Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region

Waste Electrical & Electronic Equipment Data & Management Assessment for Trinidad & Tobago

Final Project Report

EXECUTIVE SUMMARY

This report documents the outcomes of a rapid assessment executed by the Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean (BCRC-Caribbean) on the waste electrical and electronic equipment (WEEE) waste stream in Trinidad and Tobago. This study attempted to identify the local stakeholders involved in e-waste generation and management, the relationships between these stakeholders and the contribution that these stakeholders make to overall e-waste generation and management in Trinidad and Tobago. It also sought to highlight current management practices to deal with WEEE as well as the extent of stakeholder knowledge and data management with regards to this waste stream within the local context.

The study was a follow-up to and expansion of a country-wide rapid assessment undertaken by Garraway and Ott on computing equipment in 2010. The present assessment sought to widen the scope of the study and include the broad range of items that may be categorised as WEEE. In this case, the categories of the original European Union WEEE Framework Directive (2002/96/EC) were utilised in order to characterise the waste stream and its precursor electrical and electronic equipment (EEE).

Presently, WEEE generated locally is largely mismanaged as a result of a non-harmonised system to handle these wastes and the lack of facilities to adequately treat such wastes. This scenario has led to a large and increasingly complex hazardous waste stream in Trinidad and Tobago being indiscriminately disposed of in the country's waterways and landfills, and adding greatly to the issue of air, water and land pollution nationwide. Furthermore, the situation has led to the wastage of resources that have the potential to be recycled, recovered and re-used.

In the execution of this assessment, import and export data for electrical and electronic equipment (EEE) were analysed and interviews were conducted with distributors and consumers of EEE, waste collectors, and recyclers of WEEE. The data collected was presented graphically and analysed with the help of a mass flow assessment (MFA). It was found that gaps in knowledge exist across different sectors and that there are significant weaknesses with respect to data collection and management as it relates to EEE and WEEE generation.

Additionally, with a minute proportion of WEEE (less than 1%) arriving at existing e-waste management facilities in the country in comparison to national imports of EEE, there are many opportunities for improvement of the WEEE management sector, particularly for IT and telecommunications equipment and consumer appliances. The establishment of appropriate collection and advanced treatment facilities, public awareness campaigns to increase stakeholder knowledge and inclusion of e-waste legislation following revision of the existing legal framework on waste management have all been highlighted as important actions to pursue in the short-term and beyond. This study has broader application for businesses that wish to assess their internal e-waste generation, and can be used as a model for further e-waste assessments in other small island developing states (SIDS).

Based on the findings of this assessment, the BCRC-Caribbean developed a series of recommendations which, if addressed, can significantly aid in the achievement of the environmentally sound management of WEEE in Trinidad and Tobago. Some of these recommendations, presented in order of priority, include the following:

1. Establishment of a national definition for WEEE to allow for the development of a common understanding of what constitutes this waste stream among all stakeholders;
2. Revision of the regulatory framework and existing legislation and development of a national policy to adequately address e-waste as a separate waste stream for which special management is needed, and to place responsibility on manufacturers/distributors and generators to manage the waste originating from used and EoL products;
3. Training of high-level officials and port authority and customs personnel in order to strengthen their capacity to regulate and finance WEEE management activities and to control the importation and exportation of used and EoL EEE;
4. Streamlining of stakeholders with key roles in the physical management of UEEE and EoL EEE by executing a program of action items, such as training, monitoring and enforcement, and registration of informal actors in order to ensure that ESM of WEEE is achieved by all actors and their operations.
5. Execution of sector specific workshops in order to fill the gaps in knowledge of WEEE management and related issues among stakeholders and to promote a greater understanding and cooperation among stakeholders involved in e-waste management;
6. Establishment of recycling networks that facilitate relationships among consumers, local WEEE managers/waste brokers and distributors allowing for the development of take-back arrangements;
7. Establishment of community collection points where residents can drop off their UEEE and EoL EEE for safe disposal or treatment;
8. Establishment of a WEEE treatment facility (or facilities), accompanied by sound and logistical systems for collection and transportation, in collaboration with existing stakeholders involved in WEEE management;
9. Development of a comprehensive and accessible WEEE-related information hub and a national database for recording data on e-waste generated in the country in order to facilitate quantitative and qualitative WEEE assessments and to allow stakeholders to contribute and review information on a regular basis;
10. Holding of public exhibitions and awareness campaigns in order to facilitate greater awareness among the general public as well as creation of a forum whereby stakeholders involved in the management of WEEE can share their knowledge with each other and with members of the public.

These recommendations in addition to the findings of this study can provide a foundation from which a national management system for WEEE can be developed and implemented in order to achieve and harness the potential of the ESM of WEEE in Trinidad and Tobago. The work conducted here as well as that performed by previous studies provides Trinidad and Tobago with a prime opportunity to capitalise on a burgeoning global problem. Effective management of WEEE can literally procure rewards, while safeguarding the health of the nation's environment and people, in this generation and those to come. Immediate and concrete action is critical for addressing the situation.

TABLE OF CONTENTS

APPENDICES

LIST OF SELECTED ACRONYMS

BCRC-Caribbean	The Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region in Trinidad and Tobago
BFR	Brominated Flame Retardants
DTIE	Division of Technology, Industry and Economics
DWMR	Draft Waste Management Rules
EEE	Electrical and Electronic Equipment
EMA	Environmental Management Authority
EMPA	Federal Swiss Institute for Material Science and Technology
EPA	Environmental Protection Agency (U.S.)
EoL	End-of-Life
EPR	Extended Producer Responsibility
ESM	Environmentally Sound Management
EU	European Union
GoRTT	Government of the Republic of Trinidad and Tobago
HS	Harmonized System
ICT	Information and Communication Technology
ISRI	Institute of Scrap Recycling Industries
ISW/RMP	Integrated Solid Waste/Resource Management Policy
LCM	Life Cycle Management
MEA	Multilateral Environment Agreement
MEWR	Ministry of the Environment and Water Resources
MFA	Mass Flow Assessment
MOLG	Ministry of Local Government
MPPI	Mobile Phone Partnership Initiative
MSW	Municipal Solid Waste
MTI	Ministry of Trade and Industry

NGO	Non-governmental Organisation
OECD	Organization for Economic Cooperation and Development
OEM	Original Equipment Manufacturer
PACE	Partnership for Action on Computing Equipment
SAICM	Strategic Approach to International Chemicals Management
StEP	Solving the E-waste Problem Initiative
SWMCOL	The Solid Waste Management Company Limited of Trinidad and Tobago
THA	Tobago House of Assembly
UEEE	Used Electrical and Electronic Equipment
UNEP	United Nations Environment Programme
UNSD	United Nations Statistics Division
WEEE / e-waste	Waste Electrical and Electronic Equipment

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

1.1 Problem Identification

Global Scenario

In a world where the evolution of electrical and electronic equipment (EEE) seems to outpace the elimination of said equipment on becoming obsolete, waste electrical and electronic equipment (WEEE) is emerging as a growing global environmental and health problem throughout its life cycle, though with potential economic returns. While there is no standard, global definition for e-waste, it has been listed as a hazardous waste source under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Under the Convention, e-waste has been described as 'waste electrical and electronic assemblies or scrap containing components such as accumulators and other batteries, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated with Annex I constituents (e.g. cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III (e.g. explosive, flammable solids, poisonous, toxic)' (Basel Convention, 2010).

