singapore for later shipments. My interviews revealed that sometimes Bangladeshi traders travel to buy CRTs from Malaysia and PCs from China, assemble and package them in Singapore and then send them to Bangladesh. The reason why they assemble and package the grey electronics and e-scrap before bringing them into Bangladesh is that it is easier to deal with the customs when the imports are disguised as new computers rather than grey electronics and e-scrap.

In addition to importation, grey electronics and e-scrap are also generated from internal sources. To Bangladeshi consumers electronic and durable goods carry value even when they are old. They expect a monetary return when disposing of them to collectors or recyclers and are reluctant to dispose of them elsewhere. As a result, interviews with traders revealed that government offices, banks, educational institutions, NGOs, and embassies situated in Bangladesh sell their used computers and accessories to vendors, stores and shops dealing with

computer business. Households also sell old, unwanted electronic products to itinerant street hawkers who go from door-to-door and store-to-store on a regular basis. The *bhangari* stores get a very good bargain for these discarded electronics. The hawkers get less money as there are only a few owners of *bhangaries* that have control in this business giving them power over prices paid.

Some versions of the pollution haven hypothesis stipulate that dirty industries will shift from North to South where environmental regulations are thought to be less stringent. Though my findings support this hypothesis to some extent, the trade of grey electronics and e-scrap in Bangladesh mostly occurs with countries in the South. To complicate the arguments made by the ENGOs that advocates the pollution haven hypothesis, it should be noted that certain countries are both importers and exporters of the grey electronics and e-scrap to and from Bangladesh. For example, after recovering materials from the grey electronics and e-scrap that Bangladesh has once imported from China and Singapore, the discarded PCBs are sometimes exported back to those countries since Bangladesh does not have the required technology to further extract materials (such as precious metals) from the PCBs. In other cases, as I witnessed, some PCBs are disposed of by simply burning. The fact that certain grey electronics and e-scrap are sent back to richer countries casts doubts on the applicability of the pollution haven hypothesis in the context of Bangladesh for at least two reasons. First Singapore, China and many other countries are not dumping grey electronics and e-scrap in Bangladesh, rather a trade is occurring between the countries. Secondly, a comparatively poorer nation Bangladesh (GDP 1,465 USD) is exporting grey

electronics and e-scrap (e.g., PCBs) to richer nations- China (GDP 6,567 USD) and Singapore (GDP 50,523 USD). [4] Thus, the claim that ENGOs make about rich countries dumping 'e-waste' in poor ones is not completely true for Bangladesh.

Table 3.2: Source Countries of Grey Electronic and E-scrap

Countries	Percentage of Respondents Importing Grey Electronics and E-Scrap
Non-Annex VII countries (non OECD)	
China	83
Singapore	49
Taiwan	32
Malaysia	29
Hong Kong	24
India	6
UAE (Dubai)	3
Pakistan	3
Annex VII countries (OECD)	
South Korea	48
United States	13
European Union	8
United Kingdom	5
Canada	6

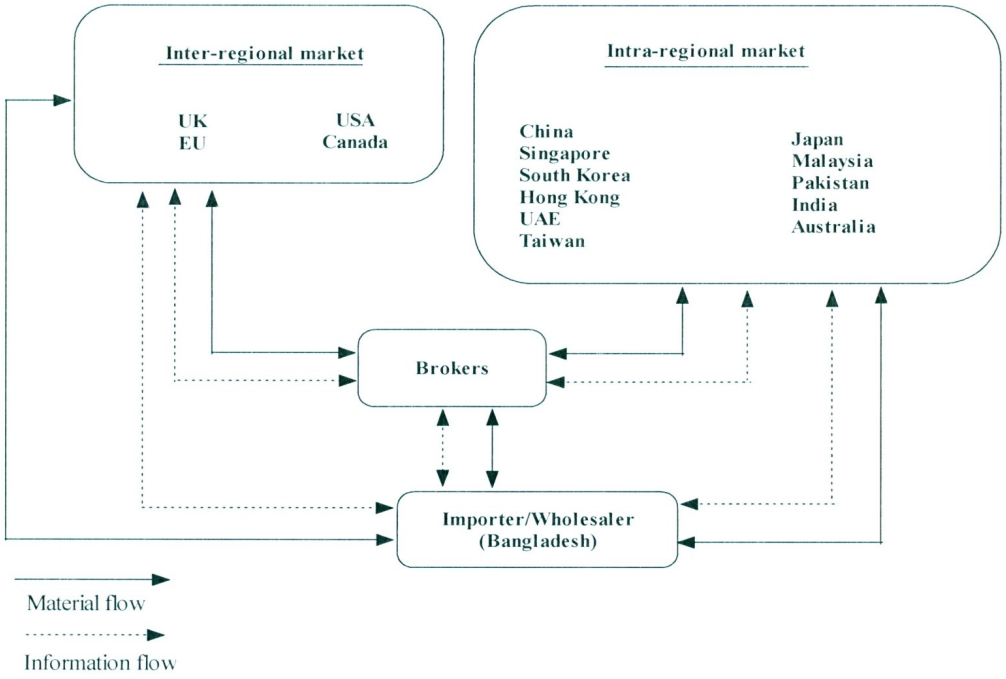
Source: Questionnaire Survey, 2008

Bangladesh imports different types of grey electronics and e-scrap from countries including both Annex VII and non-Annex VII countries (see figure 3.2). Some countries specialize in exporting certain types of grey electronics and e-scrap. For

[4] Source: IMF 2010

instance, according to traders interviewed, desktop PCs are usually imported from China, Apple branded used computers are imported from Singapore and laptops are imported from Japan and South Korea to Bangladesh.

Figure 3.2: Source Countries of Grey Electronic and E-scrap



Source: Questionnaire Survey, 2008

As mentioned previously in section 1.2 of chapter one (page 8), quantifying the exact amount of grey electronics and e-scrap entering Bangladesh is not possible as a significant volume of trade occurs illicitly. Moreover, inadequate record-keeping by the Customs of Bangladesh as well as the existence of no separate HS code for new computers, old computers, partial (e.g., monitor) and whole computers (e.g., laptop) makes the estimation of the current trade statistics difficult to determine. Another problem that emerged during interviews with the

custom officers is that different methods of quantification are used for different items. For instance, some materials are compiled by weight (e.g., ICs), some as units (e.g., CRT) and some via value (e.g., laptop price CND 100). As the trade in grey electronics and e-scrap is mainly informal, the possibilities for quantitative data collection are obviously limited. Therefore, one has to rely more on direct observation with limited historical depth. From the empirical evidence gathered during interviews with traders (e.g., importers, wholesalers and resellers), it is revealed that at least 8-10 shipments of 40-foot-long containers (each with approximately 2400 cubic feet of cargo space) consisting of grey electronics and e-scrap is imported in Bangladesh every month, while some also enters Bangladesh by air as passenger luggage (discussed in detail in 3.2.5 below).

3.2.3 Factors Behind the Dominance of Intra-Regional Trade

A number of factors have led to the dominance of intra-regional trade of grey electronics and e-scrap in the context of Bangladesh. First, according to the Basel Convention, the import of grey electronics and e-scrap from an Annex VII country to a non-Annex VII country (e.g., Bangladesh) requires 'prior informed consent' (PIC). 'Prior informed consent' means that the exporting country is required to notify and receive consent from the importing country and all transit countries prior to the transportation of the grey electronics and e-scrap (Basel Convention). According to interviews, to avoid such formalities that results in forgone time and money, ceteris paribus, traders prefer importing grey electronics and e-scrap from non-Annex VII countries. As a result, Bangladeshi traders predominantly import

grey electronics and e-scrap from other Asian countries as most of these nations are non-Annex VII countries.

Second, Bangladeshi importers are not comfortable in directly importing grey electronics from developed countries like USA and Canada. This is because countries such as USA are more prone to be under the scrutiny of ENGOs (e.g., Greenpeace International, Basel Action Network and Toxic Links India) and environmental journalists. Also, sometimes the suppliers ship unwanted non-functional grey electronics as the importer is not present to verify the cargo before shipment due to costs associated with the location of these countries. To avoid such occurrences, Bangladeshi traders prefer to import grey electronics and e-scrap from Asian countries so if necessary they can travel easily to verify their shipment.

Third, interviews with importers also revealed that Bangladeshi political parties have an important role in choosing countries from which Bangladesh will establish trade relations. This occurs as the major political parties in the country favor particular jurisdictions during their ruling period. For instance, the trade agreement between China and Bangladesh was renewed recently, which is influenced by the present ruling government in Bangladesh.

Fourth, ethnic ties play an important role in choosing countries from which importers import grey electronics and e-scrap to Bangladesh. According to the interviews with traders, there are many businesses related to grey electronics and

e-scrap in China, Singapore and Malaysia where the nationality of the owner or an employee is Bangladeshi. Importers in Bangladesh feel comfortable dealing with such businesses as they know the same language, come from the same ethnicity, and may have previous personal connection which helps them in building a trusted business relationship.

3.2.4 Network Formation

Bangladeshi traders identified trust and good communication as the main ingredients of building a network with traders and exporters abroad. With the intent of importing grey electronics and e-scrap to Bangladesh, some traders browse through the internet (e.g., www.alibaba.com) to locate interested dealers of grey electronics and e-scrap in other countries (cf. USGAO, 2008). Some Bangladeshi traders use personal connections like friends, relatives and acquaintances to find and contact sellers. Others travel internationally to find grey electronic and e-scrap dealers in far away markets and establish a business relationship with them. The advantage in travelling is that the importer can pick out items he would like to import rather than relying on the supplier to send the best of the lot. One problem all interviewed importers face is that sometimes suppliers add a few extra computers for free with the consignment (as a form of gift exchange), which is usually not mentioned in the invoice. This creates unnecessary harassment: if the quantity mentioned in the invoice does not match the quantity being shipped, the Customs officers in Bangladesh cancel the shipment or require bribery to release the shipment levying an extra cost for the

importer. The importers interviewed all suggested that they travel to the country of origin at least twice a month to avoid these unwanted situations. Once a dealer is located and contacted, the Bangladeshi trader usually begins with a small order to test whether the dealer can be trusted with future shipments. If importer and dealer feels comfortable with each other, a trade relationship is established which leads to future shipments.

Sometimes brokers (middlemen) negotiate the sale, on behalf of the buyers (importers). The job of a broker is to pass materials and information between buyers and sellers both within and between countries. He locates the dealer or another broker in another country, communicates the importer's request, makes and bargains the offer, gets a deal done and sometimes receives the consignment on behalf of his client (the importer) in exchange for a commission or pre-determined fee. Usually brokers have good connections with dealers and other brokers. They usually possess good conversational skills often in foreign languages and are usually expert in marketing techniques. Some brokers travel frequently by air to make and maintain their connections with others in the business. Rather than maintain an office, they work almost exclusively from one or several mobile phones and a laptop. Usually brokers can be located through small computer stores in Dhaka, or even outside the country.

According to two secondhand shop owners, Bangladeshi shop owners who employ brokers for their trade feel more comfortable if the broker is of Bangladeshi nationality (living in the country or abroad) as the relation between

the shop owner and the broker is based on trust. An interviewee related one incident, for example, where a broker from Korea was looking for clients who wanted to purchase laptops through him but none of the shop owners were showing any sign of interest as he was from a different ethnicity. Middlemen/brokers play an important role in the trade of grey electronics and e-scrap because importers usually prefer to stay invisible.

3.2.5 Trading Systems of Grey Electronics and E-scrap

Traders described two methods through which grey electronics and e-scrap are imported to Bangladesh. One is the 'the container system' and the other method is 'the luggage system'. Two types of products are imported by the wholesalers and other importers as: (i) Whole grey electronics and e-scrap, e.g., laptop, desktop and monitor and (ii) grey electronic and e-scrap components and parts e.g., RAM, processor and motherboard. Usually, the former are imported in large shipments/scales by the container system whereas the latter are imported through the luggage system. In the container system, shipments of grey electronics and e-scrap are delivered to Bangladesh in standard shipping containers through the seaports. In the luggage system, shipments are delivered by air passengers in their personal luggage in small amounts and very promptly.

Transport costs per unit of grey electronics and e-scrap in the container system is comparatively lower than the luggage system. For example, a typical 40 foot container shipped from Singapore to Chittagong will cost between BDT 35,000 to

55,000 (equivalent CND 583-916). Usually, the container method is used to deliver less valued grey electronics and e-scrap where the length of delivery time will not adversely affect the traders' profit margin. Materials like old CRT monitors, desktop CPUs, printers, and used motherboards which, because of their age, are of low reuse and resale value as working electronic components are imported through the container system. Despite their low resale value, they may fetch higher prices once they are disassembled into their basic materials (e.g., plastics, metals, and glass; see Chapter 4). The length of time of delivery and visibility of the shipment may become a challenge. Sometimes, high-valued grey electronics such as laptops and desktops, for example, that may still have warranty coverage from their original purchase (e.g., in Singapore) where the delivery time via container system is around three to five weeks. This warranty coverage time is significantly reduced while the shipment is in transport. Also the price of high-value e-scrap can drop significantly during this time that it takes to arrive. For example, a trader might purchase a used Apple G3 model in Singapore for BDT 50,000-70,000 (CND 833-1,166), but its resale value might drop 20 percent in less than two months as newer used models enter the market. Therefore, the more expensive but quicker luggage system is preferred in these cases to the container system.

Another problem that may occur when traders attempt to ship through legal means, (e.g., often through the container system) is that they must complete a pre-shipment inspection by the Bangladeshi authorities. For some types of grey electronics, such pre-shipment inspection is in principle not a problem but used

electronics older than those with Pentium III chipsets are prohibited from import into Bangladesh (discussed further below in section 3.2.6). This kind of situation adds costs for a trader who must resort to bribery of customs officials to get such shipments cleared. These costs can range from BDT 3,000 to 5,000 (CND 45-75) per shipment to the Bangladeshi port authorities.

Interviews also revealed that when shipping grey electronics and e-scrap via the container system, it may draw the attention of ENGOs (e.g., Greenpeace, BAN, Toxic Link India), local and international media (e.g., PBS, 2009; NTV, 2008; CBC, 2008; BBC, 2008; CNN, 2009) who ignore the potential for economic and social development, but rather focus on the negative impacts of the industry. During interviews, traders complained that the media and ENGOs do not consider the livelihood of those people who are engaged with the business of grey electronics and e-scrap. Thus, to avoid such situations, many of the traders interviewed prefer to use the alternate import method of the luggage system.

In the luggage system grey electronics and e-scrap are imported to Bangladesh by air passengers who carry the grey electronics and e-scrap in their personal luggage space. Usually used branded items such as, laptops, palm tops, personal digital assistants (PDA), cell phones, ipods and iphones are imported under this system according to the respondents. Non-working electronics of this sort are considered to be of high value because they can be repaired, refurbished, or components assembled once they are in Bangladesh. The product may still be under warranty period making complete products and their components imported in this system of

comparatively high value. Thus, the delivery by air ensures that minimum warranty time is lost due to shipping time. Again, these small shipments are also less visible by authorities, ENGOs, and the local media compared to the container system. Legalities of air travel are discussed further below.

3.2.6 Illicit Trade of Grey Electronics and E-scrap in Bangladesh

A significant amount of grey electronic and e-scrap enters Bangladesh illegally. The reason behind such illegal entry of grey electronics is three-fold. First, according to the interviews with the secondhand computer store owners, computers older than Pentium III models are in high demand. This is because they are within the purchasing power of target customers who purchase computers for the purpose of typing and composing, watching movies and playing games. But in the 'Bangladesh Import Policy Order (2006-2009)', it is clearly stated that, "Computers older than Pentium III model will not be imported - Section 26.11.1" and "Old UPS [Uninterrupted power supply] and old computer parts will not be importable - Section 26.11.7" (GOB, 2008, page 45). Yet, they find a route through the 'gaps' and 'cracks' of the legal system and enter Bangladesh.

Secondly, as the Customs of Bangladesh does not have a separate Harmonized System (HS) Code for used and refurbished computers, grey electronics and e-scrap enters Bangladesh under the HS code of new computers. This is also one of the reasons why there is no record of the amount of grey electronics and e-scrap that is entering Bangladesh. According to customs officers, in reality it is almost

impossible for the authorities to identify such fraudulent trade as they do not have enough manpower to check each and every container at port of entry.

And lastly, the National Board of Revenue, Government of Bangladesh requires Pre-shipment Inspection (PSI) by a third party before certain imports enter the country which includes all kinds of waste and reconditioned computers. This is to ensure that prohibited items are not being imported as well as inspecting the quality, quantity, and consistency of goods. This creates an obstacle in the trade of certain types of grey electronics and e-scrap. To avoid being identified by the PSI, illegal means are adopted to import these grey electronics.

The ship breaking industry is one illegal route through which grey electronics and e-scrap enter Bangladesh. According to the respondents, almost every year Bangladesh imports 300 (on the average) end-of-life ships. These ships are disassembled to get electronic equipments (including 50 computers on an average in a ship), metals and other materials such as furniture (Gregson *et al.,* 2010a). The ship breaking business provides about 15,000 computers every year to the domestic Bangladeshi market (Billah, 1999). The amount of grey electronics and e-scrap in a ship depends on what kind of ship is being disassembled. For instance, from an oil tanker ship 20 to 30 used computers can be recovered where as from a research or recreation purpose passenger ship more than a hundred used computers can be found. It is worth mentioning that usually the computers found inside these ships do not meet the importation criteria of grey electronics and e-scrap (i.e., they are mostly Pentium II and older models).

Another way grey electronics and e-scrap are illegally being transported to Bangladesh is through the luggage system. Every air passenger is allowed to bring one laptop or desktop in their luggage. As there is no risk of detection using this delivery method there are lots of people who are frequent flyers in China and Singapore called '*luggage bahini*'.[5] These people carry the product as their own luggage for a commission, which usually depends on the quantity and /or the value of the luggage. For example, a trader might purchase one used laptop in Singapore for SGD[6] 1,000 (CND 745), pay the *luggage bahini* BDT 8,000 to BDT 10,000 (CND 130- 160) to carry the laptop as his own carry-on luggage and sell it for BDT 55,200 to BDT 85,200 (CND 920-1420) in Bangladesh. If the amount of grey electronics is from ten to a hundred pieces, the trader usually travels to purchase the grey electronics. He carries them back to Bangladesh as his own luggage.[7] Each person is allowed two suitcases not exceeding a total of 65 kg (143.3 lb) or ships them as air cargo. Unlike televisions, desktops, laptops and other computer accessories (e.g., printers, scanners) are not taxable when one enters the country. To pass the luggage through Bangladeshi customs smoothly, bribes are often paid to the customs officials. According to Bangladeshi legislation anybody can bring a computer/laptop for their own usages free of cost. But traders use this opportunity and offer passengers a commission to bring in computers for

---

[5] Frequent flyers who carry the buyer's consignment as their own luggage from the seller in exchange of a commission. Usually the consignments are electronic goods. They receive the consignments from the seller at the airport of the foreign country and deliver it to the buyer at the Bangladeshi airport.