Generally, large and small appliances, IT and telecommunication equipment and consumer equipment account for about 95% of e-Waste generated (Widmer *et al.,* 2005). According to UNEP (2006), global e-waste generation is estimated at 20-50 megatons (MT) per annum, which is approximately 1-3% of the estimated global urban waste production. In developed countries, e-waste accounts for, on average, 1% of total solid waste, while in developing countries e-waste ranges from 0.1-1% of total municipal solid waste (MSW) generation (UNEP-DTIE, 2007). Presently, the main generators of e-waste are the countries of the Organization for Economic Cooperation and Development (OECD), which have highly saturated markets for EEE (Widmer *et al*., 2005). In comparison industrialized countries exhibit lower EEE market penetration rates but display the fastest growing consumption rates. This correlates well with the current large contributions of this waste stream from domestic sources, as well as the expected high outputs in the near future (ibid). China is the world's largest exporter of electronic goods (Ongondo *et al.,* 2011) as well as importer, with a reported 35 million tonnes of WEEE entering the country annually from developed countries (Yu, Ju, & Williams, 2009). Furthermore, IT and telecommunications equipment appear to be the dominant WEEE being generated in Africa, the poorer regions of Asia and Latin/South America in terms of numbers (Ongondo *et al.,* 2011). These figures may actually be gross underestimates due to stockpiling and poor record keeping.

Electrical products are ubiquitous as they play a fundamental role in modern life. However, their contents are of great concern as e-Waste contains more than 1000 different substances (Widmer *et al.,* 2005) which can be either potentially hazardous or non-hazardous to both humans and the environment (Ongondo *et al.,* 2011; UNEP-DTIE 2007), especially during the management phase. When exposed in the natural environment, the hazardous constituents can be transported via different pathways on land and through water. This includes the leaching of heavy metals and other toxic compounds into the soil and water from improperly stored and managed WEEE, thereby resulting in toxicity risks (Ogunseitan *et al.,* 2009). This ultimately affects wildlife and human health which in turn impacts upon social and economic systems. Furthermore, non-environmentally sound waste management practices during the recycling, recovery and disposal stages, including practices such as the incineration of these

products, generate and release highly toxic substances including metals, dioxins and furans, thereby causing a significant public health issue (Kimani, 2009).

Apart from the sheer speed of technological advancements and the limited facilities generally to accommodate the resulting WEEE, there are additional factors that make WEEE problematic on a global scale. These include the increased market penetration of cheap electronics in developing countries, which contributes to the growing volumes of e-waste, and the lack of political will in many countries to develop and adopt WEEE regulations to manage this valuable and hazardous waste load (Yla-Mella *et al.,* 2004).

In the European Union (EU), WEEE generation has been estimated at 5-7 million tons per annum or approximately 14-15kg per capita and is expected to grow at a rate of 3-5% per year (UNEP-DTIE, 2007). This high rate of generation has been addressed in many European countries by measures implemented to deal with the current e-waste situation. "Take-back" laws for example in Europe and in some parts of Asia legally require manufacturers to accept their "end of life" (EoL) equipment from customers after use. Focus has been placed on brown goods including computers and cellular phones and white goods such as refrigerators and air condition units. In the EU, the principle of Extended Producer Responsibility (EPR) is applied whereby producers are legally responsible for the environmental impacts of their products throughout the product's lifecycle, from resource extraction, to post-consumer stages namely recycling, recovery, reuse and disposal (Ongondo *et al.,* 2011).

Conversely, developing countries are slow to implement such policies and e-waste management remains inadequate due to a myriad of reasons. There is a general absence of proper legislation with respect to e-waste management and insufficient capacity and infrastructure to properly recycle the volumes of WEEE generated. Additionally, there is inadequate investment in recycling and disposal facilities as well as absent or ineffective take-back arrangements for EoL equipment. These factors together with a lack of awareness among consumers about the dangers of improper disposal of WEEE and the general reluctance to pay for proper disposal and recycling services makes the management of e-waste in developing countries less than successful (Ongondo *et al.*, 2011).

There is however, a positive aspect in WEEE management as it can be viewed as a valuable, tradable commodity (UNEP-DTIE, 2007). This stems from the fact that due to its varied composition EEE contains items and substances of ascribed economic value, including copper and precious metals such as gold. As such, social and economic benefits can be derived from the dismantling and extraction of the valuable components and substances of various pieces of WEEE.

Regional Scenario[1]

The issues relating to WEEE generation and management in the Caribbean region are closely in line with the e-waste issues of most of the developing world outside the region. For example, there is less than adequate capability to manage the waste that is generated. Several countries in the region do not have the financial and/or technical resources to adequately address the growing quantities of e-wastes generated in the region. While few of the Caribbean nations have e-waste disposal services available through private sector waste broker initiatives, these are limited to the collection and off-island disposal of such equipment through largely unregulated bulk shipping to scrap metal and e-waste recyclers in other parts of the world.

There is also little knowledge on the regional quantities being generated due to the absence of country specific assessments on e-waste. In countries such as Barbados (Armstrong, 2013), Suriname (Abdoelrazak, 2013) St. Vincent and the Grenadines, St. Lucia, St. Kitts and Nevis, Grenada and Dominica (Lay, 2013), no formal assessments on e-waste have been conducted and as such it is difficult to quantify the volume of e-waste that is generated regionally.