[6] Singapore Dollars

[7] Out of the 15 wholesalers and importers interviewed, none were women. Women are not seen to work as an importer or wholesaler.

them as their private luggage. Bribes are only offered when custom officers find more than two computers in the passenger's luggage (because more than two exceeds the allowable personal limit). This bribe amount can range from BDT 5,000 to BDT 10,000 (equivalent to CND 83-166).

One other illegal route through which grey electronics and e-scrap enters Bangladesh is by including grey electronics and e-scrap along with new ones at no cost. While interviewing one of the traders, it was revealed that sometimes when traders buy new computers from Chinese dealers, they get old computers for free. For instance, once he ordered 50 new computers from his usual Chinese supplier. The Chinese supplier sent him five old PCs for free along with 50 new PCs. There were many other incidents where he had to return some of the faulty motherboards (as the warranty period was not over) to the supplier in China. The Chinese supplier replaced the faulty motherboards with new ones and sent it back along with the faulty ones. These faulty ones find their way to the *bhangaries* in Bangladesh. By giving these grey electronics and e-scrap for free the suppliers intend to build a trusting relationship with the Bangladeshi businessmen. Also, sometime importers trick the authorities and buy old computer parts and components that are not legally importable and ship them in new product packages. Some traders even admitted disguising grey electronic products with new covers and packages of new branded ones which can be seen openly sold in the market in Dhaka, but at much lower prices than the original genuine brand.

Bangladesh also receives grey electronics and e-scrap in the form of donations from USA, UK, EU, Canada and Japan (e.g., through the World Bank or UNEP). While this conduit is not illicit, it does open a route for the importation of grey electronics and e-scrap. Usually the reason behind receiving donations is to bridge the digital divide between 'the haves and the have nots.' For example, hundreds of Bay Area (San Francisco, California, USA) residents donated 400 computers worth over USD[8] 120,000 value to connect 90 schools in Bangladesh with 50,000 students. These were disposed computers that were saved from being dismantled at a recycling centre (WCE, 2000). Another example is the World Bank Dhaka Office, which has handed over 100 refurbished personal computers and laptops to three non-profit organizations. According to the World Bank, this small step can be the beginning for underprivileged children to get a better opportunity in enhancing their computer skills (www.worldbank.org.bd). These two examples highlight Gregson *et al's*, (2007b) point that ridding and the performance of identity (e.g., being 'good' citizens) are tied together in complex ways with the rubbishing of things. However, according to interviews, the problem these recipient institutions face is that the donated computers usually become non-functional very soon (cf. Toxic Link India, 2003). As a result, they enter the recovery industry of Bangladesh shortly after their arrival.

During interviews with traders it was disclosed that sometimes donations do not reach the right people (e.g., computer for a school), rather the individual who is in charge of receiving the donation sells it to wholesalers and retailers, depriving

[8] USD = United States Dollars

those who the donations were meant for. During my field study in both 2008 and 2009, when asked about this allegation, almost all non-government organizations (NGOs) who were approached remained indifferent or silent to the queries. This is because NGOs are allowed to bring all kinds of grey electronics and e-scrap into the country for education purposes under the banner of 'bridging the digital divide', which is supposed to teach unprivileged and rural children computer skills. All (e.g., donations) old computers imported for vocational training or charitable institutions come under the 'capital goods' category which are under the free list and access various tax benefits. Unfortunately, as mentioned before some of the NGOs sell it to the grey electronic market directly rather than handing out the received computers to rural schools.

3.3 CONCLUSION

Trade and traffic of grey electronics and e-scrap in Bangladesh has been discussed in detail in this chapter. From surveys and interviews it was revealed that grey electronics and e-scrap are imported to Bangladesh mainly through intra-regional trade with the countries of China, Singapore, Korea and Taiwan. Bangladesh receives the highest amount of grey electronics and e-scrap from China. The reason behind this is that Bangladesh has an existing trade relationship with the country. Moreover, China offers a range of products and prices and the shipments arrive faster than shipments from any other country. Developed countries like USA and Canada export a very minimal amount of grey electronics to Bangladesh. A key reason behind this is that the Basel Convention does not permit

Annex VII countries (e.g., USA and Canada) to export their waste to non-Annex VII countries (e.g., Bangladesh). Another reason is to avoid container shipments from Annex VII countries, which easily catches the attention of ENGOs and media. Thus, based on my fieldwork there seems to be some evidence that the notion of developed countries dumping their e-waste to developing ones may not be entirely accurate in the context of Bangladesh. I found that grey electronics and e-scrap is often treated as a tradable commodity, and often imported from within the region.

From empirical evidence it was also revealed that grey electronics and e-scrap enters Bangladesh through different routes. Besides legal importation, a significant amount of grey electronics and e-scrap seems to enter Bangladesh by illegal means including personal luggage, the ship breaking industry, and disguised as new computers (e.g., by re-packaging in boxes that appear new). As grey electronics and e-scrap does not have a separate global Harmonized System (HS) Code, which is used to monitor imports and exports, whenever a shipment occurs, it arrives under the HS code for new computers and electronics. Hence, data regarding the exact amount of grey electronics and e-scrap imports and export is always difficult to obtain. The two trading systems – that is the luggage system and the container system have also been discussed in this chapter. The importers often prefer the luggage system as it draws less attention from ENGOs and local and international media and goods are shipped more rapidly. Grey electronics and e-scrap are legally and illegally imported to the country to meet the market demands which means that it carries some form of value or else such

trade between countries would have not occurred. The following chapter will discuss how Bangladesh captures and creates this value from grey electronics and e-scrap.

CHAPTER FOUR

Capturing and Creating Value from Grey Electronics and E-Scrap in Bangladesh

4.1 INTRODUCTION

This chapter uses the 'follow-the-thing' methodology to study how economic activities capture and create value from grey electronics and e-scrap after it enters Bangladesh. The findings of this chapter are based on fieldwork carried out in Dhaka, Bangladesh (2008 and 2009), where I followed grey electronics and e-scrap as far as they were recognizable as such and stopped once these items entered a new round of production, where there was no trace of its origin in electronics (see Lepawsky and Mather, 2011).

The present chapter will explain how recovered parts and components from the grey electronics and e-scrap industry make their way back into the electronics industry through refurbishing, remanufacturing and repairing. It will also shed light on how the constituent metals and materials salvaged from the grey electronics and e-scrap are used as feedstock for new rounds of production processes in multiple industries located in, and beyond, Bangladesh. While discussing the processes of value capture and creation as part of a commodity chain, interesting findings emerged that answer the questions: *How do grey electronics and e-scrap that are disposed of as 'waste' in one country (e.g., Canada) come to have 'value' elsewhere (e.g., Bangladesh) and by whom and*

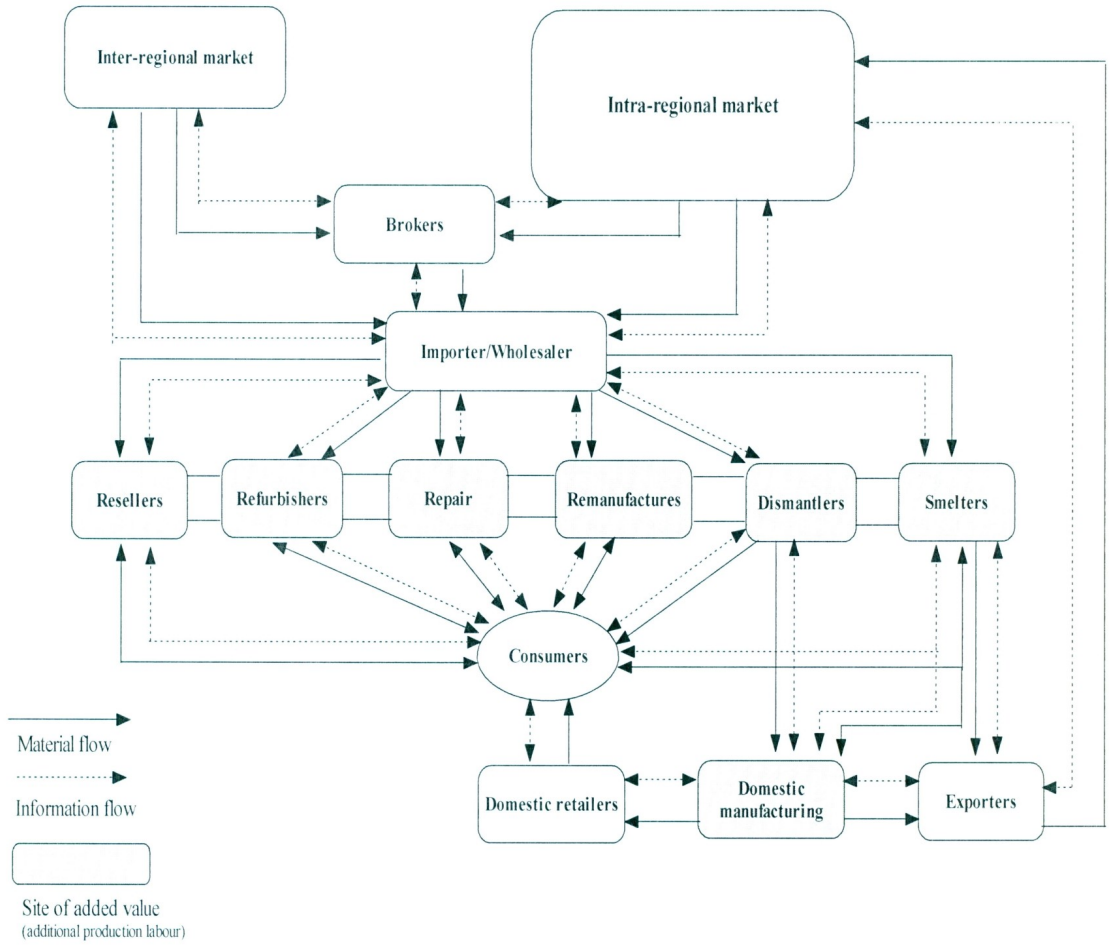
under what condition is it being processed and why? In answering the above questions, I combine conduit theory (Gregson *et al.*, 2007b) with the Marxian labor theory of value, in the context of value creation and capture. Section 4.2 takes a closer look at the different conduits through which value of the grey electronics and e-scrap is created and captured once it enters Bangladesh. In particular, it is found that the grey electronics and e-scrap finds its way to resellers, repairers, refurbishers, remanufacturers, dismantlers and smelters. Section 4.3 analyzes value capture and creation of grey electronics and e-scrap discussed in the previous section (in this chapter) under the Marxian labor theory of value and division of labour which is identified as an appropriate model for our purposes (see chapter 2). Section 4.4 concludes the chapter with a summary of the main findings.

4.2 THE CONDUITS APPROACH TO MOVEMENT OF GREY ELECTRONICS AND E-SCRAP IN DHAKA

As mentioned in Chapter 3, although grey electronics and e-scrap are imported to Bangladesh from several countries, these items are mainly imported from elsewhere in Asia. Once they enter Bangladesh, grey electronics and e-scrap move through a variety of conduits before reaching the consumer. In the process, value is recovered and added to grey electronics and e-scrap in the form of reselling, repairing, refurbishing, remanufacturing, dismantling, and smelting. Reselling, repairing and refurbishing typically indicate a modest level of reprocessing and keep the primary usage of the grey electronics and e-scrap intact. Remanufacture

employs substantial reprocessing as the gadget is turned to new or different uses from what it was originally intended for (e.g., CRT monitors converted to televisions). Whereas, dismantling and smelting occurs only when the primary usage of the grey electronics and e-scrap neither can be restored nor altered and so it is disassembled to its constituent objects and materials. A typical example observed during my fieldwork is that a wholesaler has imported 500 used computer monitors in one shipment. From the lot a reseller picks 200 monitors in good condition and purchases these from the wholesaler. On close scrutiny at his own store, he finds 180 monitors functional and in the condition to be directly sold, but 20 are not. On further examination, the reseller finds that 10 require repairing, 5 need refurbishing and the remaining 5 will not function. The reseller then sells them to retailers (the 180 functional monitors), repairers (the 10 monitors that need repairing), refurbishers (the 5 monitors that need refurbishing) and dismantlers (the 5 non-functional monitors). Repairers and refurbishers then sell repaired and refurbished computers to retailers and dismantlers sell to both the electronics sector and other industries. In these ways, grey electronics and e-scrap moves within the country (see Figure 4.1).

Figure 4.1: Commodity Chain of Grey Electronics and E-scrap

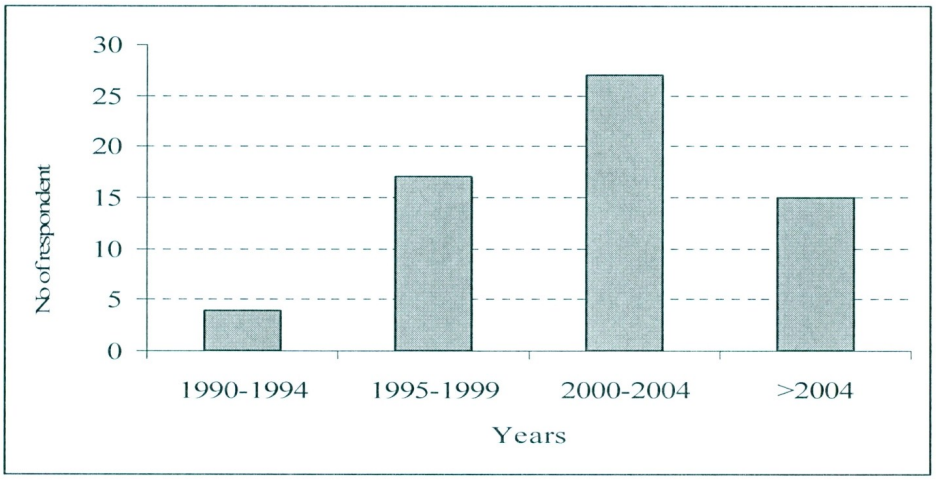


Source: Redrawn from Lepawsky and Billah, 2011

In Dhaka, six types of businesses related to grey electronics and e-scrap are identified and discussed in details in this chapter (see Figure 4.1). But, in reality any specific business may engage in more than one type of business activity, for example, a refurbisher may also provide repairing and reselling services. These lucrative businesses have flourished in Dhaka primarily since 2000. Of the questionnaire respondents, 76 percent of the stores were established between the years of 2000 and 2004 (Questionnaire Survey, 2008, Figure 4.2). Interviews with importers revealed that after China banned its imports of 'e-waste' from

developed countries in 2000 (cf. UNEP, 2009, page 79), the trade in Bangladesh significantly increased.

Figure 4.2: Year Businesses were Established



Source: Questionnaire Survey, 2008

Value addition at different stages of the grey electronics and e-scrap commodity chain varies and so does the associated profit. This is because, the amount (labor hours) and quality (physical, technical and intellectual) of labor employed in producing the surplus value varies for different conduits. A close examination reveals that the more grey electronics moves along the conduits, the more it is being segregated and disassembled into its basic components. The more the grey electronics are stripped to their constituent parts, the higher is the profit margin. Thus, according to respondents the profit margin at the entry-level traders (e.g., importers, wholesalers) in the grey electronics and e-scrap industry is less than 100 percent whereas repairers, resellers, refurbishers gain a profit of around a 100 to 150 percent. Dismantlers and smelters enjoy the highest profit, which can be

more than 200 percent. The following example (Table 4.1) helps illustrate the capture and creation of value.

A dismantler was approached to demonstrate the process involved in disassembling and recovering metals and materials during my fieldwork. The dismantler agreed and brought a non-functional old black and white 14 inch Compaq monitor from which he dismantled and recovered the metals and materials. He used a hammer, screwdriver, pliers, knife, blade and his bare hands. Table 4.1 shows the recovered spares and materials and their quantity and price that were recovered from the monitor.

Table 4.1: Profit Margin Gained from Recovering an Obsolete Monitor by a Dismantler

Material recovered	**Quantity**	**Per unit price**	**Total Price**
Plastic	1.55 kg	BDT 6.50	10.00
Picture Tube/ Glass	3.95 kg	BDT 1.50	6.00
Circuits	850 gm	As pieces	100.00
Copper (coil up/ decogin)	1.50 kg	BDT 400	580.00
Transformer, capacitor, ICs, chip, power supply	Reusable	As pieces	40.00
Scraps	500 gm	BDT 30	15.00
Total BDT			**751.00**
Monitor purchased at BDT 175 (CND[1] 3) Labor cost for dismantling BDT 50.00 (CND less than 1) Profit BDT = (751-225) = 526 (CND 10) **Profit Margin** = (526/225) = **233 % (approx)**			

Source: Interviews, 2009

[1] *The exchange rate in 2009 was 58 Bangladeshi taka (BDT) per Canadian dollar(CND)*

The profit from selling the materials recovered from one obsolete monitor including labor cost is 233 percent - a high percentage compared to that of selling a new computer. For instance, Apple typically captures a 36 percent profit on the sale of its new goods (Dedrick *et al.,* 2010). Hence, some businessmen in Bangladesh who used to sell new computers have switched to the dismantling businesses. Thus, traders and consumers do not think 'e-waste' as waste. Rather they realize it as a commodity when it moves through the conduits in Bangladesh. The following sub section describes these conduits in details.

4.2.1 Reselling

In Bangladesh, stores that sell grey electronics and e-scrap as they are received are identified as resellers. From interviews with resellers and the president of the 'Old Computer Business Association', it was estimated that there are approximately 2000 reseller stores in Dhaka city. Though specific data on the sales volume of resellers are not available, interviews reveal that the sale of grey electronics and e-scrap is approximately two-third of the sales volume of new computers, which indicates a greater demand of grey electronics computer in Dhaka.