Another issue in the Caribbean region is that there is a lack of understanding of what constitutes WEEE and of the impacts of improperly managed WEEE on human health & the environment. While some countries such as Antigua and Barbuda, Barbados and St. Kitts and Nevis have public awareness campaigns that include television and radio awareness programmes, public service announcements and newsletters (Lay, 2013), such public awareness initiatives are either absent or poorly targeted in other Caribbean countries. As a result, the majority of the generators remain largely unaware of the consequences of improper disposal and these wastes either end up in landfills, which do not possess the capacity to accommodate such materials, or are improperly stockpiled in a myriad of locations.

In many instances, WEEE is disposed of in bulk, together with the regular solid waste stream. While in St. Kitts and Nevis there is segregation of this waste stream, such segregation is non-existent in countries such as St. Lucia and Grenada (Lay, 2013). In Suriname, for example, illegal dumping of bulky wastes, inclusive of e-waste, along roadsides and in landfills continues to be a major waste management issue (Abdoelrazak, 2013). Consequently, there is little recovery in these countries and a great deal of wastage of the resources contained within.

While the lack of public awareness is a key contributing factor to the improper disposal of WEEE in many Caribbean states, the absence of appropriate legislation applicable to WEEE plays an equally important role in the current scenario. All of the Caribbean countries currently possess general laws and regulations pertaining to solid waste and/or environmental health management, which either do not encompass or specifically address WEEE management. WEEE-specific regulations are needed throughout the region, as is recognised by the National

[1] The information in this section were obtained from presentations made at the BCRC-Caribbean PACE Workshop for Capacity Development in the Environmentally Sound Management of Waste Electrical & Electronic Equipment in the Caribbean, held from 9th to 11th July, 2013 at the Hyatt Regency Hotel and Conference Centre in Port-of-Spain, Trinidad and Tobago. The presentations are available online at: http://bcrc-caribbean.blogspot.com/2013/07/presentations-from-bcrc-caribbean.html.

Solid Waste Management Authority of Jamaica which is reportedly developing regulations specific to the e-waste issue (Morrison, 2013).

There is therefore much room for improvement of WEEE management in the Caribbean region. Given the small size of many islands, it is important that steps to manage e-waste in an environmentally sound manner be taken in order to mitigate the negative impacts on human health and the environment.

Local Scenario

In Trinidad and Tobago, there is no enforced legislation for the proper disposal and management of WEEE, resulting in its dispersed, un-coordinated and wholly inadequate management. A series of information, communication and technological advancements over the last decade have occurred concurrently with the nation's economic growth and development. These activities have led to an increased presence of EEE in the country and subsequent generation of WEEE, thereby altering the waste landscape in a relatively small space of time (Garraway & Ott, 2010). Some of the relevant macroeconomic initiatives and trends positively affecting the generation of WEEE have included:

- The liberalisation of the telecommunications sector in 2006, especially in the provision of voice and data services;
- The development of the information and technology services sector which has been associated with increased commercial growth and business activities during the last 10 years and has included initiatives to support network readiness. Network readiness refers to the ability of an economy to engage in the digital world based on a range of Information and Communication Technologies (ICT) capacities (Bilbao-Osorio, Dutta & Lanvin, 2013);
- The development of an electronic Government Portal and online services for the conduct of Government business;
- The annual provision of laptops to students entering the secondary school system upon completion of the Secondary Entrance Assessment Exam since the year 2010. Hewlett-Packard (HP) was awarded a contract to supply laptops with 55,000 being distributed from 2010-2011 (Pickford-Gordon, 2012).

A 2010 waste characterisation study conducted on the waste delivered to Trinidad's four landfills by CBCL Limited, failed to effectively identify and, by extension, quantify the WEEE levels for the country. While this paucity of data creates an incomplete picture, making it difficult to comprehensively asses the local WEEE situation, a 2010 rapid assessment conducted on personal computers in Trinidad and Tobago by Garraway & Ott and the Federal Swiss Institute for Materials Science and Technology (EMPA), indicated that for 2008 alone approximately 30,000 computers became obsolete, which corresponds to approximately 500 tons of computer waste or around 0.40 kg per capita. This exceeded computer waste generation levels in countries like Colombia, Uganda and China and the obsolescence quantity is expected to double by 2014 (Garraway & Ott, 2010). Statistics on the quantity of computers imported annually from 1994 to 2010 revealed a trend of overall growth as seen in Figure 1.

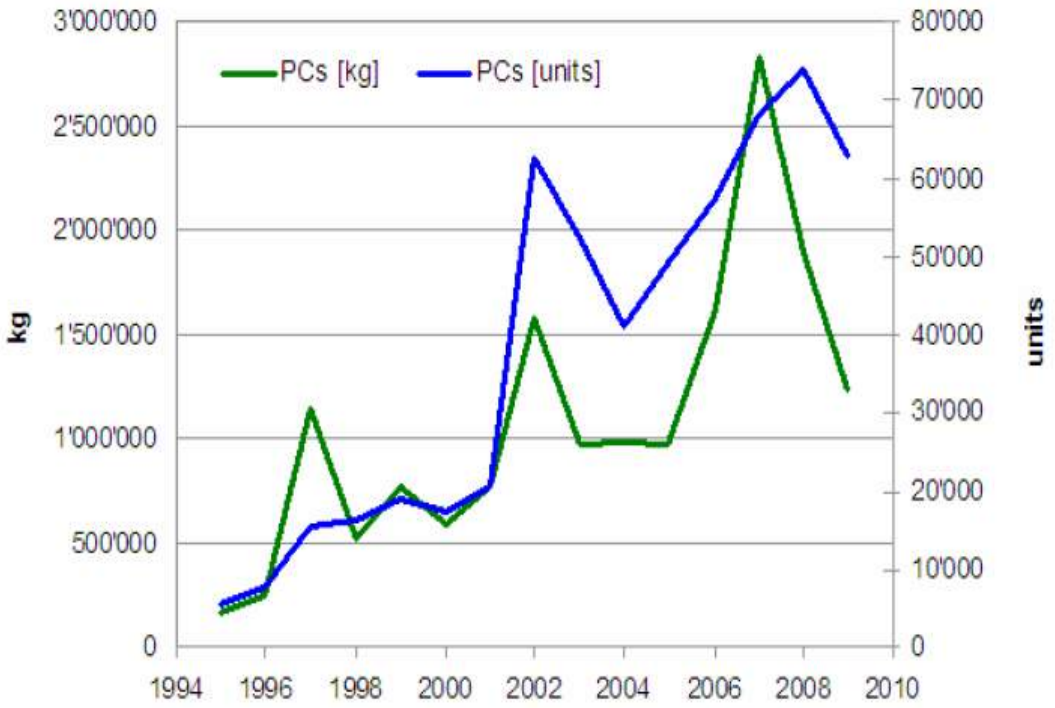

Figure 1: Imported computers (desktops and laptops) into Trinidad and Tobago
Source: Garraway & Ott, 2010

Additionally, ICTs have been playing an increasingly important role in the nation. According to the Telecommunications Authority of Trinidad and Tobago (2012) mobile services continued to record the highest penetration rate of 138.6 per 100 inhabitants, followed by the internet with a rate of 24.7, whilst the internet and subscription TV markets experienced increases in their penetration for the period 2007-2011. These statistics point to a growing technologically based society with undoubted increases in the usage of EEE. These facts taken in conjunction with the findings of the Garraway & Ott (2010) study imply that, by extension, there is a growing rate of WEEE generation. It is essential to have a proper regulatory framework in place to ensure the environmentally sound management of the growing quantities of e-waste.