Grey electronics and e-scrap reselling is very good business in Dhaka, Bangladesh. This is because there is a good market demand for grey electronics and e-scrap which, as mentioned earlier, is comparatively cheaper than new computers in Dhaka. Consumers in Bangladesh have preferences for manufacturing countries when they choose their electronic products. For instance, consumers prefer Japanese made electronic products over Chinese ones as they

believe that China uses cheap materials in production processes whereas Japan being a well-off nation, uses and keeps their electronics well maintained and upgraded to new models. Consumers through experience have also learnt that Chinese made electronics show signs of technical problems within six months of their uses. As a result they consider a used Japanese laptop to be a good purchase over a new one made in China.

Consumers also claim that there is a big difference between today's products and earlier ones. Interviews with resellers reveal a similar preference to that of consumers (as discussed in Chapter 3). According to the traders, China manufactures three categories of computers - economy quality, domestic quality and export quality. Economy quality are made from new, salvaged and counterfeit components and then disguised as new computers. These types of computers are then exported to poor Asian nations like Bangladesh where they are affordable to majority of the people as the price is comparatively lower than a branded computer (e.g., IBM, Apple). The second type, i.e., the domestic quality is made for domestic usage in China and the third type, i.e., the export quality (e.g., IBM and Apple) is made for North American, European and Japanese. The second and third types are more desirable by Bangladeshi consumers and resellers even when they are old, because they last longer than the Chinese-made economy quality ones. To make these products more lucrative to customers, the reselling stores for free of charge install operating systems like Linux and Windows and other software. Thus, many consumers feel that it is worth investing in a grey computer rather than buying a new one.

Resellers' profitability depends largely on the residual surplus value added to original manufacturing of what is now, in the resellers' hands, grey electronics and e-scrap. There is hardly any physical alteration of the grey electronics besides installing software and operating systems. Besides, resellers only sell the functional grey electronics to the customers and sell or dispose of the non-functional ones to the repairers and refurbishers. As a result, minimal labour is required in this conduit. This leads to higher profitability than the wholesalers and importers but lower than the repairers/refurbishers, dismantlers and smelters (discussed in the following sections).

4.2.2 Repairing

"Repair and maintenance are not incidental activities. In many ways, they are the engine room of modern economies and societies" (Graham and Thrift, 2007: p.19). Repairing is the process that adds value to non-functioning or defective grey electronics by "correcting specified faults in a product" (Parker, 2007: p.16). Interviews revealed that in Dhaka where a new computer is very expensive and repairing is less costly; consumers repair their electronic gadgets partly because they do not want to move away from their memories (e.g., emotional, sentimental) and also because as long as they can use it by repairing they can avoid bearing the higher cost of purchasing a replacement machine.

The cost of repairing electronics is comparatively low in Bangladesh compared to other parts of the world since labor, which is the largest component of the repairing industry, is very cheap in Bangladesh. In contrast, in a study in UK, 26

percent of the respondents said that they usually had their appliances repaired and the rest (i.e., 74 percent) rarely, seldom, or never had appliances repaired because of the high associated cost (Cooper, 2005). This is why many of the grey electronics that enter Bangladesh are first bought by repairing stores from the wholesalers and importers at a very cheap price, fixed to ensure they are in a working condition and then sold. The repair system and cheap labour of countries like Bangladesh also encourages middle and low class consumers to repair castoff electronics, which extends product life while also capturing and creating value. Thus, as the repair practice is dying out in developed countries (see McCollough, 2009), electronics are being disposed as waste. In Bangladesh the situation is rather different. Here value is renewed through the conduits of the repairing industry.

Recently, some companies operating in Bangladesh, like Samsung, Siemens, Philips, Videocon, Cannon, Toshiba and A4tech have introduced 'take back' policies which means that the customer will receive a new product (e.g., computer) if they return the old one with an additional fee (cf. StEP, 2007). While interviewing some of the customers who have exercised this option, almost every one of the customers were unsatisfied with this service. They complain that the new electronics they receive in exchange are made of low quality material and will probably not last for long. During interviews with repairers similar sentiments were revealed. Most of them affirmed that the components that are being used in computers nowadays are not worth fixing, as they will not last for long like the previous ones. Also some of the latest electronics, like laptops, are not designed to

facilitate repairing of components. For instance, some current hard drives and RAMs in laptops are not designed for easy removal and disassembly. This is very different from other industries like the car industry where spare parts are available to facilitate repair and gain higher profit margins by its sale (Allwood *et al.*, 2006, p. 39). To encourage buying new computers and to reduce dependence on secondhand computers, the importation of certain parts and components that are required for repairing old computer have been banned by the Bangladeshi legislation (discussed in Chapter 3, section 3.2.5) often leading to illicit importation of such grey electronics and e-scrap.

Figure 4.3: Upgrading existing computer with help of repairer

© *Photograph by the author*

Repair and maintenance operations all add value through the labour power they employ to bring grey electronics up to working standard and to keep them

operating over time. According to interviews, usually, this conduit in the grey electronics and e-scrap industry of Bangladesh gains more than 100 percent profit margin. Most of the repairers offer at least two years of service warranty which means that the service to repair is free as per the rule of the importation of grey electronics and e-scrap (GOB, 2008), but if parts are needed, the consumer has to pay for it. As a result, the repairing business is in high demand among people that cannot afford to replace a faulty computer with a new one. A typical repair store (Figure 4.3) in Bangladesh not only repairs and sells grey electronics, but also provides local customers with computer servicing, thus extending their product's life. The importance of the repairing conduit is not only in extending the useful life of grey electronics but also in sustaining resource reuse of materials and reducing environmental impacts. Hence, repairing has the added advantage of slowing the rate at which objects and materials become waste and can therefore be considered as a form of waste prevention.

4.2.3 Refurbishing

Like repairing, refurbishing entails any action necessary to bring non-working grey electronics up to a satisfactory working standard by exchanging worn-out parts with functional ones, and also performing other maintenance activities. The basic feature of refurbishing for a computer is threefold. Firstly, the hardware (e.g., parts and components) and software functionality is verified through initial testing. Secondly, repairing is done and old parts are replaced with new (or used functioning) ones wherever needed. Lastly, if everything is working, the required software (e.g., applications and operating system) that controls the hardware and

provides desired user functionality is installed. There were several examples from interviews where refurbishers have used or scavenged working parts from three to five non-working computers to make one working computer. Though refurbishing a product sometimes requires disassembling the whole unit its composition and design is not changed significantly. Those grey electronics that cannot be refurbished are sold to the dismantlers.

The refurbishing business is comparatively more profitable than the repairers and resellers as refurbishers' investment costs (i.e., buying non-working computers from the wholesalers and importers) is very low but the price they sell their refurbished computer for is quite high. A typical example would be - three non-working computers were bought for BDT 1000 (CND 16) each, and the price of the computer that has been refurbished from those three, is BDT 8,000 (CND 133) resulting in about 160 percent profit, which is a higher profit margin than is typically experienced in the reselling and repairing sectors. A second source of income for the refurbishers comes from the sales of the remaining or surplus materials of grey electronics and e-scrap that is further processed by dismantlers and smelters.

Refurbishing of grey electronics and e-scrap often requires considerable expertise and specialized labor with technical knowledge of computers and other electronics. Usually permanent young male workers who have differential wages based on the level of technical knowledge they possess dominate this conduit. For example, during my field study, I came across a laptop refurbishing store where there were 15 permanent employees working and who were paid according to

their skills and experience. The senior technician, who also travels for materials internationally, was being paid BDT 18,000 (CND 261) per month. The senior technicians that were not traveling earned BDT 15,000 (CND 217) per month and the other technicians (i.e., junior technicians) were drawing a salary ranging from BDT 9,000 (CND 130) down to BDT 5,000 (CND 72) per month according to their skills, experience and seniority in the job. There were also other employees in the store who were not technicians; they were either helpers or cleaners whose salaries varied from BDT 3,000 (CND 43) to BDT 1,500 (CND 22) per month. Like the repairing industry, the refurbishing industry has also created a significant number of jobs for the people in Bangladesh. Thus, what has been of no use to the repairers and resellers is still not waste; rather it is a source of use, exchange, and surplus value when it has entered the refurbisher's premises.

4.2.4 Remanufacturing

Remanufacturers engage in a variety of creative activities that repurpose grey electronics into different electronic commodities. In this conduit the grey electronics are dissembled, parts are replaced and then reassembled into a sound working condition, but put to purposes other than they were originally designed for. Sometimes missing, defective, broken or substantially worn-out parts are either restored to sound working condition, or are replaced with functionally good used or new parts. Depending on the parts added, this process may significantly change the unit's composition and design. Moreover, the process also changes the primary purpose of the electronic gadget. For instance, the purpose of a monitor is to display images from a computer. But in the remanufacturing industry it is often

seen that non-functional monitors are brought to the premise that have lost their ability to display images. On inspection, if the picture tube inside is found to be in good condition, then it is not disassembled, rather the unbroken CRT is used to locally manufacture a television (TV). This is done by inserting a TV card/channel box in it (Figure 4.5). Another common example is repurposing CD ROMs of desktop computers into portable CD players for cars and buses instead of an expensive car stereo player. Installing a CD ROM costs BDT 50 (less than CND 1) whereas to install a new CD player in a vehicle (Figure 4.4), it would cost approximately BDT 5,000 (equivalent to CND 83).

Figure 4.4: Consumers buy CD ROMs to use in cars to play music

© *Photograph by the author*

Remanufacturing adds value to grey electronics and e-scrap through the labour power employed to bring it up to a working condition and to keep it operating over time, but also creativity, technical knowledge and expertise are required in the remanufacturing process. As mentioned earlier this sector, like the others in the grey electronics and e-scrap industry, is also male dominated (an issue discussed in more detail below). The cost of labor depends on the level of skills the worker possesses. According to interviews with the workers, most of the employees in this sector are somewhat skilled but less than 5 percent have formal training. As a result the labour cost is not as much as it would have been with institutionally qualified workers. As a result this sector typically gains profit margins of almost 200 percent. Besides, demand for remanufactured grey electronics is quite high as products such as TV is largely driven by their much cheaper purchase price for domestic consumers (Figure 4.5). For example, a new 15 inch TV set costs between BDT 15,000 to 25,000 (CND 217-362) in Bangladesh whereas a CRT monitor converted into a television using parts derived from grey electronics and e-scrap sells for approximately BDT 3,000 to 5,000 (CND 45-72). This enables a wider range of Bangladeshis belonging to different income levels to be able to possess these little luxuries of life.

Figure 4.5: Monitor converted to Television

© Photograph by the author

In the context of Bangladesh, the remanufacturing option is gaining popularity, since it offers a means for upgrading certain electronic products (e.g., computers, photocopying machines) without discarding the whole unit. For instance, in addition to making televisions, old CRT monitors are also used in producing video games for children's recreation (Figure 4.6). Moreover, remanufacturing reduces the environmental pollution brought about by e-wastes.

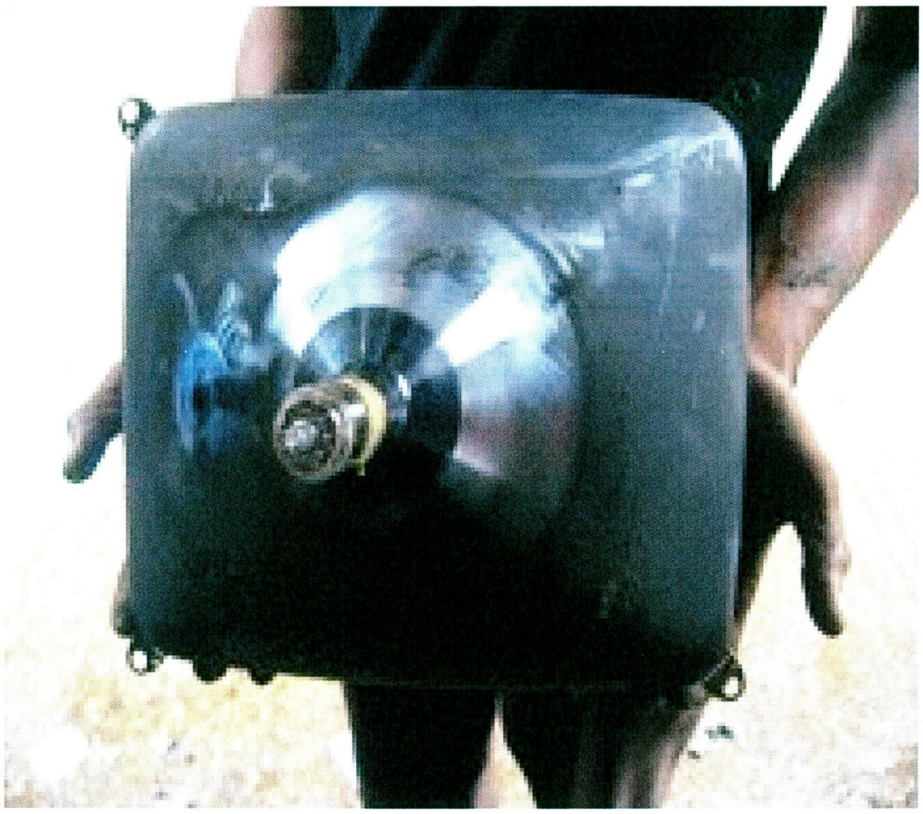
Figure 4.6: Video games for kids using old computer monitors

© Photograph by the author

In cases where monitors cannot be repaired or refurbished, they are disassembled manually with the help of screwdrivers and pliers to recover functioning circuit boards, or CRT which will be assembled in another product or sold separately (Figure 4.7). Thus, remanufacturing systems that use recovered-materials reduce the environmental impact of the industry by reusing materials and reducing energy use compared to industries that produce newly manufactured products (King *et al.*, 2006). This process reuses raw materials that would otherwise need to be mined from the earth and again adds value, through additional labour, to the original product. Another example that I came across was empty toner and inkjet cartridges that are used in laser printers, fax machines, and photocopiers. These empty cartridges are not thrown in the waste or landfills, but rather refilled and sold to the local markets by the remanufacturers. Remanufacturing in Bangladesh

is becoming increasingly recognized as a means for minimizing the environmental impact of discarded products while bolstering the local economy (cf. Goldey *et al.*, 2010).

Figure 4.7: CRT used for local manufacture of TVs



© Photograph by the author

4.2.5 Dismantling

Grey electronics and e-scrap that cannot be repaired, refurbished, or remanufactured in the state they are received in, find their way to the dismantlers at *bhangari* stores. Grey electronics and e-scrap are stripped down to their constituent parts, metals and other materials. As a result they are no longer the electronic gadgets they used to be. The *bhangaries* play a key role in sorting grey

electronics and e-scrap. Once *bhangaries* disassemble, separate, and clean the purchased grey electronics and e-scrap into reusable components, metals and materials, they are sold to a wide range of different types of industries as valuable feedstock and raw materials for new rounds of production.

Dismantling is a popular business in Dhaka because much of the material (e.g., plastic, glass and metals) can be recycled for a considerably high value. During an interview with the head of the 'Old Dhaka Scrap Buyer Association' it was estimated that about 2,500 *bhangari* shops and 1000 wholesalers operate in Dhaka city. Each *bhangari* is specialized in certain fields. For instance, some have expertise in dismantling computers, some in breaking cell phones and some in dismantling circuit boards. Specialization is not only based on the type of material, but also the spatial agglomeration of these industries. Such specialization drives productivity and economic growth in the informal and formal economy. For example, plastic that is recovered from grey electronics and e-scrap is mostly sold to the plastic manufacturing industry in Lalbagh area of Dhaka where 90 percent of the plastic factories are located. This area specializes in plastic recovery, reprocessing and manufacturing (see Kulke and Staffeld, 2009). A recent study on the plastic industry of Bangladesh found that more than 83 per cent of plastic waste generated per day in Dhaka city is "recovered and eventually processed into new plastic items" (Kulke and Staffeld, 2009, p. 33). Two types of businesses have flourished based on the plastic that is recovered from grey electronics. One is making pellets which are sold to manufacturing industries. The other is making various consumer products (e.g., toys, containers, balls, sandals, shoes, buckets,

mugs and bowls) that are sold locally. In addition to plastic pellets and products, processed plastic is exported to China, Korea, Vietnam and Thailand (McIntyre, 2008).

As the cost of unskilled labor used in some aspects of dismantling is cheaper than the previously described conduits (sections 4.2.1, 4.2.2, 4.2.3 and 4.2.4), comparatively higher profits can gained by *bhangari* owners (see Figure 4.1). The reason why this conduit gains the highest profit margin in this sector is because the employees are mostly women and children and they are non-permanent contract based workers. Discriminatory and exploitative wages based on gender, division of work, level of skill and ages are common in this segment of the industry (see section 4.3).

A division of labor based on skill level exists in this sector, too. Two different types of disassembly are practiced - one is by skilled technicians and the other by unskilled workers. Skilled technicians identify and salvage the reusable components (e.g., RAM, processors and power supply), which can later be used for the assembly of another product. Parts that are in good condition such as CRTs are sold to the remanufacturing industry; other reusable components such as screws and circuit boards are collected in sufficient quantities and sold to repair shops and refurbishing operations (Figure 4.8) and find their way back to the electronics industry.

Figure 4.8: Collecting reusable parts from dismantling store

© *Photograph by the author*

Manual sorting ensures that maximum value is captured from each piece of grey electronics and e-scrap. Sorting is done inside the workplaces, or along the road side. The process is labor intensive, with mostly women and children (almost two-thirds of the workers engaged in this conduit of the industry) employed to divide the grey electronics and e-scrap into different categories and placing them in separate bags. By doing so, *bhangari* stores are adding value to the grey electronics and e-scrap as they want to be sure that every part and bit of material is placed in the right place. To get the work done properly, the owner trains the workers well and keeps them motivated (by conversing, offering snacks and giving cigarette breaks) to create the most surplus value for the grey electronics

and e-scrap. In this way, the production is kept well controlled, and the productivity is in focus all the time with hourly and daily measurements (discussed in details in section 4.3). Once all kinds of reusable components are sorted, unskilled workers physically break the remaining grey electronics and e-scrap to separate other materials from metals. As Bangladesh does not have the required automated technology, recovery is done manually with simple hand-made tools like hammers, pliers, blades and knives. For example, copper is recovered by stripping wires using blades rather than being burnt because burning reduces its quality causing the copper to sell for a lower price and profit. Stripping the wires manually keeps the quality intact. This process cannot be automated hence is labor intensive and time consuming and needs minimal skills. Women and children are often employed for this job.

According to the *bhangaries*/dismantlers, manual disassembly has four advantages. Firstly, the dismantlers can carefully recover components (e.g., CRT) that contain hazardous substances and minimise catastrophes that may release harmful elements to the environment and secondly, they can gently recover reusable components (e.g., RAM) made from expensive materials, keeping them intact as high value. Thirdly, parts (e.g., Integrated circuit (IC)) that have a long operational life span and can be reused in the same or different products without degradation of performance must also be handled with care to maximize value. Lastly materials are sorted and categorized according to material composition, which is easy to do by hand. This way of manual sorting and disassembling practice not only reduces pollution from open burning, but also by recovering

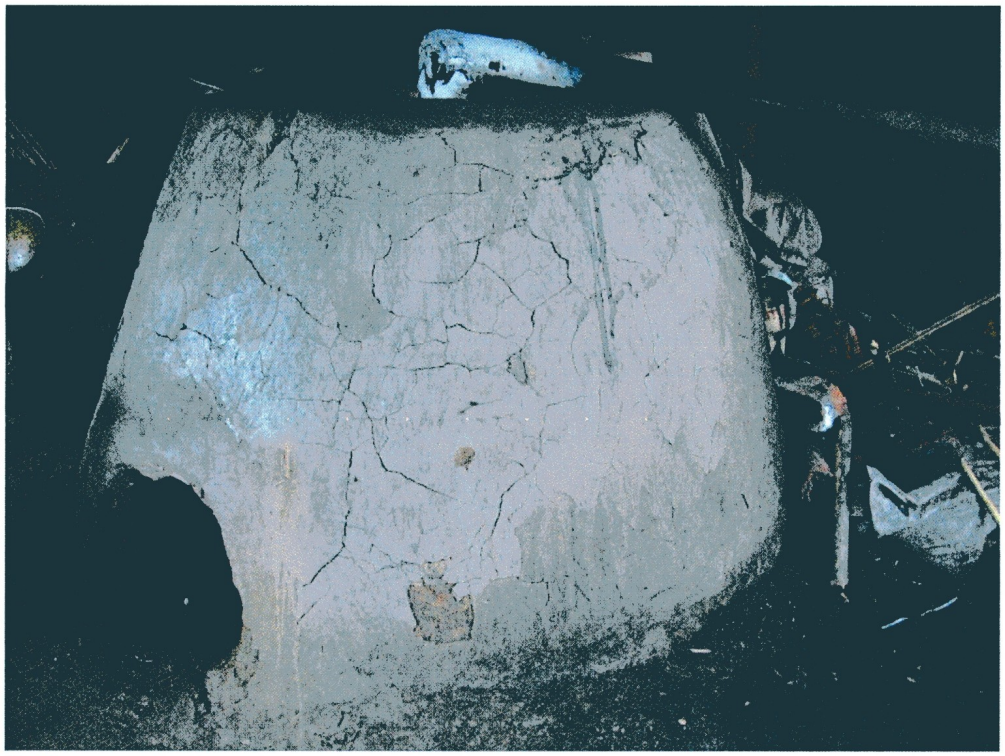
valuable materials. In Dhaka, grey electronics and e-scrap dismantling performs has an environmental benefit which is largely ignored by ENGOs (see BAN, 2002a-b, 2005; Greenpeace, 2003). In this way, manual disassembly is essential to saving resources, protecting the environment, and realizing sustainable development. This complicates the dominating storyline as the survival and livelihood issues of the associated workers depend on the industry.

4.2.6 Smelting

What cannot be recovered by the dismantlers using their simple hand-made tools finds its way to smelters. Usually, the remaining microchips, processors, printed wired boards (PWB) and printed circuit boards (PCBs) that cannot be sold as useable parts by the dismantler or need some form of heat to be released, still have value as they contain precious metals such as gold, copper, aluminium and lead. Smelters melt-out the precious metals from discarded grey electronics and turn e-scrap into chunks of metals (e.g., silver and gold bars), and in doing so transform the physical form of the object and material. These transformations involve collecting, cleaning, sorting, and then processing of materials using *bhati* so that they may form a new product. A *bhati* is an oval-shaped hand-made big earthen jar or container-like stove where the mouth is fitted with a pipe. The other end of the pipe is connected with a fan so that when air is blown it passes through the pipe into the *bhati.* The bottom of the *bhati* is opened with a side-hole facilitating molten matter to flow out. Figure 4.9 is a photo of a *bhati* that is used for this purpose. Before grey electronics processing became a lucrative business, *bhati*

was used to extract gold, silver and copper from the ashes of the goldsmiths' workplace.

Figure 4.9: Traditional '*bhati*' system



© *Photograph by the author*

Many different metals are extracted using the *bhati* process, including aluminum, silver, and gold. Initially, the ash of the burnt husk of rice is spread across the bottom of the *bhati* and then charcoal is placed over it. The charcoal is then set on fire. A mixture of materials (e.g., lead, copper and silver), borax and lime are placed over the burning charcoal in the ratio of 4:1:1. Burning continues for 2-3 hours, during which metals, such as lead and aluminum, ooze out eventually (Figure 4.10) at different temperatures and at different stages of the process.

Figure 4.10: Lead extraction from *'bhati'* burning

© *Photograph by the author*

One example of extracting precious metals by smelters is the process of extracting gold from microchips that contain gold pins. Smelters classify microchips into three categories according to their models and based on the amount of precious metals they possess (Figure 4.11 and 4.12). Pentium-I and earlier models contain the largest amount of gold and Pentium-IV model computer processors contain the least amount. Smelters with their hand-made tools recover chips, and gold-plated pins from the microchips by chipping them off since the gold pins are located on the surface of the microchips. According to the smelters, 50 grams of gold can be extracted from a 220-250 AMD Pentium-I processors using the *bhati* which could

lead to a profit margin somewhere around 250 percent as the profit margin is dependent mainly on the amount of precious materials the microchips posses.

Figure 4.11: Different types of microchips

© *Photograph by the author*

After removing what can be salvaged with tools, silver, copper and other precious metals are recovered from circuit boards, microchips and other discarded parts using the *bhati.* It is worth mentioning that if the amount of chemicals is not accurate then the desired result will not be achieved. In this sense, smelting requires very specialized knowledge, despite its locale in the so-called 'informal sector'. Usually the *bhati* businesses are family businesses as smelters usually do

not want to share their expertise with outsiders. Hence, specialized labour with certain expertise is needed to run the *bhati* process.

Figure 4.12: Extraction of gold from processor and jack

© *Photograph by the author*

Besides the *bhati,* no other machinery or protective gear is used for the extraction of different metals and materials. Though no comparative study has taken place, it is apparent that very little open burning occurs in the smelters' premises by the *bhati* compared to the processing methods used in areas like Guiyu, China. By using the *bhati* process the little waste Bangladesh makes is usually in the form of emissions. A comparative study of these kind of emissions by the *bhati* compared to other forms of processing need further study.

Once the smelter recovers the gold, goldsmiths buy the precious metals from the smelter for the prevailing market price at that point of time taking into consideration the impurities it may contain. The price of gold has been increasing (beyond the usual inflation rates) with a few exceptions, thus making recovery lucrative for these dismantlers and smelters. The remaining ash in the *bhati* after extraction is not discarded. Rather it is sieved to collect tiny particles of precious metals (Figure 4.13). This sieved ash is then sold as a commodity to households and restaurants as a cleaning agent. What the health consequences may be of this connection between electronics and food and the domestic sector, has yet to be investigated. However, as a consequence of the connection, nothing ends up in the landfills or dumpsites. Instead, some form of value is recovered and parts and materials are sent to different industries as feedstock.

Figure 4.13: Sieving ash to recover precious metals

© *Photograph by the author*

Other extracted metals from grey electronics and e-scrap find their ways to different industries in the country as well as outside. For instance, two types of aluminum are recovered. One is called *kalo* (Black) which is used as it is and not purified, and the other one is *shada* (white) which is comparatively more purified, and of high priced quality. *Kalo* aluminum is used to manufacture low quality domestic commodities like pots and pans that are comparatively cheaper and affordable for the poor while the *shada* aluminum is used in making high quality kitchen utensils and exported to other Asian markets (e.g., China and India). Similarly, recovered copper is used in manufacturing high quality knobs and handles for doors and furniture (Figure 4.14 and 4.15).

Figure 4.14: Export quality door knob

© *Photograph by the author*

Japan and Malaysia are two major importers of these products. Thus, using every conceivable by-product of grey electronics and e-scrap is similar to the ship breaking industry of Bangladesh where value is captured and created by dismantling and disassembling the ships into its constituent parts, metals and materials and selling them to different industries (Gregson *et. al.,* 2012; Gregson *et al.,* 2010a; Amin and Billah, 2007; Billah and Mahbub, 2004). Hence, the grey electronics and e-scrap industry in Bangladesh is not confined to one sector like the secondhand textile industry (Norris, 2010; Hansen, 2004), but rather revalued into multiple sectors (e.g., plastic, gold, copper).

Figure 4.15: Door handles made from grey electronics and e-scrap

© *Photograph by the author*

From the above discussion, it is evident that a new commodity chain begins continues from the disposal phase rather than being a 'final consumption' point of the commodity chain. Based on conduit theory grey electronics and e-scrap of the

end point disappears and grey electronics and e-scrap is revalued anew. Here the problem of GCC/GVC is highlighted as final consumption and a final purchase does not occur. As a result it is difficult to identify from where the commodity chain begins and where it ends. Thus, grey electronics and e-scrap is not the end point of the production-consumption-disposal chain rather it is situated in the midst of a non-linear continuous process that may not have an end and a beginning (see also Lepawsky and Mather, 2011).

4.3 VALUE CAPTURE AND CREATION: THE LABOUR THEORY OF VALUE

In the previous section, it has been demonstrated that grey electronics and e-scrap possess value after disposal. Momentarily, the grey electronics and e-scrap may be identified as waste in one place, but regains its value while passing through the resellers, repairers, refurbishers, remanufacturers, dismantlers and smelters in Bangladesh. In the grey electronics and e-scrap recovery industry, the value is captured by the importers, wholesalers, and resellers as they sell the grey electronics and e-scrap in the condition they have received it. Hence, very little physical labor is employed to the objects they are selling. Whereas, repairers, refurbishers, and remanufacturers create value by applying new rounds of labor to the object to bring it to a working standard and dismantlers and smelters create new usages of the object or become a feedstock to a new production site. Therefore, substantial amount of physical labor is needed and value is produced by labour in excess of the amount needed to maintain it. Understanding value capture and creation is crucial to understand geographical unevenness of different

actors at different nodes in the chains and production networks (Leslie and Rimmer, 1999). Thus, to understand how value is captured and created it is necessary to discuss the labor theory of value and division of labour.

As discussed in chapter 2, the labor theory of value is the fundamental premise from Marx's economics. According to Karl Marx, the value of an object is a result of the labor applied to produce it. In other words, the more surplus labor goes into an object, the more it gains value. This is true for the grey electronics and e-scrap industry of Dhaka, Bangladesh. Value addition at different stages of grey electronics and e-scrap commodity chain varies and so does the associated profit. This is because; the amount of labor hours and type (e.g., physical, technical and intellectual) of labor employed in producing the surplus value varies for different conduits. In section 4.2, it was shown that profit margin is at a minimum level when the grey electronics and e-scrap is being sold by traders but reaches the maximum level when it is dismantled to its constituent parts at the *bhangari* stores. In other words, when value is captured by importers, wholesalers, brokers and resellers, there is hardly any physical labor involved. On the contrary, when value is added, for instance bringing a non-functioning computer to working standards, the grey electronics moves more into the commodity chain where to a greater extent specialized labor is employed.

In addition, based on my interviews and observations, it is revealed that the division of labor in the recovery industry of grey electronics and e-scrap in Dhaka is based on gender, skills and age, which also plays a role in determining the wage rate. For example, high status jobs are dominated by men in the position of

wholesalers, importers and senior technicians where as lower status routine jobs of dismantling and smelting are occupied mainly by children and women. Moreover, Massey's (1984) idea of spatial divisions of labour contributes to where these jobs are located. For instance, during the field study, I found that the grey electronics and e-scrap industry is clustered in mainly three areas in Dhaka city. The first is the central city area (e.g., Elephant Road and its surrounding area), where offices of major computer equipment companies and services are located (e.g., resellers, repairers, and refurbishers), the second is old parts of Dhaka city (Mothijhel Commercial Area) where remanufacturing industry and other industries like the plastic industries are clustered and the third are the peripheries of Dhaka city (will not be disclosed), where all dismantlers and smelters are agglomerated. Thus, to understand how value is captured and created the division of labor and uneven power relation between the different actors will be discussed in the following sections.

4.3.1 Gender

The whole organization of labour in the Dhaka grey electronics and e-scrap industry is based on gender division. Gender division of labor has oriented female and male workers to different tasks with consequent wage inequality. The female workforce in this division of labour is regarded as supplementary, contractual and temporary, in contrast to permanent male labour.

Men have monopolized the technical jobs of value addition through repairing, refurbishing and remanufacturing in Bangladesh. They increasingly require technical knowledge or experience to take up such positions. Traders mentioned that patriarchal norms are applied to the division of labor in the repair, refurbish and remanufacturing industries in Dhaka. As a result, women are not seen in these premises. Another reason that the owners emphasized is that they claim women have neither the technical know-how nor the access to learning since men and women have different and unequal access to technology and technical education. During my fieldwork, not a single woman was found or heard of working as a technician nor were the businesses owned/run or supervised by women. When asked why women were absent, the respondents indicated several religious, cultural and pragmatic reasons.

According to respondents, women are not encouraged to engage in businesses where they have to come into contact with other men frequently or work in public places. Two major reasons are behind such an outlook. Firstly, Bangladesh is a patriarchal society hence; men dominate women in every sphere of the economy. For instance, it is a common scenario in Bangladeshi politics that a qualified candidate may not gain party nomination just because she is a woman. An international survey conducted by the Inter-Parliamentary Union demonstrates that Bangladesh ranked 122 globally out of 184 countries with only 2 per cent of women members in the national parliament in 2001 (Inter-parliamentary Union, *Women in National Parliament*, June 2002, p. 4.) Secondly, as a majority of the people in the country are Muslims and believe that women should maintain

a certain amount of modesty in workplaces women are often encouraged not to work in the midst of men whom they are not related to. Restrictions on women's mobility in the public domain means that they are allowed to work as either unpaid family labor or paid workers within the homes. The invisibility of such work has tended to make the women's participation rate in the work place extremely low in Dhaka city (Kabeer and Mahmud, 2004).

Situated among the networks and conduits of the grey electronics and e-scrap commodity chain are the dismantlers and smelters who disassemble, sort and separate metals and materials from the broken pieces (e.g., stripping copper from wire) of grey electronics and e-scrap. Disassembling and recovery work is considered to be the most labor-intensive as well as the least desirable job in the low-income working community. The president of the 'Old Dhaka City Association for Sellers and Buyers of Old Goods' stated that women constitute more than two-thirds of the workers that are engaged mostly in the dismantling and smelting sectors in the grey electronics and e-scrap industry. During interviews with owners of *bhangari* stores it was revealed that men in particular were involved in breaking things and moving around heavy objects and women are not because women are prevented from entering certain types of employment due to their presumed physical weakness (Momsen, 2002). Women's involvement is predominantly situated in the shadow of the informal sector, where economic distinctions such as low wages and poor working conditions are considered to belong to women (cf. Rouse and Ali, 2001; Beall, 1997). According to employers, women are obedient and cheap, do not complain or argue, and can be hired and

fired easily. Their jobs include sorting, cleaning, and separating objects like ICs, screws and pins from circuit boards. Interviews with such workers revealed that they take up cleaning and sorting work for a variety of reasons. These include the opportunity to earn money, to assist their families and the lack of work in rural areas. Some see the financial independence as a means of dealing with marital problems.

But when employers were asked the reason behind employing women in these jobs, they explained that women are more suited to working with *bhangari* and smelting stores because sorting, cleaning, and separating objects is more like domestic work. Also, as the proportion of workers in certain jobs becomes overwhelmingly female, the jobs themselves may become identified as feminine. However, this has not always been the case, as many sorting jobs done in the past by men have now been taken up by women. This is often explained by the notion that men have always moved when they find a better opportunity, whereas women are very heartfelt workers and try to keep their existing jobs as long as they can. Thus, gender, and patriarchal norms have limited women's participation in this sector of the industry.

Age and gender continue to be exploited in this industry as part of a downward push on costs which results in a discriminatory wage base. Wage rates for men range from BDT 180 to 200 (CND 3 to 3.33) per day whereas women earn a wage of BDT 60 to 80 (CND 1 to 1.33) per day which indicates that women get one-third of their male counterparts. This evidence from my study suggests that womens' labor tends to be concentrated in lower-paying jobs like dismantling and

smelting sectors, and do not have access to the same type of jobs as men. Kapsos' (2008) study shows that women earn 21 percent less than their male colleagues in Bangladesh. The largest male-female wage gaps in the informal sector were found mostly in the construction, hotel and restaurant industries in which women earn an average of 30 percent less than male workers. The study shows that when women's education increases, the male-female wage gap decreases, as women tend to see more benefits from additional education in terms of earnings than male workers. So it is clear that those women who are involved in grey electronics and e-scrap dismantling and smelting process are disadvantaged and discriminated by wages, gender and income to a greater extent than other industries when compared to Kapsos' results.

4.3.2 Skills

Gender plays a key role in determining the level of skills a worker possesses in grey electronics and e-scrap industry in Dhaka. During my fieldwork, it was observed that technical and specialized jobs are always performed by male workers. It is a common notion in the grey electronics and e-scrap industry that the jobs that the women workforces undertake are the jobs that require no specific training or skills.