To address the issue of growing quantities of e-waste generated locally, appropriate methods of treatment and disposal are required. However, the first step towards achieving this would be to gain an understanding of the e-waste landscape and the volumes of waste that must be dealt with. This study attempts to do so via a rapid assessment of several categories of WEEE in Trinidad and Tobago, while attempting to understand the factors that would influence a full national assessment of WEEE, and, by extension, the development of a national strategy and system for treating with this waste stream. The WEEE management strategy can complement existing legislation and can also provide inputs to facilitate the development of new legislation specific to e-waste management in the country. It may also provide a basis following revision and adaption, to define the framework for a similar system in the region.

1.2 Project Objectives

Given the shortfalls in the data set and general lack of knowledge of the WEEE situation, the Basel Convention Regional Centre for the Caribbean (BCRC-Caribbean), embarked on a study to develop an understanding of the existing data sets and current generation and flows of EEE and WEEE in Trinidad and Tobago. The ultimate goal of this data collection and evaluation would be to contribute towards the development of a national strategy for WEEE management.

The specific objectives of the study include:

1. To collate and evaluate data and information pertaining to the generation and flows of EEE and WEEE in Trinidad and Tobago;
2. To assess the various mechanisms currently employed in collecting and managing data and information pertaining to the flows of EEE and WEEE in the country;
3. To assess the current status of used and EoL EEE management in the country among various stakeholders;
4. To evaluate the roles and relationships among stakeholders in WEEE management and quantify their contributions to WEEE generation;
5. To assess the national system for WEEE management through the data and information gathered and develop recommendations through which the system can be enhanced in order to ensure the ESM of WEEE and to capitalise on local opportunities associated with WEEE management.

1.3 Project Scope

As there is no generally accepted definition for the term 'e-waste' (Widmer *et al.,* 2005), the European Union (EU) Framework Directive was used as the main reference for the definition of WEEE under this project. The Directive refers to electrical or electronic equipment which is waste, that is "any substance or object which the holder disposes of or is required to dispose of pursuant to the provisions of national law in force, as well as all components, sub-assemblies and consumables, which are part of the product at the time of discarding" (EU, 2002). The following categories of WEEE as outlined under the Directive were applied to the study:

1. Large household appliances
2. Small household appliances
3. IT and telecommunications equipment
4. Consumer equipment
5. Lighting equipment
6. Electrical and electronic tools

7. Toys, leisure and sports equipment
8. Medical devices
9. Monitoring and control instruments
10. Automatic dispensers

The intent of assessing all of these categories was to garner a comprehensive understanding of a range of this particular waste stream within the country and to move away from the focus on one major category.

2.0 BACKGROUND

Electronic waste has been described as a 'double'-edge sword' (Zumbuehl, 2006) as there are both negative implications for humans and the environment if there is mismanagement as well as positive attributes via the potential for economic returns through the recovery of valuable resources from these pieces of equipment. This section seeks to provide a balanced review of these opposing issues by exploring both sides of this topic.

2.1 Issues with WEEE

2.1.1. Dangerous Components

On average, when comparing the contributions by weight of various components of e-waste, iron and steel predominate with just under 50%, followed by plastics (21%) then non-ferrous metals including precious metals with 13% (Widmer *et al.,* 2005), as shown in figure 2 below.

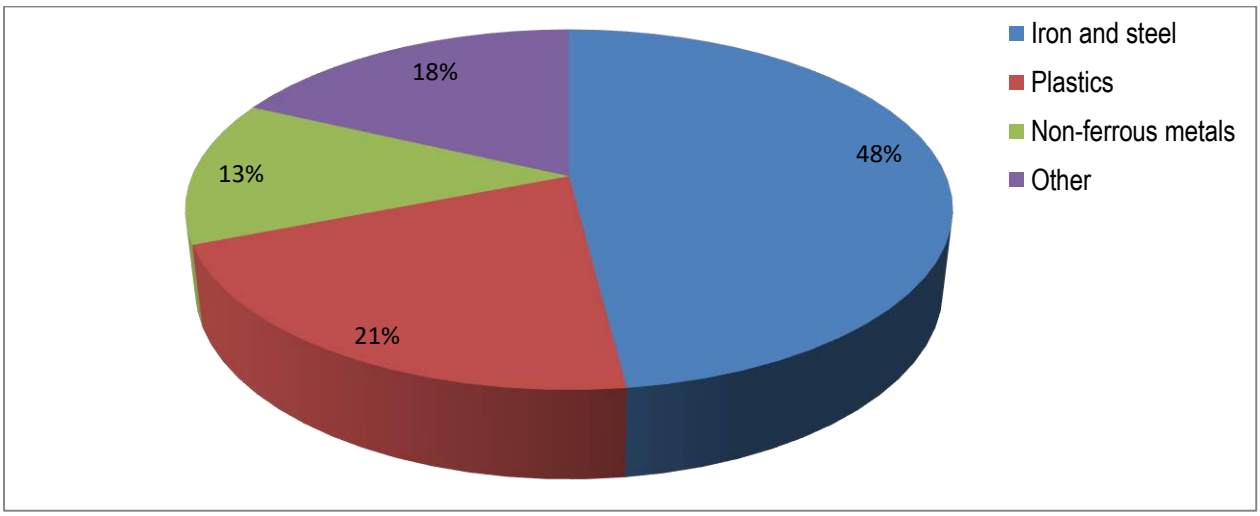

Figure 2: Contributions by weight of various components of e-waste.