In the grey electronics and e-scrap industry of Bangladesh, there was not a single woman that worked in a specialist skilled job such as technicians, supervisory and assistant technicians. For instance, as importers, wholesalers, resellers and brokers require good communication skills that can be earned through some form of

education to contact foreign exporters, repairers, refurbishers, remanufacturers, dismantlers and smelters, these jobs are almost entirely male dominated. Besides, it is necessary for importers, wholesalers, and brokers to have education and knowledge of foreign markets as well as procedures of importation (e.g., obtaining Letter of Credit). Thus, the jobs associated with selling grey electronics and e-scrap as well as jobs that ask for expertise and knowledge to verify and examine grey electronics and e-scrap are undertaken by skilled labor, and remain as privilege of men.

Both male and female workers co-exist in the dismantling and smelting sectors of the grey electronics and e-scrap industry. As the major activity in the two sectors is mostly sorting, removing and cleaning parts and material which is considered unskilled work, more females are employed in these sectors. However, the owners explain that some expertise is needed to identify useful parts and to guide and supervise the women labor. Hence, these jobs are occupied by the male counterparts.

Sometimes young children are seen working in repairing, refurbishing and remanufacturing stores as apprentices. Their role in this sector is also significant. They are paid on the level of skills they possess. Sometimes their earnings are necessary to meet their family's basic needs. As becoming a technician is practically impossible without minimal knowledge and experience, and institutional training can be expensive, guardians of some children who are young in age and inexperienced allow them to work as '*pete bhaate*'(unpaid). This means the child labor gets no monetary benefits. Instead they get only three meals

a day for their toil at these stores so that one day they can cross the line from being a helper to a technician. Their unpaid work not only benefits the owners, but also increases the children's sense of autonomy, enabling them to gain skills and competencies useful for their individual independence.

The wage of workers in these stores varies based on their experience and the skills they possess. For instance, in a printer repairing store the monthly salary for the skilled technician is BDT 5,000 (CND 83), the technician in training is BDT 3,000 (CND 50) and the helper is BDT 1,500 (CND 25). Interviews with owners revealed that only five percent of these workers received institutional training and the remaining 95 percent have acquired their skills through observation and experience by being an apprentice at an early age. During the early stages, an apprentice serves food or drinks to the workers in the store, cleans the premise, tools, machineries and parts, and assists skilled workers before finally moving on to more skilled tasks. Throughout their term, work is combined with learning. And after spending years of assisting and observing, some apprentices open their own business separately. In this way, the division of labour in the grey electronics and e-scrap is based on skilled work which is carried out mostly by men and unskilled work carried out by women and children.

4.3.3 Age

In addition to skill and gender, age is also important. As discussed above children sometimes serve as apprentices with repair and refurbishing in the dismantling and smelting sectors, both boys and girls are engaged in the same kind of work such as sorting parts and are paid equally. A recent study (2005) by the U.S.

Department of Labor noted that an estimated 13.4 percent of Bangladesh's children (approximately 1.3 million) aged between 5 to 14 were counted as working and that children are "vulnerable to exploitation in a variety of potentially hazardous occupations and sectors including ... glass factory and rag picking" (p. 35).

In Bangladesh, a country with high poverty rate, children are not left out of the work force. In the grey electronics and e-scrap industry children are seen holding bags, marking them according to the content and job, and moving materials to their allotted places in *bhangaries* and smelters premises. They are part-timers working for 2-3 hours every day. These tasks are divided according to age rather than gender as they are considered to be light-weight, physically easy tasks. But, gradually as the child grows, due to their gender, they are placed in different types of jobs in the industry, and gain different kinds of experience. For instance, if the child is a boy, he may be moved to work for a senior technician as a helper or assistant. The child does not require much skill or a particular knowledge to do such a job but may require greater physical strength. As the child gets older he acquires competence through experience and practice to take on certain tasks autonomously. According to the owners of repairing and refurbishing stores, none of them are considered as technicians at first and none have chosen assisting to be their life-long career. Instead, when they have gathered substantial know-how they open their own business separately or gain a job as a skilled technician.

If the child is a girl, she is not moved to work for a technician or reseller, but rather is sent to work with other women in the dismantler and smelters' premises

where less skill is needed. She is deprived from gaining the knowledge and expertise a boy of her age could have acquired working for a technician or a reseller. As a result, due to her gender (section 4.3.1) she is usually confined in the smelter and dismantlers premise for the rest of her working life if she remains in grey electronics and e-scrap industry. This also explains why there are no women importers, resellers and technicians in the industry. Interviews with employers of dismantlers and smelters also reveal that they prefer to hire younger, unmarried or divorced female workers as they are thought to work harder than other women since they do not have to spend time with their husbands and family. However, some owners stated that they employed inexperienced young women because those with more experience generally try to get work in the ready-made garments factories, where wages and working conditions are thought to be better.

Figure 4.16: Children sorting metals and materials

© Photograph by the author (permission to use from respondents)

Children are paid less than women. They earn about BDT 30 (CND 0.50) per day. In the case of children there is no discriminatory wage rate based on the gender. Given the labor-intensive nature of the industry, employers are more eager to draw on young female laborer and children (Figure 4.16 and 4.17) as they are comparatively cheaper and are more vulnerable to exploitation by employers. Yet, it is these workers who make this industry profitable. Such exploitive practice can be seen in other industries of the country, for instance, the formal export-oriented garments industry in Bangladesh (Rock, 2003). Thus, skills, gender and age are very important factors in value capturing and value creation of grey electronics and e-scrap recovery economy.

Figure 4.17: Women are working inside the dismantling store

© *Photograph by the author (permission to use from respondents)*

The uneven practice of labor power, the labor health and environmental hazards of the grey electronics and e-scrap industry are issues that are often raised by ENGOs and academics (Basel Action Network, 2005, 2002a,b; Greenpeace, 2005; Toxic Link India, 2003; Silicon Valley Toxics Coalition, 2004; Iles, 2004; Pellow, 2002). Much of the literature on environmental justice is about environmental equity and how the underprivileged population often undertakes environmentally hazardous work. Though important and relevant concerns, these critics overlook the opportunity the grey electronics recovery industry creates for the livelihoods of the poorest of the poor. In a developing country like Bangladesh, 80 percent of the economic activities in the cities take place in the informal sector (Baker *et al.*,

2007: p.102). In Dhaka alone, it is estimated that approximately 200,000 of the urban poor are involved in different types of recycling and material reuse industries and by doing so approximately 35 billion BDT (equivalent to USD 505 million) of the municipality's fund is being saved (Ittefaq, 2010). This includes a large and active informal sector that is involved in grey electronics and e-scrap recycling. During an interview with the 'Old Dhaka Scrap Buyer Association' it was estimated that in and around Dhaka city, some 60,000 workers are directly engaged in this sector. If one includes children, wives, and other dependants, somewhere around three hundred thousand individuals' survival depends on the trading, processing and salvaging industry of grey electronics and e-scrap.

Substantial new employment has been generated by this industry, though often with exploitive wages. Usually, women and children are the ones victimized by such exploitive wages but their livelihoods may improve as their average monthly earnings are almost double the monthly per capita 'poverty line' income, which is 725 BDT in Dhaka (Government of Bangladesh, 2003). Although this income does not indicate a high standard of living, it does suggest that certain minimum basic needs are being met. From interviews it was revealed that the majority (somewhere around 70-80 percent) of these workers were urban poor, street/slum children, women without other employment opportunities or migrants from rural areas who moved to urban areas (Elahi, 1989; Mahbub and Islam, 1991). During an interview with one such worker, when asked why she worked in this industry as there are health implications, she explained with a big smile, - "*We are poorest of the poor. We need food first for our survival then the environment. Moreover,*

environment is not for us; it is for the wealthy people." Thus, for a country like Bangladesh where 50 percent of the population lives below the poverty line (Mahmood, 2006), recycling of grey electronics and e-scrap is one of the most economically viable options available to meet the basic needs (cf. Kulke and Staffeid, 2009).

Looking at the material aspects of the grey electronics and e-scrap recovery industry, the activities of recovering objects, metals and materials can be seen as having environmental benefits as these recyclables are used instead of virgin materials in several manufacturing industries. For example, production based on recycled aluminum can use as little as 5 percent of the energy needed for production based on virgin materials. And lower energy consumption generally means lower carbon-dioxide CO_2 emissions (EEA, 2007). Hence, increased recycling can contribute to reducing energy related emissions of CO_2 (EEA, 2008). Lately, many industries are marketing energy-efficient electronics to reduce the pressure on the environment. They may have a lower environmental impact and consume less energy, but they still contribute to the increase in the consumption of resources. The search for strategies of sustainable development should therefore be aimed more towards extending the period of use through repair, refurbishment, and reuse while making these activities as safe and equitable as possible.

4.4 CONCLUSION

Post-consumption, grey electronics and e-scrap find a new form of life depending on the condition it enters Bangladesh. It is considered as a resource and income generator in Bangladesh. One thing that can be concluded from the above discussion is that once in Bangladesh, grey electronics and e-scrap behaves as a resource and generally does not end up in landfills – rather these goods wind-up in production sites. Grey electronics and e-scrap passes through a variety of conduits before it reaches its potential value. When it moves from wholesalers/importers to dismantlers and smelters, it is increasingly disaggregated into its constituent materials. In the process, grey electronics and e-scrap is recovered or produced as new forms of value. The value that is added in different phases of reuse, rekindle and (re)production is not the same at each phase, nor is the profit margin. This is mainly because of the labor employed in the process. It has been found that the more grey electronics are dismantled to its basic materials, the less skilled labor is needed which leads to low labor cost and more pecuniary gain. But of course this relation of skill to wage also reflects gender and age discriminatory practices, which depress wages in order to realize value. In other words, processes regaining the functional value of grey electronics are less profitable than processes that recover its material value due to profits extracted from labour in the latter case.

GVC and GPN frameworks have a theory of value that does not account for the rekindling of value after final purchase/final consumption or after disposal. So they are blind to all of the vast economic activity going on in the post

consumption sectors of Dhaka. Two major problems with these (GVC and GPN) approaches emerged during the fieldwork. Firstly, after disposal 'e-waste' that appears in Dhaka creates raw materials of new products and additional rounds of economic activity occur. Secondly, researchers are focused mainly on formal economic activities, as if these activities are the most significant to understanding the organization and operation of GVCs and GPNs. The grey electronics and e-scrap industry in Bangladesh suggests this presumption should be questioned.

Moreover, like conduits theory the findings of the present study suggest that there is a wider range of value (i.e., sentimental and emotional) concerns than simply economic value. The findings also suggest that there could also be substantial material recovery and resource conservation implications of the grey electronic and e-scrap industry in Dhaka. These potential environmentally positive benefits could be quite substantial and also contribute to the forging of a sustainable materials recovery economy.

Lastly, the division of labour did not depend only on the skills, age and technical knowledge of grey electronics and e-scrap industry in Dhaka, which I have examined. It seems that there was a gender division of labour, in the sense that men and women performed different tasks and so were paid differently. The gender division of labour, that is to say, was supported by disparity of payment and the wage gap between men and women workers. At the same time, it is also important to note that the grey electronics and e-scrap industry has also provided job opportunities for the poor including unskilled women workers for whom

income opportunities are scarce. It has been estimated that in Dhaka city 60,000 people are engaged in grey electronic and e-scrap processing businesses.

In conclusion, a country like Bangladesh, where very few people have access to the internet and own computers, grey electronics has brought a tremendous change in their socio-economic lives. People who cannot afford a new computer or even a TV have been able to do so as the industry of grey electronics and e-scrap has made affordable for them by refurbishers and remanufacturers. In this way, the useful life of grey electronics and e-scrap is extended and the materials that do not fit any of the mentioned categories enter a new round of production by dismantlers and smelters in different industries producing consumers' goods like sundries at a low price for a resource poor country like Bangladesh. Thus, grey electronics and e-scrap is not situated at the end of the production-consumption-disposal chain. Rather it is in the midst of a non-linear, and largely continuous, web that may have no essential end or beginning.

CHAPTER FIVE

Conclusion

5.1 INTRODUCTION

From source (e.g., electronics manufacturing) to sink (e.g., cast-off electronics) electronic waste has been considered a cause of emissions, pollution, toxins and waste (Gabrys, 2011). Unfortunately, the plethora of economic activity after disposal of grey electronics and e-scrap that brings them back into a new rounds of production is poorly acknowledged by policy makers and ENGOs. There are only a few studies that acknowledge the after-disposal activities of grey electronics and e-scrap like other secondhand production and consumption (e.g., ship breaking, used cars and clothing). However, the economic activity that occurs after consumption has generally been considered as marginal activities in economic geography despite a need for extensive study (Crang *et al.,* 2012; Lepawsky and Mather, 2011; Brook, 2010, 2011; Gregson *et al.,* 2010a; Gregson and Crewe, 2003; Hansen, 2000). In Bangladesh, grey electronics and e-scrap are considered valuable (i.e., not waste), yet the same devices are labeled as valueless (e.g., e-waste) or waste in other regions (e.g., Europe and North America). This is a problem that has been encountered throughout the fieldwork in Bangladesh. That is, study participants were reluctant to consider imported 'e-waste' as waste; this response by study participants associated with the trade lead me to use

different terms, 'grey electronics and e-scrap', to reflect the valuable nature of 'e-waste'. The present study maintains the same idea given by some recent geographic studies which question the conceptualization of 'waste' as an endpoint of the production-consumption-disposal chain (Lepawsky and Billah, 2011; Lepawsky and McNabb, 2010; Lepawsky and Mather, 2011; Gregson *et. al.*, 2010a). Rather they have argued waste to be a 'web of potentiality' and found it to have beneficial economic returns.

The capture and creation of value from grey electronics and e-scrap in Dhaka, involves many complexities including the interplay of international policies, rules and regulations, and social norms and cultural practices. These complexities also include both licit and illicit activities that contribute to the capture and creation of value from grey electronics and e-scrap. The positive contribution of the grey electronics and e-scrap sector in Dhaka has enabled significant job creation, feedstock for other production activities, improved access to technology, upgrading, and affordability, and the extension of product life to a wider population of lower income families. Thus, 'e-waste' is a valuable trade in Bangladesh, though the processing of it can also be risky in terms of health and environmental consequences.

5.2 KEY FINDINGS

The geographies of the international grey electronics and e-scrap trade as explained by the pollution haven hypothesis is far more complex than the idea of developed countries simply dumping 'e-waste' in developing countries. This is evident in the trade pattern of grey electronics and e-scrap in Bangladesh. Bangladesh is an important participant in the global trade of grey electronics and e-scrap that is organized intra-regionally within Asia. Most of the grey electronics and e-scrap enter Bangladesh from China, Singapore and South Korea. Some of these countries play the role of transshipment hubs (e.g., Singapore, Hong Kong, and Dubai) where warehousing and/or storefronts are set-up. This is similar to Lepawsky and McNabb's (2010) description of e-waste being traded among 'poor countries' (p.117). My study's findings are also consonant with what Kahhat and Williams (2009) found about how Peru repurposes used computers imported from USA rather than dumping them and exports remainders for processing in Europe. This contradicts the pollution haven hypothesis, which states 'waste' tends to move from richer regions (e.g., the Global North) to poorer regions (e.g., the Global South). A recent study also shows that the developing nations (e.g., China and India) will be the largest sources of grey electronics and e-scrap by 2015 (Yu *et al.,* 2010). The present study is similarly consonant with these findings. International trade flows of grey electronics and e-scrap, as characterized by the popular media and ENGOs, are about dumping and/or exporting 'e-waste' to developing countries from developed countries. The current study finds the trade flows of 'e-waste' dominantly from South to South rather than North to South. In

the dominant storyline about e-waste narrated by ENGOs and mainstream media, such findings are absent. Taken together, studies like Kahhat and Williams (2009), Yu *et al*., (2010) and my research suggest a need to represent the so-called e-waste trade more carefully. Moreover, these studies and my own suggest that international legislation (e.g., the Basel Convention) needs to be more nuanced in order to implement relevant and just grey electronics and e-scrap trade policy in the future.

The existence of trade and traffic of grey electronics and e-scrap means that some form of 'value' exists or is created after disposal (Lepawsky and McNabb, 2010). In contrast to a linear trajectory of grey electronics and e-scrap in a consumer capitalist economy that are meant to be produced, consumed, and discarded, the present ethnographic research reveals that more complicated trajectories are the norm. Once grey electronics and e-scrap enters Bangladesh, new commodity chains are formed which indicates that grey electronics and e-scrap are not the end-points of linear production-consumption-disposal chains. Rather they are part of an open web of potential connectivity (Gregson *et al.,* 2007b).

A significant amount of grey electronics and e-scrap enters Bangladesh illegally through the loopholes of the legal system. Lepawsky and McNabb (2010) mentioned the gaps of the Basel Convention treaty (p.178), which include an inconsistent definition of 'hazardous waste', ambiguous definition of 'environmentally sound', and no barriers to the transboundary movement of e-

waste for reuse, recovery and recycling. These have facilitated the trade and trafficking of grey electronics and e-scrap in Bangladesh. Moreover, as there are no legal barriers to trade between developing countries, grey electronics and e-scrap can easily move between any such countries.

The present thesis ascertains the main conduits through which grey electronics and e-scrap move in and out of Bangladesh. These conduits include reselling, repairing, refurbishing, remanufacturing, dismantling and smelting which all play a key role in capturing and creating value from post-consumption economic activities. The grey electronics and e-scrap, as they undergo more processing through these various conduits, accumulate more profits. It is also found that substantial economic activity exists revolving around the geographies of trading, salvaging and material recovery of grey electronics and e-scrap in Bangladesh. Interviews with knowledgeable participants suggest up to one third of Dhaka's daily production of discards are returned to production by the city's informal rubbish recovery economy workers. As many as 60,000 people are estimated to be directly making a living from collecting and processing grey electronics and e-scrap in Dhaka. If Dhaka's average household size is considered, this figure may expand as high as 300,000 people in the city dependent on the grey electronics and e-scrap industries.

Value is recovered as well as produced from grey electronics and e-scrap in the country to meet domestic demand and is also exported abroad. The tradable grey electronics and e-scrap are organized around several informal business operations of reuse, recovery and recycling activities in Dhaka. What cannot be repaired, refurbished or reused moves to the dismantlers and smelters. After removing reusable components, the remains go through a variety of processing activities to be disaggregated into their constituent metals and other materials which are later sold as feedstock in new rounds of production in both international and domestic markets. As a result, grey electronics and e-scrap processing exists within wider sets of non-linear relationships through the different conduits and there is no end point at least theoretically. Instead materials may be altered and transformed many times over. There are several examples where materials and metals extracted from grey electronics that were originally imported from China, return to that country in the form of plastic containers that were produced by the Bangladeshi local plastic industry for export. Though previous studies (e.g., Hansen, 1995, 2003, 2004; Milgram, 2005; Norris, 2005, 2010) show that cast-off goods can move within a single sector to be revalued (e.g., textiles and garments) in Bangladesh grey electronics and e-scrap are not confined to one sector. Rather, they may also be recycled into non-electronic goods (e.g., plastic and metal household items, and the glass industry). Thus, the linear conceptualization of the transformation of value-to-waste does not account for the economic, cultural or political realities that organize the trade and traffic of grey electronics and e-scrap in Dhaka (cf., Lepawsky and McNabb, 2010).

A close examination of the grey electronics and e-scrap trade in Bangladesh reveals that different levels of traders capture and create value which results in profit margins that are unequal. Value is captured and created not only by repairing, refurbishing and remanufacturing grey electronics and e-scrap, but also when grey electronics and e-scrap lose their physical form and are disaggregated into their constituent parts. The closer grey electronics and e-scrap moves to its constituent parts, the higher the eventual profit margin tends to be. This is because of an available cheap labor supply that promotes recycling and material recovery, as low quality recyclables that are not economically viable to process in other developed countries can still be processed in Bangladesh. An informal recycling and recovery industry has flourished in the country, mainly in Dhaka city, based on the import of grey electronics and e-scrap. Among these premises manual labor plays a major role in creating and capturing value from grey electronics and e-scrap where the exploitation of labor power exists. This gives Bangladesh a comparative advantage in the recycling and recovery industry that needs a relatively large number of cheap workers.

A discriminatory wage system exists on the basis of gender, skill and age that make grey electronics and e-scrap processing operations more profitable. It is mainly the women and children employed in the industry that are being exploited. Hence, the dismantling and smelting sector of the industry captures comparatively more profit than that of the other sectors in the grey electronics and e-scrap industry as it is mostly women and children employed in it.

Labour exploitation must be interpreted carefully and in conjunction with positive aspects of the industry that come with it. These positives include employment and increased access to technology for a broader base of the population via the existence of a market for used computers and parts. The mass of the population of Bangladesh is not financially in a position to afford brand new computers. The culture of reusing, repairing, refurbishing and recycling grey electronics has given underprivileged people an opportunity to enhance their IT skills (e.g., through internet browsing). Many other industries have benefited from grey electronics and e-scrap industry such as cyber cafes and printing presses as their investment costs are comparatively less than those businesses that invest in new computers.

5.3 POTENTIAL AREAS OF FUTURE RESEARCH

The present study started from following the grey electronics and e-scrap that entered Bangladesh but stopped at the point where grey electronics and e-scrap was unrecognizable as such and entered new sectors that manufacture non-electronic products. It would be worthwhile to track what happens when these grey electronics and e-scrap are transformed into other products. For instance, the grey electronics and e-scrap that comes from China that is exported from Bangladesh to Singapore or Japan is ultimately transformed into totally different products (e.g., door knobs); thus, going beyond the 'boundaries and edges' of grey electronics and e-scrap (Lepawsky and Mather, 2011), would be worth further

investigation since doing so might give us a more nuanced understanding of the organization and ongoingness of economic activities.

Most of the research on grey electronics and e-scrap has focused largely on the informal sectors of developing countries and their hazardous effects on the environment including risky handling and processing techniques. But the techniques for recovering precious and semi-precious metals are not universal. Much of the existing e-waste literature emphasizes the use of low temperature incineration (i.e., burning in the open air); for example, copper can be extracted from plastic coated wires through open air burning. The toxicological consequences of open air burning have been well documented. But there is another form of incineration being used in Dhaka, namely the *bhati* process. The toxicological effects of the *bhati* recovery system could be further researched. Since the *bhati* system uses enclosed clay based 'ovens' to work, the resulting temperatures achieved are likely to be much higher than open air burning. Higher temperatures can mitigate the toxicological consequences of incineration. It is possible that the *bhati* system is a low technology, low cost, but also relatively safe method of extracting precious and semi-precious metals from grey electronics and e-scrap. The amount and types of emissions from the *bhati* process are unknown. Thus, it would be worth doing a comparative study between the *bhati* system and other existing recovery processes of grey electronics and e-scrap, including high-technology smelting in order to compare, for example, relative costs and energy use as well as environmental and health impacts.

In addition, few e-waste studies discuss the potentially positive impacts of the informal sector. There are several more questions that arise: Does formal recycling using highly mechanized, state-of-the-art technology always result in an environmental benefit compared with informal recycling? Why is informal recycling typically thought to create waste and pollution while formal recycling is often presumed, wrongly, to be environmentally beneficial (see MacBride, 2012)? Why is the creation of employment opportunities in poor countries through the informal sector not better acknowledged? These aforementioned questions should be pursued in order to better understand the impact of the grey electronics and e-scrap industries in Bangladesh and other developing countries.

Finally, one drawback of the present study is that concrete data on the amount of materials used in Bangladesh that are recovered from the grey electronics and e-scrap industry is lacking. For instance, a study shows that 80-90 percent of the iron used as raw material in the rerolling industry of Bangladesh is recovered from the ship breaking industry (Gregson *et. al.,* 2011; Gregson *et al.,* 2010a; Amin and Billah, 2007). No similar figures are available for the grey electronics and e-scrap industry. This would be worth researching as more precise figures would enable policy makers to make more rational decisions.

In a consumer capitalist economy, 'e-waste' is often considered to be the end point of a linear production-consumption-disposal chain. Yet, as my research shows, on entering Bangladesh e-waste offers multiple potential value that is part

of further economic activities in Dhaka. Along the way it is possible to rethink economic activity in terms of materials transformation. The present thesis demonstrates that profit margins increase as grey electronics and e-scrap are moved from resale, repair and refurbishment towards dismantling and smelting. My findings indicate that the 'end' of the chain of production and consumption may not wind up in landfill sites as waste. Instead it can enter into a new web of highly profitable economic activities. As stated earlier there is no such essential thing as 'e-waste' (i.e., as it tends to be categorized in countries of the North) in Dhaka. Moreover, what is typically conceptualized as the end of a global value chain or production network (i.e., 'final price' or 'final consumption') is not final. Rather, economic activity can go on in new webs of economic action (cf. Gregson *et al.* 2010a). The movements of grey electronics and e-scrap in Bangladesh reveal webs of flows into reuse, repurposing, and transformation wherein metals and materials are extracted. These in turn can continue their material lives as inputs into other economic activities (e.g., utensils, jewelry making) (see Lepawsky and Mather, 2011). My findings in this thesis and the growing academic conversation about waste and discards suggest 'waste' is a rich direction for future research that can help us question taken for granted assumptions about the geographies of economic organization, environmental justice, and what we assume to be waste and value.

BIBLIOGRAPHY

Alexander, Catherine. 2005. Value: economic valuations and environmental policy. James. G. (eds.). *A Handbook of Economic Anthropology* 455-471.

Allwood, J.M., Laursen, S.E. and Malvido de Rodríguez, C., Bocken, N.M.P. 2006. *Well Dressed? The present and future sustainability of clothing and textiles in the United Kingdom.* University of Cambridge, Institute for Manufacturing. Last access December 28, 2010 http://www.ifm.eng.cam.ac.uk/people/cm459/.

Amin, S. M. N., and Billah, M. 2007. Environmental impacts of ship scrapping in Bangladesh. *Pennsylvania Geographer* 45 (1): 113–130.

Ansari, N.L., Ashraf, M.M., Malik, B.T., Grunfeld, H. 2010. Green IT awareness and practices: Results from a field study on mobile phone related e-waste in Bangladesh, *IEEE International Symposium on Technology and Society.*

Appadurai, A. (eds.) 1986. *The Social Life of Things: Commodities in Cultural Perspective*. Cambridge University Press: Cambridge.

Baker J. L., Hammam, S., Bernard, C., Zhu, X., Patel, P. 2007. Dhaka: Improving Living Conditions for the Urban Poor. *Bangladesh Development Series* Paper No. 17: The World Bank Office June: 158, Dhaka. Available online: http://www.worldbank.org.bd/bds

Babbitt, C., Kahhat, R., Williams, E., Babbitt, G. 2009. Evolution of product lifespan and its role in the environmental assessment and management of products: a case study of personal computers in higher education. *Environmental Science and Technology* 43(13): 5106-5112.

Basel Action Network (BAN). 2002a. *Exporting Harm: The High-Tech Trashing of Asia.* Seattle: 1-54.

Basel Action Network (BAN). 2002b. *Exporting Harm: The High-Tech Trashing of Asia, the Canadian Story.* Seattle: 1-35.

Basel Action Network (BAN). 2005. *The Digital Dump: Exporting Re-use and Abuse to Africa.* Seattle: 1-88.

Bandyopadhyay, A. 2008. A regulatory approach for e-waste management: A cross-national review of current practice and policy with an assessment and policy recommendation for the India perspective. *International Journal Environment and Waste Management* 2(1/2): 139-186.

BBC. 2008. Ghana's growing e-waste trade, British Broadcasting Corporation, UK. Available online: http://news.bbc.co.uk/2/hi/africa/7544003.stm

Bangladesh Bureau of Statistics (BBS). 2001. *Population Census 2001, National Report (Provisional)*, Bangladesh Bureau of Statistics, Ministry of Planning, Dhaka.

Bernard, H. S. 2002. *Research Methods in Anthropology: Qualitative and Quantitative Approaches.* Altamira Press: N Y.

Beall, J. 1997. Thoughts on poverty from a South Asian rubbish dump - Gender, Inequality and household waste. *Institute of Development Studies Bulletin* 28(3): 73-90.

Billah, M. 1999. *Economic Significance and Environmental Impact of Ship Breaking Industry of Bangladesh.* Unpublished Master Thesis, Department of Geography and Environment, University of Dhaka, Bangladesh.

Billah, M. and Mahbub A Q M. 2004. Economic Importance and Environmental Impact of Ship Breaking Industry in Bangladesh. *Bhugol O Paribesh Journal* The Bangladesh Geographical Society 4:53-78.

Brooks, A. 2012. Stretching Global Production Networks: The International Second-hand Clothing Trade. *Geoforum.* Available online version 16 July 2012.

Brooks, A. 2011. Networks of Power and Corruption: The Trade of Japanese Used Cars to Mozambique. *The Geographical Journal* 178 (1): 80 – 92.

Brooks, A. 2010. Spinning and Weaving Discontent: Labour Relations and the Production of Meaning at Zambia-China Mulungushi Textiles. *Journal of Southern African Studies* 36 (1): 113 – 132.

CBC. 2008. E-waste dumping ground. Available online: http://www.cbc.ca/national/blog/video/environmentscience/ewaste_dumping_ground.html

Chen, A., Dietrich, KN., Huo, X., Ho, S.M. 2011. Developmental Neurotoxicants in E-Waste: An Emerging Health Concern. *Environmental Health Perspective* 119(4): 431- 438.

Chen, D., Bi, X., Liu, M., Huang, B., Sheng, G. and Fu, J. 2011. Phase partitioning, concentration variation and risk assessment of polybrominated diphenyl ethers (PBDEs) in the atmosphere of an e-waste recycling site. *Chemosphere* 82 (9): 1246-1252.

Chen, S.J., Ma, Y.J., Wang, J., Chen, D., Luo, X.J., Mai, B.X. 2009. Brominated flame retardants in children's toys: concentration, composition, and children's exposure and risk assessment. *Environmental Science and Technology* 43(11): 4200- 4206.

Chatterjee, R. 2007. E-waste recycling spews dioxins into the air. *Environmental Science and Technology* 41(16): 5577-5577.

Clapp, J. 2002. What the pollution havens debate overlooks. *Global Environmental Politics* 2 (2): 11-19.

Clapp, J. 2001. Distancing of Waste: Over-consumption in a Global Economy. In *Confronting Consumption*, (eds.) Tom Princen, Michael Maniates, and Ken Conca, 155-177. MIT Press: Cambridge MA.

Clark, A., Holland, C., Katz, J., and Peace, S. 2009. Learning to see: lessons from a participatory observation research project in public spaces. *International Journal of Social Research Methodology* 12(4): 345- 360.

CNN. 2009. Sifting through the mounting problem of e-waste, CNN tech. Available online: http://articles.cnn.com/2009-08-02/tech/e-waste.recycling_1_e-waste-greenpeace-report-greenpeace-study?_s=PM:TECH

Coe, N. M., Hess, M., Yeung, H.W.C., Dicken, P., Henderson, J. 2004. 'Globalizing' regional development: a global production networks perspective. *Transactions of the Institute of British Geographers* 29(4): 468- 484.

Coe, N., Dicken, P. and Hess, M. 2008a. Introduction: global production networks– debates and challenges. *Journal of Economic Geography* 8: 267-269.

Coe, N., Dicken, P. and Hess, M. 2008b. Global production networks: Realising the potential. *Journal of Economic Geography* 8: 271-295

Cook, I. 2004. Follow the Thing: Papaya. *Antipode* 36(4): 642- 664.

Cooper, T. 2005. Slower consumption: reflections on product life spans and the 'throwaway society'. *Journal of Industrial Ecology* 9(1–2): 51- 67.

Crang, M. A., Hughes, A., Gregson, N., Norris, L. and Ahamed, U. F. 2012. Rethinking Governance and Value in Commodity Chains Through Global Recycling Networks. *Transactions of the Institute of British Geographers* (July 11). http://dro.dur.ac.uk/9248/.

Crang, M. and Cook, I. 2007. *Doing ethnographies* London: Sage.

Dedrick, J., Kraemer, K. L. and Linden, G. 2010. Who profits from innovation in global value chains? A study of the iPod and notebook PCs. *Industrial and Corporate Change*19 (1): 81–116.

Deng, W. J., Louie, P. K., Liu, W. K., Bi, X. H., Fu, J. M., and Wong, M. H. 2006. Atmospheric levels and cytotoxicity of PAHs and heavy metals in TSP and PM2.5 at an electronic waste recycling site in southeast China' *Atmospheric Environment* 40(36): 6945–6955.

Drackner, M. 2005. What is Waste? To Whom? An Anthropological Perspective on Garbage. *Waste Management and Research* 23(3): 175-181.

Dragulanescu, N. G. 2002. Social Impact of the 'Digital Divide' in a Central Eastern European Country. *The International Information and Library Review* 34(2): 139-151.

Dicken, P. 1998. *Global shift: transforming the world economy*, 3rd ed. Sage: London.

Dicken, P., Kelly, P., Olds, K., Yeung, H.W.C. 2001. Chains and networks, territories and scales: towards an analytical framework for the global economy. *Global Networks* 1(2): 89 -112.

Digital Bangladesh. 2010. Honourable Prime Minister's Speech on "Digital Bangladesh and E-governance Training Workshop", Government of the People's Republic of Bangladesh. Available online: http://www.pmo.gov.bd/index.php?option=com_content&task=view&id=408&Itemid=353

Dolan, C. S. 2007. Market affections: moral encounters with Kenyan fair trade flowers. *Ethnos* 72 (2): 239- 261.

Douglas, M. 1966. *Purity and Danger: An analysis of concept of pollution and taboo*. Routledge: New York.

European Environment Agency (EEA). 2009. *Waste without borders in the EU? Transboundary shipments of waste*. Report 24: Copenhagen.

European Environment Agency (EEA). 2008. *Better management of municipal waste will reduce greenhouse gas emissions*. Briefing No 1/2008, Copenhagen. Available online: http://reports.eea.europa.eu/briefing_2008_1/en/.

European Environment Agency (EEA). 2007. *Europe's environment -The fourth assessment.* Chapter 7.3. European Environment Agency, Copenhagen. Available online: http://reports.eea.europa.eu/state_of_environment_report_2007_1/en.

Elahi, K.M. 1989. Population Displacement due to Riverbank of the Jamuna in Bangladesh, in Clarke et al. (ed.), *Population and Disasters*. Oxford: Basil Blackwell.

Environment and Social Development Organization (ESDO). 2010. *Study on E-waste: Bangladesh Situation.* ESDO, Dhaka Bangladesh.

Fan, K. S., Chang, C. T., NI, S. P., and Lee, C. H. 2005. Transboundary hazardous waste management. Part I: waste management policy of importing countries *Waste Management and Research* 23(6): 505- 513.

Foster, R. J. 2006. Tracking globalization: Commodities and value in motion. In Tilley C. (Ed.) *Handbook of material culture.* pp. 285-302. Sage: London.

Gabrys, J. 2011. *Digital Rubbish: A natural history of electronics*, Ann Arbor: University of Michigan Press.

Gabrys, J. 2009. Sink: the dirt of systems. *Environment and Planning D: Society and Space* 27 (4): 666- 681.

Gereffi, G. 2002. Prospects for industrial upgrading by developing countries in the global apparel commodity chain. *International Journal of Business and Society* 3 (1): 27- 60.

Gereffi, G., and Frederick, S. 2010. The global apparel value chain, trade, and the crisis: challenges and opportunities for developing countries, in Cattaneo, O., Gereffi, G., and Staritz, C., (eds): *Global Value Chains in a Post crisis World: A Development Perspective*. World Bank Press, Washington DC: 157–208.

Gibbon, P., Bair, J. and Ponte, S. 2008. Governing global value chains: an introduction, *Economy and Society* 37 (3): 315–338.

Gibson, K., and Tierney, J. 2006. Electronics Waste Management and Disposal Issues and Alternatives. *Environmental Claims Journal* 18(4): 321-332.

Gille, Z. 2007. *From the cult of waste to the trash heap of history: the politics of waste in socialist and post-socialist Hungary*. Bloomington: Indiana University Press.

Glassman, J. 2011. The geo-political economy of global production networks. *Geography Compass* 5 (4): 154- 164.

Grant, R., and Oteng-Ababio, M. 2012. Mapping the Invisible and Real 'African' Economy: Urban E-waste Circuitry. *Urban Geography* 33(1): 1- 21.

Graham, S. and Thrift, N. 2007. Out of order: understanding repair and maintenance. *Theory Culture and Society* 24(3): 1–25.