Other components like cable, screens, circuit boards as well as some hazardous substances form the outstanding share. While it has been argued that the quantities of hazardous components have seen a steady decline over time, (Widmer *et al.,* 2005), for many of the chemicals little is known about their toxicity and environmental properties (Lundgren, 2012). Below highlights some of the major categories of hazardous components found in e-waste streams and the risks they pose.

Heavy metals

Lead, cadmium and mercury are three prominent heavy metals contained in e-waste. Lead can be found in cathode-ray tubes (CRTs), computer monitors and circuit boards, cadmium in plastics, semiconductor chips and older CRTs and mercury in thermostats, flat screen backlights, medical equipment and mobile phones (Boeni, *et*

al., 2008; Puckett & Smith, 2002). Based on a report of the European Commission, 40% of the lead found in landfills derives from consumer electronics (Commission of the European Communities, 2000 as cited in Zumbuehl, 2006). These heavy metals are linked to brain and kidney damage in humans, and accumulate in other living organisms and the environment with negative implications.

Brominated flame retardants (BFRs)

According to Puckett and Smith (2002), more than 50% of the BFRs used in electronics consist of tetrabromobisphenol A (TBBPA) while 10% is polybrominated diphenyl ethers (PBDEs). These flame retardants are found in circuit boards and in the plastic casings of electronics. They produce dioxins when burnt (Widmer *et al.,* 2005) and this group of chemicals are dangerous to human health. PBDE in particular is regarded a persistent organic pollutant (POP) and regulated under the Stockholm Convention.

Other halogenated hydrocarbons

This category includes polyvinylchloride (PVC) and chlorofluorocarbons (CFCs). PVC is found in wire insulation and computer houses (Puckett & Smith, 2002) while CFCs can still be found in some refrigerants used in electrical cooling appliances. As with BFRs, toxic dioxins and furans are created from these substances when plastic components of WEEE are burnt (Lundgren, 2012).

Rare earth elements

Rare earth elements include Americium and Europium. Americium is used in smoke detectors and persons can be exposed to the primary isotope, Am-241, by inhalation of americium-contaminated dust during dismantling or burning (EPA, 2012). The primary health concern is tumour formation caused by the radiation emitted by the isotopes. Europium can be found in the tubes of televisions and is linked to increased risk of developing liver and bone cancer (Peterson *et al.,* 2007).

2.1.2. Health & Safety Issues

Workers and local residents directly involved in or in close proximity to recycling and incineration activities can be exposed, via inhalation, dust ingestion, oral intake and skin exposure (Lundgren, 2002), to the hazardous materials contained in e-waste. Exposure-related health risks include respiratory problems such as silicosis (Lepawsky & McNabb, 2010), pneumonitis and respiratory irritation (Yu *et al.,* 2006), dermal diseases, eye irritations, stomach disease (Raghupathy *et al.,* 2010, Nordbrand, 2009), and brain damage and cancers in the medium to long term (Puckett and Smith, 2002).

Additionally, workers are at risk of occupational hazards such as electric shocks (Prakash & Manhart, 2010) and implosion when handling CRTs due to the vacuum inside the tubes. Chemical splashes, flying particles and radiant heat are further dangers workers are exposed to (Lundgren, 2012).

The likelihood of these health and safety risks occurring is exacerbated by the lack of protective gear worn by workers particularly in developing countries and the informal sector. Boeni *et al.,* (2008) has indicated several studies have highlighted the underprivileged as the main entities responsible for dismantling of EEE usually without occupational health and safety measures. The absence of sanitary facilities and practices is also an issue in the developing world. According to Widmer et al. (2005), persons involved in the e-waste sector in developing countries are either unaware of the health risks associated with the dismantling and processing of e-waste and/or have limited financial resources to invest in adequate precautionary measures.

2.1.3. Environmental Issues

Some of the components of WEEE, such as the heavy metals, accumulate in living organisms and the environment. Lead for example, accumulates in the environment and has high acute and chronic effects on the biota. Mercury accumulates in organisms and concentrates up the food chain (Puckett and Smith, 2002). In addition to bioaccumulation and biomagnification, long distance transport of some substances has been observed leading to contamination, habitat degradation and the decline in biological diversity and populations in even remote areas.

Leaching and surface runoff of harmful toxins contained in e-waste are issues especially at landfill sites and recycling/processing facilities. Pollution of aquifers, streams and rivers is therefore likely when WEEE related activities take place near to these water courses. According to Laissaoui & Rochat (2008), heavy metals that are mobile are transferred to the groundwater and plants, posing a threat to biological populations, while those metals that are immobile can cause irreversible soil contamination.

Pollution resulting from e-waste related activities is not limited to land and water. When burning occurs, harmful dioxins and furans are released polluting the surrounding air. This has negative implications for organisms breathing in these substances. In short, indiscriminate e-waste dumping and processing activities results in an overall decline in environmental quality, resulting in habitat loss and the decline of biodiversity and natural populations.

2.1.4. Socio-economic Issues

In an attempt to bridge the “digital divide” across regions, EEE in either new or used form has been exported in significant quantities as donations, or otherwise from developed to developing and transition countries. There have however, been accusations that such exports are allegedly covert attempts to dispose of unwanted toxic WEEE, as for instance in some cases the EEE exports to Africa are not even pre-tested for functionality (Ongondo

et al., 2011). It is estimated that this dumping of e-waste has led to the creation of a digital dump with a global total of about 180 million units discarded per year (Osibanjo, 2011). Furthermore, such exports have bolstered informal e-waste recovery and recycling activities, which have supported the activities that produce the negative implications for human health and safety previously mentioned.

2.1.5. Implications for Material Cycling

The issue of stockpiling of WEEE occurs for a number of reasons globally. However, the practice resonates even more so in the United States of America, the outcome of which is the inability of valuable resources to re-enter the materials cycle, thereby encouraging further mineral extraction and environmental destruction from the direct effects of mining, manufacturing, transport and energy use in the creation of a new product (Ongondo *et al.,* 2011). So critical is this issue of resource depletion and access to natural deposits, that the EU has created a list of what they deem to be ‘‘potentially critical’’ raw materials.

2.2 Benefits of WEEE

2.2.1. Socio-Cultural

In some countries, such as Morocco, local artistes use e-waste material to produce artwork (Laissaoui and Rochat, 2008). The created artwork can be sold for aesthetic purposes or for functional purposes. Two examples of such e-waste based artwork can be seen in Figure 3 below.

(a) Cityscape created by Italian artist Franco Recchia using old computer parts.

(b) Seating created by Chilean artist Rodrigo Alonso using keyboards, motherboards and wiring.