Gregson, N., Crang, M., Ahamed, F., Akhter, N. and Ferdous, R. 2010a. Following things of rubbish value: end-of-life ships, "chock-chocky" furniture and the Bangladeshi middle class consumer. *Geoforum* 41(6): 846–854.

Gregson, N., Watkins, H., and Calestani, M. 2010b. Inextinguishable fibres: demolition and the vital materialisms of asbestos. *Environment and Planning A* 42 (5): 1065–1083.

Gregson, N., Crang, M., Ahamed, U.F., Akter, N., Ferdous, R., Foisal, S., Hudson, R. 2012. Territorial Agglomeration and Industrial Symbiosis: Sitakunda-Bhatiary, Bangladesh, as a Secondary Processing Complex. *Economic Geography* 88(1): 37–58.

Gregson N., Metcalfe A., Crewe L. 2007a. Identity, mobility, and the throwaway society. *Environment and Planning D: Society and Space* 25 (4): 682–700.

Gregson N., Metcalfe A., Crewe L. 2007b. Moving things along: the conduits and practices of divestment in consumption. *Transactions of the Institute of British Geographers* 32(2): 187–200.

Gregson, N., Crewe, L. and Metcalfe, A. 2005. Disposal, devaluation and consumerism: or how and why things come not to matter. Report to the Economic and Social Research Council. University of Sheffield, Sheffield UK.

Gregson, N. 2007. *Living with things: Ridding, accommodation, and dwelling.* Wantage: Sean Kingston Publishing.

Gregson, N., and Crewe, L. 2003. *Second-Hand Cultures.* Berg: Oxford.

Gregson, N., and Crewe, L. 1997. The bargain, the knowledge, and the spectacle: making sense of consumption in the space of the car-boot sale. *Environment and Planning D: Society and Space* 15(1): 87-112.

Greenpeace International. 2005. *Recycling of Electronic Wastes in China and India: Workplace and Environmental Contamination,* Greenpeace: Amsterdam.

Greenpeace International. 2008a. *Toxic Tech: Not in Our Backyard. Uncovering the Hidden Flows of e-waste,* Greenpeace: Amsterdam.

Greenpeace International. 2008b. *Poisoning the poor Electronic waste in Ghana,* Greenpeace: Amsterdam.

Grossman, E. 2006. *High Tech Trash: Digital Devices, Hidden Toxics, and Human Health.* Washington DC: Island Press.

Government of Bangladesh (GOB). 2004. *A National Strategy for Economic Growth and Poverty Reduction,* Ministry of Finance. Government of the People's Republic of Bangladesh: Dhaka.

Government of Bangladesh (GOB). 2006. *Imports and Export (Control) Act. 1950 (XXXIX of 1950),* Ministry of Commerce, Government of the People's Republic of Bangladesh: Dhaka.

Government of Bangladesh (GOB). 2008. *Import Policy Order (2006-2009).* Ministry of Commerce, Government of the People's Republic of Bangladesh: Dhaka.

Goldey, C. L., Kuester E.U., Mummert, R., Okrasinski, A. T., Olson, D., and Schaeffer, J.W. 2010. Lifecycle Assessment of the Environmental Benefits of Remanufactured Product within a "Green" Supply Chain. Presented at the *IEEE International Symposium on Sustainable Systems and Technology,* Washington DC: May 17-19.

Hay, I. 2000. *Qualitative research methods in human geography.* Oxford: Oxford University Press.

Hansen, K. T. 1995. Transnational biographies and local meaning: used clothing practice in Lusaka. *Journal of Southern African Studies* 21(1): 131-45.

Hansen, K. T. 2004. Helping or hindering? Controversies around the international second-hand clothing trade. *Anthropology Today* 20 (4): 3–9.

Hansen, K. T. 2000. *Salaula: The World of Secondhand Clothing and Zambia,* Chicago: University of Chicago Press.

Hawkins, G. 2001. Plastic bags: living with rubbish. *International Journal of Cultural Studies* 4 (1): 5–23.

Henderson, J., Dicken, P., Hess, M., Coe, N., and Yeung, H. W.C. 2002. Global production networks and the analysis of economic development. *Review of International Political Economy* 9 (3): 436–464.

Hess, M. and Yeung, H.W. C. 2006. Guest editorial: whither global production networks in economic geography? Past, present and future *Environment and Planning A* 38(7): 1193–204

Hetherington, K. 2004. Secondhandedness: consumption, disposal, and absent presence. *Environment and Planning D: Society and Space* 22 (1): 157–173.

Herat, S. 2007. Sustainable management of electronic waste (e-waste). *Clean-Soil Air Water* 35(4): 305-310.

Herat, S. 2008. Environmental impacts and use of brominated flame-retardants in electrical and electronic equipment. *Environmentalist* 28 (4): 348–357.

Hicks, C., Dietmar R., Eugster M. 2005. The recycling and disposal of electrical and electronic waste in China - legislative and market responses. *Environmental Impact Assessment Review* 25(5): 459-471.

Hopkins, T.K., Wallerstein, I. 1986. Global commodity chains in the world economy prior to 1800'*Review. A Journal of the Fernand Braudel Center* 10 (1): 157–170.

Hossain M.M. 2010. Role of technology in consumption and everyday life in rural Bangladesh. *Technology in Society* 32(2): 130–136

Hudson, R. 2008. Cultural political economy meets global production networks: a productive meeting? *Journal of Economic Geography 8 (3): 421-440.*

Hughes, A. 2000. Retailers, knowledge's and changing commodity networks: the case of the cut flower trade. *Geoforum* 31(2): 175-90.

Huisman, J., F. Magalini, R. Kuehr, C. Maurer, S. Oglivie, J. Polk, C. Delgado, E. Artim, J. Szlezak, and A. Stevels. 2008. *Review of Directive 2002/96 on Waste Electrical and Electronic Equipment (WEEE)*. Bonn: United Nations University.

Huo, X., Peng, L., Xu, X. J., Zheng, L., Qiu, K. Z., Zhang, L. B., Han, D., and Piao, Z. X. 2007. Elevated blood lead levels of children in Guiyu, an electronic waste recycling town in China. *Environmental Health Perspectives* 115(7): 1113-1117.

Industry Council for Electronic Equipment Recycling (ICER). 2005. *Status report on waste electrical and electronic equipment in the UK*, London.

Iles, A. 2004. Mapping environment justice in technology flows: computer waste in Impacts of Asia. *Global Environmental Politics* 4(4): 76-105.

International Monetary Fund (IMF). 2010. World Economic Outlook database. Available online: http://imf.org/external/pubs/ft/weo/2010/02/weodata/index.aspx

Inter-parliamentary Union. 2005. *Women in National Parliament*. U.S. Department of Labor, June 2002: p. 4. Available online: http://www.ipu.org/wmn-e/classif.htm

International Telecommunications Union (ITU) 2009. *The world in 2009: ICT facts and figures.* Available online: http://www.itu.int/ITUD/ict/material/Telecom09_flyer.pdf

Jain, A. 2006. Perspective of electronic waste management in South Asia: Current status, issues and application of 3 Rs. Promoting *Reduce, Reuse, and Recycle in South Asia,* Synthesis Report of 3R South Asia Expert Workshop, Kathmandu, Nepal, September 1.

James, M. J. 2002. Low-cost information technology in developing countries: Current opportunities and emerging possibilities. *Habitat International 26*:21-31.

James, M. J. 2001. Low-cost computing and related ways of overcoming the global digital divide. *Journal of Information Science 27*(6): 385-392.

Japan International Cooperation Agency (JICA). 2005. *Final Report on The Study on the Solid Waste Management in Dhaka City* Vol. I: Summary. JICA Japan.

Johns, J. 2006. Video games production networks: value capture, power relations and embeddedness. *Journal of Economic Geography* 6 (2): 151–180.

Kabeer, N. and Mahmud, S. 2004. Globalization, gender and poverty: Bangladeshi women workers in export and local markets. *Journal of International Development* 16(1): 93–109.

Kang, H. Y., and Schoenung, J. M. 2005. Electronic waste recycling: A review of US infrastructure and technology options. *Resources Conservation and Recycling* 45(4): 368-400.

Kaplinsky, R., and Morris, M. 2001. *A Handbook for Value Chain Research.* International Development Research Centre, Ottawa, ON.

Kaplinsky, R. and Morris, M. 2008. Value Chain Analysis: A Tool for Enhancing Export Supply Policies. *International Journal of Technology of Technological Learning* 1(3):283-308.

Kapsos, S. 2008. *The Gender Wage Gap in Bangladesh.* Asia-Pacific Working Paper Series, ILO.

Kahhat, R. and Williams, E. 2009. Product or Waste? Importation and End-of-Life Processing of Computers in Peru. *Environmental Science and Technology* 43 (15): 6010–6016.

Kahhat, R., Kim, J., Xu, M., Allenby, B., Williams, E., Zhang, P. 2008a Exploring E-waste Management Systems in the United States. *Resource Conservation and Recycling* 52(7): 955-964.

Kahhat, R., Kim, J., Xu, M., Allenby, B. and Williams, E. 2008b. 'Proposal for an e-waste management system for the United States' *ISEE '08 Proceedings of the 2008 IEEE International Symposium on Electronics and the Environment.* IEEE Computer Society, San Francisco CA.

King, A. M., Burgess, S. C., Ijomah, V., McMahon, C. A. 2006. Reducing waste: repair, recondition, remanufacture or recycle? *Sustainable Development* 14(4): 257–267.

Kenny, M. and Florida, R. 1994. Japanese maquiladoras: production organisation and global commodity chains. *World Development* 22(1): 27- 44.

Kulke, E. and Staffeld, R. 2009. Informal production systems – the role of the informal economy in the plastic recycling and processing industry in Dhaka. *Die Erde* 140 (1): 25–43.

Ladou, J. and Lovegrove S. 2008. Export of electronics equipment waste. *International Journal of Occupational and Environmental Health* 14(1): 1-10.

Lane, R., Horne, R. and Bicknell, J. 2009. Routs of reuse of second-hand goods in Melbourne households. *Australian Geographer* 40(2): 151-68.

Lepawsky, J. and Billah, M. 2011. Making chains that (un)make things: waste–value relations and the Bangladeshi rubbish electronics industry. *Geografiska Annaler: Series B, Human Geography,* 93 (2): 121–139.

Lepawsky, J. and Mather, C. 2011. From beginnings and endings to boundaries and edges: rethinking exchange through electronic waste. *Area* 43(3): 242- 49.

Lepawsky, J. and McNabb, C. 2010. Mapping International Flows of Electronic Waste. *The Canadian Geographer* 54(2): 177-195.

Leslie, D. and Reimer, S. 1999. Spatializing commodity chains. *Progress in Human Geography* 23(3): 401-20.

Leung, A., Cai, Z. W., and Wong, M. H. 2006. Environmental contamination from electronic waste recycling at Guiyu, southeast China. *Journal of Material Cycles and Waste Management* 8(1): 21–33.

Leung, A. O., Duzgoren, N.S., Cheung, K.C., Wong, M.H. 2008. Heavy metals concentrations of surface dust from e-waste recycling and its human health implications in southeast China. *Environmental Science & Technology* 42(7): 2674-2680.

Limb, M. and Dwyer, C. (ed.). 2001. *Qualitative Methodologies for Geographers* (pp. 1-22) London: Arnold.

Li, Y., Xu, X., Wu, K., Chen, G., Liu, J., Chen, S., Gu, C., Zhang, B., Zheng, L., Zheng, M. and Huo, X. 2008. Monitoring of lead load and its effect on neonatal behavioral neurological assessment scores in Guiyu, an electronic waste recycling town in China. *Journal of Environmental Monitoring* 10 (10): 1233–1238.

Li, H., Bai, J., Li, Y., Cheng, H., Zeng, E. Y. and You, J. 2011. Short-range transport of contaminants released from e-waste recycling site in South China. *Journal of Environmental Monitoring* 13 (4): 836–843.

Li, H., Yu, L., Sheng, G., Fu, J., Peng, P. 2007. Severe PCDD/F and PBDD/F pollution in air around an electronic waste dismantling area in China. *Environmental Science and Technology* 41(16): 5641–5646.

Li, J., Duan, H., Shi, P. 2011. Heavy metal contamination of surface soil in electronic waste dismantling area: site investigation and source-apportionment analysis. *Waste Management and Research 29* (7): 727-738.

Massey, D. 1984. *Spatial Divisions of Labour: Social Structures and the Geography of Production.* Macmillan: London.

Massey, D. 1994. *Space, Place, and Gender.* University of Minnesota Press: Minneapolis.

Mahbub, A.Q.M. and Islam, N. 1991. Urban Adjustment by Erosion Induced Migrants to Dhaka. in K.M. Ahmed, and M. Mafizuddin (eds.) *Riverbank Erosion, Flood and Population Displacement in Bangladesh.* Dhaka: REIS, JU.

MacBride, Samantha. 2011. *Recycling Reconsidered: The Present Failure and Future Promise of Environmental Action in the United States*. MIT Press: Massachusetts.

Marx, K. 1999. *Capital Volume 1*. Zodiac, K. H., Thurrott, A., McDorman, B., Schultz, B. and Gimenez M. transcribers Available online: http://www.marxists.org/archive/marx/works/1867-c1.

McCollough, J. 2009. Factors impacting the demand for repair services of household products: the disappearing repair trades and the throwaway society. *International Journal of Consumer Studies* 33(6): 619–626.

McIntyre, Stefanie. 2008. *Bangladesh turns waste into dollars*, Reuters UK: 5 August. Accessed on 11 August 2009 http://uk.reuters.com/news/video?videoId=88389

Miller, B. and Torr, D. J. 2003. *Developing Nations: Current Controversies*. Indiana University: Greenhaven Press.

Ministry of Science and Information Communication and Technology (MOSICT). 2004. *National Policy and Institutional Delivery Regime: A case of Bangladesh*, Section 1, Bangladesh secretariat, Dhaka, page I - LXIX.

Milgram, L. B. 2005. '*Ukay-ukay*' chic: tales of secondhand clothing in the Philippine Cordillera. In Palmer, A. and Clark, H. (eds.) *Old Clothes, New Looks: Second Hand Fashion*. Berg: Oxford, pp. 135–153.

Momsen, J. 2002. Gender and entrepreneurship in post-communist Hungary. In Rainnie, A. Smith A. and Swain, A. (eds.) *Work, employment, and transition: Restructuring livelihoods in post-communism*. Routledge: London, pp.155-70.

Mundada, M. N.; Sunil, K.; Shekdar, A. V. 2004. E-waste: a new challenge for waste management in India. *International Journal of Environmental Studies* 61(3): 265– 279.

Mwesige, G. P. 2004. Cyber elites: a survey of Internet Café users in Uganda. *Telematics and Informatics* 21(1): 83–101.

Nadvi, K. 2008. Global standards, global governance and the organisation of global value chains. *Journal of Economic Geography* 8(3): 323-43.

National Safety Council. 1999. *Electronic product recovery and recycling baseline report: recycling of selected electronic products in the United States.* Washington, D.C. National Safety Council's Environmental Health Center.

New Age. 2009. *Not all waste,* July 1.

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

Norris, L. 2005. Cast(e)-off clothing. *Anthropology Today* 21(3): 24.

Norris, L. 2010. *Recycling Indian Clothing: Global Contexts of Reuse and Value.* Indiana University Press: Bloomington.

O'Brien, M. 1999. Rubbish Power: Towards a Sociology of the Rubbish Society. In Hearn, J., and Roseneil, S. (eds.) *Consuming Cultures: Power and Resistance.* St Martin's Press: New York. pp. 262–277.

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

Oteng-Ababio, M. 2010a. Private sector involvement in solid waste management in the Greater Accra Metropolitan Area in Ghana. *Waste Management and Research* 28(4): 322-329.

Oteng-Ababio, M. 2010b. E-Waste: A New Challenge for Waste Management in Ghana. *International Development Planning Review* 32(2): 191-206.

Oteng-Ababio, M. 2012. When Necessity Begets Ingenuity: E-Waste Scavenging as a Livelihood Strategy in Accra, Ghana. *African Studies Quarterly 13(1/2):1-22.*
Parker, D. 2007. *An Analysis of the Spectrum of Re-use*. Aylesbury, Oakdene Hollins Ltd: DEFRA.

PBS. 2009. *Ghana: Digital Dumping ground.* Available online http://www.pbs.org/frontlineworld/stories/ghana804/index.html

Pellow, D. N. 2002. *Garbage Wars: The Struggle for Environmental Justice in Chicago*. MIT Press: Cambridge MA.

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

Palpacuer, F. 2008. Bringing the social context back in: Governance and wealth distribution in global value chains. *Economy and Society* 37(3): 393-419.

Qiu, B., Peng, L., Xu, X., Lin, X., Hong, J., Huo, X. 2004. *Medical investigation of e-waste demanufacturing industry in Guiyu town.* Proceedings of the International Conference on Electronic Waste and Extended Producer Responsibility; April 21–22, Beijing, China: Greenpeace and Chinese Society for Environmental Sciences; 79–83.

Ribot, J. C. 1998. Theorizing access: forest profits along Senegal's charcoal commodity chain. *Development and Change* 29 (2): 307–341.

Rock, M. 2003. Labour conditions in the export-oriented garment industry in Bangladesh. *South Asia: Journal of South Asian Studies* 26(3): 391-407.

Rouse, J., and M. Ali. 2001. Waste Pickers in Dhaka - Using the sustainable livelihoods approach. Key findings. WEDC: Loughborough, UK. Available online: www.lboro.ac.uk/wedc/publications/wpd.htm.

Schmidt, M. 2005. A production-theory-based framework for analyzing recycling systems in the e-waste sector. *Environmental Impact Assessment Review* 25(5): 505-524.

Schmidt, C.W. 2002. E-junk explosion. *Environmental Health Perspectives* 110(4): 188-194.

Schmidt, C. W. 2006. Unfair trade - E-waste in Africa. *Environmental Health Perspectives* 114(4): A232-A235.

Schmitz, H. 1999. Global competition and local co-operation: Success and failure in the Sinos Valley, Brazil, *World Development* 27 (9): 1627-50.

Sepúlveda, A., Schluep, M., Renaud, FG., Streicher, M., Kuehr, R., Hagelüken, C., Gerecke, A.C. 2010. A review of the environmental fate and effects of hazardous substances released from electrical and electronic equipments during recycling: examples from China and India. *Environmental Impact Assessment Review* 30(1): 28–41.