Figure 3: Examples of artwork created from electronic waste components. Sources: (a) Recchia, 2012; (b) Alonso, 2012.

The pieces of artwork produced are typically a manifestation of the available materials and the talent of the artist(s). Therefore, it not only allows old, discarded WEEE components to be incorporated into something

aesthetically pleasing or useful but it highlights the artistic talent present while supporting the development of this sector through revenue generation. Some pieces may be sold for as much as $995 US (Heimbuch, 2010), providing a significant source of income to these artists.

2.2.2. Economic

E-waste related activities can act as a source of income to persons via the sale of transformed e-waste material as mentioned above, or via employment in the e-waste management sector. Jobs exist for sorters, recyclers, dismantlers, transport operators and so forth. This has led to the evolution of an entirely new economic sector, so much so that companies such as Boliden (Sweden), WEEE AS (Norway) and Citiraya (UK) are seeing the merit in this waste stream and making investments (Widmer *et al.,* 2005). In addition, TES-AMM of Singapore and Sims Recycling Solutions, originally of Australia, are two major recycling companies that have realized the economic potential of large-scale e-waste recycling and recovery and offer these services on a global scale.

The creation of low and semi-skilled jobs in the e-waste management sector can help to curb unemployment and improve economic prosperity especially in the developing world. Prakash and Manhart (2010) report that, in Ghana, about 20,000 – 33,000 persons, which constitutes 0.19-0.32% of the total labour force, may be employed in the e-waste refurbishing and recycling sector. They also assume that about 1-1.7% of the total urban population are either partially or fully dependent on refurbishing and e-waste recycling operations. The monthly incomes earned by collectors, refurbishers and recyclers in Ghana were estimated by Prakash and Manhart (2010) to be within the ranges of $US 190-250, 70-140 and 175-285 respectively.

It was stated in the same study that more and more Ghanaians opt for employment in the e-waste recycling sector rather than agriculture, for example, as there is a regular flow of cash due to the high demand for recovered materials and the continuous inputs of e-waste (Prakash and Manhart, 2010). There is indeed an increasing demand for scrap metals in many other countries across the globe. These countries are markets for the increasing quantities of e-waste generated globally, and thus represent an economic opportunity for exporting states. Importing states stand to benefit as well from recycling the received e-waste and their components.

Proper recycling and recovery activities can reduce input costs since the need for raw materials in the manufacture of electronics can potentially be lowered. This of course also represents an additional business opportunity for local and foreign investors, especially in the recovery of precious metals from e-waste (Osibanjo, 2009), as there is the opportunity to partake in the lucrative e-waste transboundary trade industry (Lau *et al.,* 2013).

An example of such a company is Super Dragon Technology Company Limited in Taiwan, which has recognized the economic value of e-waste recovery. With a gold and precious metal recovery facility in Taiwan, the company is primarily involved in the refining and sale of precious metal such as gold and silver, recycling, and the treatment of mixed waste metals (figure 4). The Company's refined precious metal products include gold, silver, iron, copper and aluminium. Furthermore, they also utilise the recycled plastic and other non-metallic components in order to create new materials such as their own personalised non-metal manhole covers and construction material and

artwork. The material flows from imported WEEE works further to act as a highly coveted supply to appease the demand for affordable, second-hand EEE in several emerging economies.

Figure 4: Images of the Super Dragon Technology Company Limited plant facility and refined gold products and construction products developed using materials from e-waste components

2.3 The Case for and Actions towards the Environmentally Sound Management of WEEE

The aforementioned issues demonstrate the duality of the electronic waste stream. While attempts to manage WEEE may be the source of several risks to human and environmental health, it is also critical in order to secure the livelihoods of individuals involved in such activities while ensuring that their finite resources are protected and not squandered. With this being the scenario presented to waste managers and other stakeholders all over the world, the only option remaining for this waste stream is to balance both the threats and the potential benefits through augmenting and ameliorating current management practices addressing this waste stream at all scales.

Armed with this awareness on the dichotomous nature of WEEE, efforts have been made by international bodies to effectively treat with the problem. The primary authority for global environmental governance, the United Nations Environment Programme (UNEP), has increasingly integrated the issue of electronic wastes throughout its far-reaching global environmental agenda. The primary global-level initiative towards the management of WEEE is the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal. This is a legally binding international environmental agreement which was adopted in 1989 and seeks to control the transboundary movement of hazardous waste and encourage its environmentally sound management (ESM) in order to protect human health and the environment (Basel Convention, 2011).

The Parties to the treaty have formed private sector partnerships in an attempt to achieve the ESM of WEEE. The first of these was the Mobile Phone Partnership Initiative (MPPI) formed between the world's top mobile phone manufacturers and signatories to the Basel Convention. It aimed to promote reuse, collection, proper transboundary movement, recovery and recycling of EoL mobile phones and awareness raising and training. In

2008 the second partnership with similar aims, but this time however, working towards the ESM of EoL computers, known as the Partnership for Action on Computing Equipment (PACE) was formed.

Another environmental convention for which the toxicity issues associated with WEEE management and disposal is also a concern is the Stockholm Convention on Persistent Organic Pollutants (POPs). This Convention seeks to eliminate the use of POPs that are contained in EEE such as tetrabromodiphenyl ether (TetraBDE) and pentabromodiphenyl ether (PentaBDE), two BFRs that are widely utilised in their production (UNEP, 2009). It also addresses the release of unintentionally produced POPs which can be generated through improper WEEE management practices such as the incineration of these equipment and components. In this respect, Parties to the Convention must ensure that articles containing these substances are only recycled and disposed of via practices deemed as environmentally sound and that exports of such items be limited to the amounts permitted within its borders.

Other international initiatives under which the e-waste management issue has been prioritised include the Strategic Approach to International Chemicals Management (SAICM). Under SAICM, seven emerging policy issues have been highlighted; of which the presence of hazardous substances within the life-cycle of electrical and electronic products is one focal area. The Global Plan of Action has identified work in the areas of green design, environmentally sound manufacturing and awareness-raising for e-products, as well as the identification and compilation of a host of international best practice resources within this field (SAICM, 2013).

The Solving the e-Waste Problem (StEP) intiative is also aimed at tackling the e-Waste problem via a multi-stakeholder approach. Its main objectives are to optimize the lifecycle, utilisation and re-use of EEE and to increase awareness on the disparities in the digital divide as well as general EEE knowledge (StEP, 2013[a]). To this end there are five taskforces: policy, re-design, re-use, recycle and capacity building, with specific attention being focused on these respective areas on a local and international scale (StEP, 2013[b]).