Shinkuma, T. and Huong N.T.M. 2009. The flow of E-waste material in the Asian region and a reconsideration of international trade policies on E-waste. *Environmental Impact Assessment Review* 29(1): 25-31.

Shinkuma, T. and Managi, S. 2010. On the effectiveness of a license scheme for E-waste recycling: The challenge of China and India. *Environmental Impact Assessment Review* 30:262–267.

Silicon Valley Toxics Coalition (SVTC). 2001. *Poison PCs and Toxic TVs: The Greatest Threat to the Environment you've never heard of,* Silicon Valley Toxics Coalition. San Jose, CA. Http://www.svtc.org

Sinha, D. 2004. The management of electronic waste: a comparative study on India and Switzerland, University of St. Gallen. Master Thesis.

Slade, G. 2006. *Made to break: technology and obsolescence in America*, Harvard University Press: Massachusetts.

Smith, T., Sonnenfeld, D. A., and Pellow, D.N. 2006. *Challenging the chip: Labor rights and environmental justice in the global electronics industry.* Temple University Press: Philadelphia.

Starosta, G. 2010a. Global commodity chains and the Marxian law of value. *Antipode* 42 (2): 433–465.

Starosta, G. 2010b. The outsourcing of manufacturing and the rise of giant global contractors: a Marxian approach to some recent transformations of global value chains. *New Political Economy* 15 (4): 543–563.

Strasser, S. 1999. *Waste and want: a social history of trash.* Metropolitan Books: New York.

Shove, E. 2003. *Comfort, Cleanliness and Convenience: The Social Organization of Normality*. Berg: Oxford.

Tang, X., Shen, C., Shi, D., Cheema, S.A., Khan, M., Zhang, C., Chen, Y. 2010. Heavy metal and persistent organic compound contamination in soil from Wenling: an emerging e-waste recycling city in Taizhou area, China. *Journal of Hazardous Materials* 173(1-3): 653-660.

Terazono, A., Murakami, S., Abe, N., Inanc, B., Moriguchi, Y., Sakai, S., Kojima, M., Yoshida, A., Li, J., Yang, J., Wong, M. H., Jain, A., Kim, I., Peralta, G. L., Lin, C. C., Mungcharoen, T., Williams, E. 2006. Current status and research on e-waste issues in Asia. *Journal of Material Cycles and Waste Management* 8(1):1-12.

Thompson, M. 1979. *Rubbish theory: The creation and destruction of value.* Oxford University Press: Oxford.

Tong, X. and Wang, J. C. 2004. Transnational flows of e-waste and spatial patterns of recycling in China. *Eurasian Geography and Economics* 45(8): 608-621.

Toxics Link India. 2003. *Scrapping the High-Tech Myth: Computer Waste in India.* Toxic Link India: New Delhi.

Toxics Link India. 2004. *E-waste in Chennai: Time is running out.* Toxic Link India: New Delhi.

Toxics Link India. 2007. *Mumbai: Choking on e-waste: A Study on the Status of e-waste in Mumbai*. Toxic Link India: New Delhi.

United States Government Accountability Office (USGAO). 2008. *Electronic waste: harmful US exports flow virtually unrestricted because of minimal EPA enforcement and narrow regulation. Testimony before the Subcommittee on Asia, the Pacific, and the Global Environment, Committee on Foreign Affairs, House of Representatives*. GAO-08-11667: Washington DC, 17 September.

United Nations Environment Programme (UNEP). 2009. *Recycling from E-waste to Resources.* UNEP DTIE: Sustainable Consumption and Production Branch, Paris: France.

Valentine, G. 2001. At the drawing board: developing a research design. In M. Limb and C. Dwyer (eds.) *Qualitative Methodologies for Geographers: Issues and Debates.* Arnold: New York.

Waste Concern. 2005. *Urban Solid Waste Management Scenario of Bangladesh: Problems and Prospects, a Technical Documentation.* June: Dhaka.

Wang, H., Han, M., Yang, S., Chen, Y., Liu, Q. and Ke, S. 2011. Urinary heavy metal levels and relevant factors among people exposed to e-waste dismantling. *Environment International* 37 (1): 80–85.

Wang, J. P., and Guo, X. K. 2006. Impact of electronic wastes recycling on environmental quality. *Biomedical and Environmental Sciences* 19(2): 137-142.

World Computer Exchange (WCE). 2000. Computers donated by hundreds in Bay area for Schools in Bangladesh, Bridging the global digital divide for youth. Available online: http://www.worldcomputerexchange.org/our-network

Weidenhamer, J. D., and Clement, M. L. 2007a. Widespread lead contamination of imported low-cost jewelry in the US. *Chemosphere* 67 (5): 961–965.

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

Weidenhamer, J. D., and Clement, M. L., 2007c. Evidence of recycling of lead battery waste into highly leaded jewelry. *Chemosphere* 69 (10): 1670–1672.

Whitson, R. 2011. Negotiating place and value: geographies of waste and scavenging in Buenos Aires. *Antipode* 43(4): 1404- 1433.

Widmer, R., Oswald-Krapf H, Sinha-Khetriwal D., Schnellmann M., Bonai H. 2005. Global perspectives on e-waste. *Environmental Impact Assessment Review* 25(5): 436- 458.

Wilson, S. and Zambrano, M. 1994. Cocaine, commodity chains and drug policies: A transnational approach, pp.279-316 in Gereffi, G. and Korzeniewicz, M. (ed.) *Commodity chains and global capitalism*. Greenwood Press: Westport CT.

Winter, M. 2003. Geographies of food: agro-food geographies–making new connections. *Progress in Human Geography* 27:505-13.

Williams, E. 2004. Energy intensity of computer manufacturing: Hybrid assessment combining process and economic input-output methods. *Environmental Science and Technology* 38:6166-6174.

Williams, E., Kahhat, R., Allenby, B., Kavazanjian, E., Kim, J., Xu, M. 2008. Environmental, social, and economic implications of global reuse and recycling of personal computers. *Environmental Science & Technology 42*(17): 6446-6454.

Wong, C. S. C., Wu, S. C., Duzgoren, N. S., Aydin, A., Wong, M. H. 2007a. Trace metal contamination of sediments in an e-waste processing village in China. *Environmental Pollution 145*(2): 434-442.

Wong, C. S. C., Duzgoren, N. S., Aydin, A., Wong, M. H. 2007b. Evidence of excessive releases of metals from primitive e-waste processing in Guiyu, China. *Environmental Pollution 148*(1): 62-72.

Wong, M. H., Wu, S. C., Deng, W. J., Yu, X. Z., Luo, Q., Leung, A. W., Wong, C. C., Luksemburg, J., and Wong, A. S. 2007c. Export of toxic chemicals—a review of the case of uncontrolled electronic-waste recycling. *Environmental Pollution* 149(2): 131–140

Wu, K., Xu, X., Liu, J., Guo, Y., Li, Y. and Huo, X. 2010. Polybrominated diphenyl ethers in umbilical cord blood and relevant factors in neonates from Guiyu, China. *Environmental Science and Technology* 44 (2): 813–819.

Xing, G. H., Chan, J.Y., Leung, A. W., Wu, S. C., and Wong, M. H. 2009. Environmental impact and human exposure to PCBs in Guiyu, an electronic waste recycling site in China. *Environment International* 35(1): 76–82.

Yang, Y., and Williams, E. 2009. Logistic model-based forecast of sales and generation of obsolete computers in the US. *Technological Forecasting & Social Change* 76(8): 1105-1114.

Yoshida, A., and Terazono, A. 2010. Reuse of secondhand TVs exported from Japan to the Philippines. *Waste Management* 30(6): 1063-1072.

Yoshida, Aya. 2011. Recyclable waste and goods trade of Mainland China. In Kojima and Michida (eds.) *Economic integration and recycling in Asia: An interim report.* Chosakenkyu Hokokusho, Institute of Developing Economics: 29-43.

Yu, X. Z., Gao, Y., Wu, S.C., Zhang H.B., Cheung, K.C., Wong, M.H. 2006. Distribution of polycyclic aromatic hydrocarbons in soils at Guiyu area of China, affected by recycling of electronic waste using primitive technologies. *Chemosphere* 65(9): 1500-1509.

Yu, J., Williams, E., JU, M. and Yang, Y. 2010. Forecasting global generation of obsolete personal computers. *Environmental Science and Technology* 44 (9): 3232–3237.

APPENDIX ONE

Questionnaire A and B

Interview number---------- Date / Time: ----------/----------

EXPLORING THE CULTURAL AND ECONOMIC VALUE OF USED COMPUTER IN BANGLADESH

I am Mostaem Billah, a graduate student of the Department of Geography, Memorial University of Newfoundland, Canada. I am doing a research entitled 'Exploring the cultural and economic value of used computer in Bangladesh'. A key component in this research is to assess information about the formal and informal business structures of 'used computers' within Bangladesh. You have been identified as a key informant. I ask for your support in this important research by completing this questionnaire. Should you have any questions or require assistance in completing the questionnaire, please do not hesitate to contact me at *mostaem.billah@mun.ca* or by telephone at 0181 7002060 and my supervisor Dr. Josh Lepawsky at *jlepawsky@mun.ca* or by telephone at709 737-3098.

A reasonable effort will be made to protect participants' anonymity and confidentiality. Reports and presentations related to this research will use pseudonyms for attributing quotations from interviews. Completed questionnaires will be stored in a secure location, kept in strict confidence and reviewed only by me and my supervisor. Your participation in this research is voluntary. You have the right to withdraw your consent to participate or request that your information be withdrawn from the study at any time without a negative consequence for you.

The proposal for this research has been approved by the Interdisciplinary Committee on Ethics in Human Research at Memorial University. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709 737 8368.

(Please note that, in accordance to the Tri Council Guidelines, Section 2.1 (c), the present questionnaire will be translated into Bengali).

Questionnaire A

Computer, Components Parts and Accessories Importers

Kw¤úDUvi, cÖavb Askwe‡kl Ges hš¿vsk Avg`vbx

Interview number----------	Date / Time: ----------/----------

EXPLORING THE CULTURAL AND ECONOMIC VALUE OF USED COMPUTER IN BANGLADESH

1. When did you start this business? (Avcwb KLb G-e¨emv ïi“ Ki‡jb)

2. How did you learn about this business? (Avcwb wKfv‡e G-e¨emv m¤ú‡K© Rvb‡jb)

3. What did you do before starting this business? (G e¨emv ïi“ Kivi Av‡M wK Ki‡Zb)

4. Are you a/an (Avcwb wK GKRb)
   □ Importer (Avg`vbx KviK) □ Whole- seller (cvBKvix) □ Retailer (LyPiv)

5. Please Check the Categories of computer and Accessories you import, Whole-sell or sell (retailing)? (Avcwb †Kvb ai‡bi Kw¤úDUvi I Kw¤úDUvi hš¿vsk Avg`vbx, cvBKvix, LyPiv mieivn K‡ib Zvi ZvwjKv)

Accessories	Category	Remarks
Computer (Brand)		
Desktop PC		
Laptop		
Mouse		
Keyboard		
CPU		
Casing		
Hard Disk		
RAM		
CD/DVD Rome		
CD/DVD Writer		
Sound Card		
AGV card		
Floppy drive		
Mother Board		
Processor		
Stabilizer/UPS		
Other		

6. Please provide the import, whole-sale and retail price mentioning the quantity/ amount? (Avcwb wK cwigvY Kw¤úDUvi Avg`vbx, cvBKvix I LyPiv wewµ K‡ib Zv D‡j-L Ki“b)

Item	Quantity/Amount	Price
Brand New Computer		
Old Computer		
Used Computer		
Refurbished Computer		
Thrown-away Computer		
Accessories of Computer		
Computer		
Desktop PC		
Laptop		
Mouse		
Keyboard		
CPU		
Casing		
Hard Disk		
RAM		
CD/DVD Rome		
CD/DVD Writer		
Sound Card		
AGV card		
Floppy drive		
Mother Board		
Processor		
Stabilizer/UPS		
Other		

7. Please provide the source of origin (country), Trade route and Ports of the following items. (Avcwb wb‡æ D‡j-wLZ DcKiYmg~n †Kvb †`k, †Kvb c‡_, †Kvb e›`‡i wb‡q Av‡mb)

Item	Source	Route			Ports	
	Country of Origin	Sea	Land	Air	Chitg.	Mongla
Brand New Computer						
Old Computer						
Used Computer						
Refurbished Computer						
Thrown-away Computer						
Accessories of Computer						
Computer						
Desktop PC						
Laptop						
Mouse						
Keyboard						
CPU						
Casing						
Hard Disk						
RAM						
CD/DVD Rome						
CD/DVD Writer						
Sound Card						
AGV card						
Floppy drive						
Mother Board						
Processor						
Stabilizer/UPS						
Other						

8. Please describe your procurement procedures in importing computers and accessories. (Kw¤úDUi, wewfbœ Ask we‡kl Gi Avg`vbx c×wZ eY©bv Ki"b)

9. Do you have any competitors? It yes please mentions the name of their country. (G- e¨vemvq †Kvb cÖwZ`Üx Av‡Q wK? hw` †_‡K _v‡K, Zv‡`i †`kmg~‡ni bvg D‡j-L Ki"b)

10. How Many Computer do you sell every month? Do you keep sales-records. (Avcwb gv‡m KZ,‡jv Kw¤úDUvi wewµq K‡ib? Avcwb wK weµ‡qi †iKW© iv‡Lb)

11. Do we import computer –waste? □ Yes □ No. (Avgiv wK Kw¤úDUvi eR© Avg`vwb K‡i _vwK? □ nu¨v □ bv)

12. If yes, please mention quantity, price, source (country of origin), trade route (air, water and land), ports (Chattigong or Mongla). (hw` nu¨v nq, D‡j-L Ki"b cwigvY, g~j¨ Drm¨ (†`‡ki bvg), evwYR¨ c_ (Rj, ¯'j I AvKvk), e›`i (PÆMÖvg I gsjv)|

13. Do you import old computer? If yes, please mention quantity, price, source (country of origin), trade route (air, water and land), ports (Chattigong or Mongla). (Avcwb wK cyivZb Kw¤úDUvi Avg`vwb K‡ib? hw` nu¨v nq, D‡j-L Ki"b cwigvY, g~j¨ Drm¨ (†`‡ki bvg), evwYR¨ c_ (Rj, ¯'j I AvKvk), e›`i (PÆMÖvg I gsjv)|

14. Do you pay any custom duty and/or any other taxes? If yes, how much. (Avcwb wK ïé I Ki cÖ`vb K‡ib? hw` nu¨v nq Zvn‡j wK cwigvY)|

15. What sort of problems / obstacles you face while importing computers (New, old, used or refurbished). (Avcwb Kw¤úDUvi Avgv`vbxi †¶‡Î wK ai‡bi mgm¨v ev evuavi m¤§yLxb nb)|

    a. b.

    c. d.

16. What is your suggestion in solving this problem? (GB mgm¨v mgvav‡bi Avcbvi civgk© wK?)|

    a. b.

    c. d.

Thank you!!!

Questionnaire B

Collection, Breaking and Recovery of Obsolete Computers and Accessories

Interview number----------	Date / Time: ----------/----------

EXPLORING THE CULTURAL AND ECONOMIC VALUE OF USED COMPUTER IN BANGLADESH

1. Why and when did you start this business? (Avcwb KLb G-e¨emv ïi“ Ki‡jb)

2. How did you learn about this business? (Avcwb wKfv‡e G-e¨emv m¤ú‡K© Rvb‡jb)

3. What did you do before starting this business? (G e¨emv ïi“ Kivi Av‡M wK Ki‡Zb)

4. Do you import obsolete computer/ accessories from foreign country? □ Yes □ No.

5. If yes please mention the country of origin, quantity/amount, trade route including ports.

6. Do you receive used or obsolete computer as charity, donation etc. If ‘yes’ please describe their source, quantity.

7. Do you collect obsolete computer/accessories (locally)? □ Yes □ No.

8. If ‘yes’ please describe the procedure of collection mentioning source, quantity.

9. Do you buy these obsolete computers? If yes how much do you pay? From where (source) do you purchase these.

10. Do you simple collect obsolete computer for breaking? If ‘yes’ how many in a day or month or year.

11. How much profit do you earn by breaking or dismantling and obsolete computer? Please explain.

12. These obsolete computers are sorted or broken or dismantling for:

- ☐ Resale
- ☐ Repair and sale
- ☐ Recovery of parts
- ☐ Recovery of precious metals (e.g. gold)
- ☐ Recovery of metals and non-metals (e.g. aluminum, plastic)
- ☐ Other uses

13. Do you recover various parts from the obsolete computer for making new electronic goods (e.g. Television)? If 'yes' please describe.

14. What sort of risk is involved in dealing with obsolete computers, please elaborate?

15. What types of precautions/ strategies do you take to ensure workers' health and safety?

Thank you!!!

APPENDIX TWO

INTERVIEW CONSENT FORM

Name of Participant _____

Department or Organization Represented _____

Research Project: *Exploring the Cultural and Economic Value of Used Computers in Bangladesh*

Researcher: Mostaem Billah, Department of Geography, Memorial University, Canada
mostaem.billah@mun.ca

Supervisor: Dr. Josh Lepawsky, Department of Geography, Memorial University, Canada
jlepawsky@mun.ca

This interview is being used to collect information as part of my MA research Thesis. Your participation is voluntary. You have the right to withdraw from the interview, to refuse to answer any question, to withdraw your consent to participate in the study or request that your information be withdrawn from the study at any time during this interview or in the future.

It is my intent to offer all participants anonymity and confidentiality. The final paper will not have direct quotes attributed to you or your organization. Upon completion of the research, the surveys, tapes and any kind of documents you provide me will be stored in a secure location for five years by me, will be kept in strict confidence and only reviewed by me and my supervisor.

By signing below you are indicating that your participation in this interview is voluntary, that you understand the purpose and conditions of this research and confirm your willingness to participate in the study.

Signature
_____**Date**_____

By signing below you are indicating your consent to take pictures and use them in presentations

Signature_____**Date**_____

By signing below you are indicating your consent to tape record this interview

Signature_____**Date**_____

The proposal for this research has been approved by the Interdisciplinary Committee on Ethics in Human Research at Memorial University. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 737-8368