Efforts have also filtered down to the regional and, by extension, the national levels, as is observed in the EU where action has been directed towards various phases of the product's life cycle. The Restriction on Hazardous Substances (RoHS) Directive prohibits new EEE containing more than agreed levels of certain hazardous substances such as lead, cadmium, mercury and certain flame retardants from being placed on the EU market. Alternatively, the Energy Using Products Directive has a framework geared towards the establishment of stipulations for EU eco-design so as to facilitate the unrestricted flow of these products within the EU market. The WEEE Directive focuses on the final-stage of the product and includes measure that mandates manufacturers and importers in the EU member states to take back their products post-consumption and guarantee the use of environmentally sound methods for disposal (Widmer *et al.,* 2005). As such the objective of the WEEE Directive is two-fold (Official journal of the European Union, 2003, pp. 24-38):

i. As a first priority, the Directive aims to prevent the generation of WEEE
ii. Additionally, it aims to promote reuse, recycling and other forms of recovery of WEEE so as to reduce the disposal of waste

Environmental non-governmental organisations (NGOs) have also taken up the mantel in the fight against improper handling and management of e-waste, with one of the frontrunners in this regard being the Basel Action

Network (BAN). The organisation is a global advocate against illegal trade in toxic waste streams. It has among other activities, established a certification standard, 'e-Stewards', to encourage the use of responsible and best practices in the recycling of e-waste (BAN, 2010).

There are of course additional schemes, networks and organisations working towards the ESM of WEEE, however, these highlighted here are the key players on the global stage.

3.0 OVERVIEW OF THE CASE

3.1 Trinidad and Tobago Development Indicators

Trinidad and Tobago is a twin-island republic situated in the southernmost archipelago of the West Indies. The country has a population of 1.3 million people with a population growth rate of 0.09% (CIA, 2013). The nation is well endowed with a range of human and natural resources, the status of which is constantly evolving.

3.1.1. Economy

The World Bank estimated the GDP of Trinidad and Tobago to be US $23.99 billion in 2012. For the same year, the GNI per capita was estimated at US $14,400. These figures give the country a "high income" status (World Bank Group, 2013a).

The economy of Trinidad and Tobago is largely dependent on the country's oil and natural gas resources. With petroleum gases and refined petroleum oils constituting 34% and 17% of exports respectively in the year 2010 (Observatory of Economic Complexity, 2011), the petrochemical sector is one of the main contributors of foreign revenue to the country's economy. Moreover, these rich supplies categorise the country as the main producer of oil and natural gas in the Caribbean (MEEA, 2011) as well as provides such lucrative returns that the nation is considered to be the most industrialised economy of the English-speaking Caribbean (Artana *et.al,* 2007). Tourism also plays a major role, though more prominently on the island of Tobago, in bringing in foreign exchange.

In addition to products from the petrochemical industry, Trinidad and Tobago exports agricultural commodities such as cocoa, sugar and coffee, which Singh *et al*. (2005) reports to be on the decline, as well as vegetables and citrus fruits. Trinidad and Tobago exports mainly to the United States, countries within the Latin America and Caribbean region, and the United Kingdom (Observatory of Economic Complexity, 2011).

Imported commodities include motor vehicles, electrical and electronic equipment and other manufactured goods. These imports come mainly from the United States, China, Japan, South America and the United Kingdom (Observatory of Economic Complexity, 2011).

3.1.2. Society

Literacy

According to statistics from the World Bank Group (2013b) and United Nations Statistics Division (2012), as of 2010-2011, both male and female youth literacy rates stood at 100%. Meanwhile, the World Bank Group (2013b) reports adult literacy rates to be 99% for males and 98% for females for the period 2005-2011.

Enrolment rates

In 2010, the net enrolment ratio[2] in primary education was 94 for both boys and girls. In 2004, the net enrolment ratio in secondary education stood at 70 for males and 66 for females. Finally, with respect to tertiary enrolment, in 2005 the tertiary gross enrolment ratio[3] was 13 for men and 10 for women (United Nations Statistics Division [UNSD], 2012).

Enrolment rates are useful to consider as they roughly indicate the student populations that must be catered for by the country's information technology base. Assuming that as enrolment increases, the employment of IT equipment increases to accommodate the increase in student population size, IT purchase or usage rates in the education sector can be inferred from trends in enrolment rates.

Employment

According to statistics provided by the Central Statistical Office (CSO) and included in the Review of the Economy report for 2010 (GoRTT, 2010), there was a decline in the unemployment rate from the year 2004 to the year 2008, after which an increase was observed in 2009. However, unemployment rates were not uniform across all sectors. Statistics for the second half of 2009 and the second half of 2010 show that unemployment rates were observably the highest in the Sugar Industry especially in 2009. Lower rates of unemployment were observed for Transport and Storage, and Finance, Insurance, Real Estate and Business Services.

As of 2010, the percentage of the population unemployed in Trinidad and Tobago was estimated to be 5.3% (UNSD, 2013). This figure represents a reduction from 8% in 2005 and indicates that more persons had a source of disposable income, which they could spend on cheap electronics and the latest technologies if they so desired.

However, in his feature address at a Trinidad and Tobago Industry and Commerce Luncheon Meeting, the Central Bank Governor of Trinidad and Tobago, indicated that the unemployment rate had increased from 4.2% in December 2011 to 5.4 % in the first quarter of 2012 (Rambarran, 2012).

It is estimated that about 62.9% of the population is involved in the service industry, followed by 20.4% employed in construction and utilities, another 12.8% engaged in manufacturing, mining and quarrying and a meagre 3.8% in agriculture (CIA, 2007). Booming sectors can be determined from the distribution of the country's workforce and, similarly, opportunities for employment can be identified in less explored sectors, such as the e-waste management sector.

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[2] The net primary (secondary) school enrolment ratio refers to "the number of children enrolled in primary (secondary) school who belong to the age group that officially corresponds to primary (secondary) schooling, divided by the total population of the same age group" (UNICEF, n.d.).

[3] The gross tertiary enrolment ratio is defined as the "ratio of total enrolment in tertiary education, regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving." (World Bank Group, 2013c).

Access to ICT

Telephone subscriptions and internet usage are indicators of access to information and communications technology. On observing the trends in the total number of telephone subscribers per 100 inhabitants, there was a fourfold increase from 37.1 to 163.1 over the period 2000-2010 (UNSD, 2013). With respect to internet users per 100 inhabitants, there was a six fold increase from 7.7 to 48.5 over the same period (ibid). These statistics reveal that the number of persons with access to technology has been on the rise since 2000.

3.1.3. Environment

Trinidad is a heavily industrialised country, with economic activities in the ammonia, iron, steel, cement and light manufacturing industries. These industries as well as small and medium enterprises, rising urbanisation and constant infrastructural developments are the main sources of air, water and land pollution. This coupled with the growing demand for goods and services, leads to the generation of greater quantities of waste, which is of course inclusive of WEEE. The fact that Trinidad and Tobago is such a small country, measuring 5120 km^2 in area (UNSD, 2013), exacerbates the pollution problem as there is limited land mass for waste disposal.

Added to limited land availability is the fact that the country continues to use outdated solid waste disposal systems with no municipal facilities to accommodate electronic and other hazardous waste. The primary means of solid waste disposal is landfilling. The landfills are situated in close proximity to residential areas (Garraway & Ott, 2010) and many of them have reached or exceeded their operating timeframe.

There is in existence three public landfills in Trinidad, namely Beetham, Forres Park and Guanapo that are managed by the principal waste management body, The Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL). Additionally, there is a landfill in Tobago, at Studley Park, which is under the directive of the Tobago House of Assembly and has long exceeded its lifespan. According to SWMCOL (2007), none of these landfills were designed for the storage and environmentally sound management of hazardous waste. The Beetham Landfill for instance which currently serves as the country's largest waste disposal site, comprising 61 hectares and receiving more than 54% of the country's waste (Singh *et al.,* 2009), is an unlined facility situated on wetlands and at the northern edge of the Caroni swamp, the largest mangrove swamp in Trinidad (Mohammed, 2010). The proximity to such fragile ecosystems undeniably amplifies the pressure the environment has to contend with.

The regulating authority for the environment, the Environmental Management Authority (EMA), has established and revised draft Waste Management rules, however specific legislation addressing e-waste dumping and mismanagement is still non-existent. Lax monitoring also allows unauthorised disposal of waste and hazardous materials by private individuals and organisations into landfills and waterways to go undetected and without the incurrence of penalties.

3.2. Legal & Institutional Framework

3.2.1. Legislative & Policy Frameworks & Mechanisms

The National Environmental Policy (NEP), first adopted in 1998, then revised in 2005, is the umbrella policy that provides the overarching environmental policy directives for Trinidad and Tobago. The Policy's goal is environmentally sustainable development or a balance between economic development and environmental use that neither compromises, but rather enhances the quality of life of current and future generations. The NEP (2006) outlines five principles that are to be used to guide the government's environmental policy:

1. Respect and Care for the Community of Life
2. Keep within the Country's Carrying Capacity
3. Empower Communities to Care for their own Environments
4. Polluter Pays Principle
5. Precautionary Principle

Several pieces of subsidiary legislation, polices and affiliated acts dealing with the environment as a whole exist:

- The Environmental Management (EM) Act of 2000 designed to promote environmental awareness and appreciation and proper coordination and management. Section 18 of the Act also provides that: "The Policy may be revised from time to time." (EM Act, 2000)
- Certificate of Environmental Clearance Rules (2001) which are used to gauge the effects of any kind of development (both positive and negative) on the environment
- Water Pollution (Amendment) Rules 2006
- Draft Climate Change Policy 2010
- Draft National Protected Areas Policy 2010
- National Policy and Programmes on Wetland Conservation for Trinidad and Tobago, 2002
- Draft Tourism Policy 2008

With regards to e-waste, there is no specific legislation that guides management of this hazardous waste stream. However, there have been rules, acts and polices developed over the years that are geared towards the regulation of various types of waste and hazardous chemicals. These include:

- The Litter Act of 1973
- The Pesticides and Toxic Chemicals Act, 1979 and Act No. 11 of 1986
- Municipal Corporations Act of 1990
- Draft Waste Management Rules (DWMR) 2008, which is subsidiary legislation to the EM Act of 2000 and outlines methods of storage, collection, transportation, treatment and disposal of hazardous wastes.

More recently, the Government of the Republic of Trinidad and Tobago approved the final draft of an Integrated Solid Waste/Resource Management Policy (ISW/RMP) for Trinidad and Tobago, which was developed under the

Ministry of Local Government (MoLG) in 2012. The 10-year strategy outlined in this policy highlights six categories of waste to which special attention is to be paid, including e-waste. The overall objective of the policy is to achieve affordable, sustainable and socially acceptable integrated waste management of solid wastes (exclusive of liquid waste), including hazardous wastes, and substances, in the municipal, commercial and industrial waste streams, in a manner that is protective of human health and the environment (MoLG, 2012).

The Policy emphasizes the importance of capacity building, public education and awareness and legal and institutional framework development in the management of solid and hazardous wastes (MoLG, 2012). It also highlights key stakeholders who are to be involved in the integrated management of said waste. These include generators (and their responsibility to manage their waste in the appropriate manner), the local Solid Waste Management Company (SWMCOL), which the Policy aims to legally designate as an Authority, the private sector, and the public sector (MoLG, 2012).

Revision of the Draft Waste Management Rules of 2008 is also expected to indirectly address the management and movement of e-waste locally. The draft Rules currently lists waste electrical and electronic assemblies in the First Schedule, Part B (B1110) (GORTT, 2008). These assemblies are not designated as hazardous unless they exhibit a hazardous characteristic that is included in Part C of the Rules, as is stated under the Basel Convention (2011). The Rules also outlines the procedures that must be followed in the handling and transport of hazardous wastes.

In addition to the local policy framework, the country must also adhere to certain provisions at the international scale which dictate how e-waste and the containing substances should be handled at the national level. Such provisions are detailed under the conventions and other international treaties to which Trinidad and Tobago is a Party. The applicable treaties are as follows:

- The Basel Convention;
- The Stockholm Convention;
- The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade;
- The Vienna Convention on Substances that Deplete the Ozone Layer and its Montreal Protocol;
- The London Convention on the Prevention of Marine Pollution by Dumping of Wastes and their matter;
- The Cartagena Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region and the Protocol Concerning Pollution from Land Based Sources;
- The UNEP London Guidelines on Exchange of Information on Chemicals in International Trade and the second provision on Prior Informed Consent (PIC); and
- The International Convention for the Prevention of Pollution from Ships, as modified by the Protocol of 1978 (MARPOL 73/78).

3.2.2. Regulatory & Operational Framework

Within Trinidad and Tobago there are several authorities under which the purview of waste management falls. Although each may have a general understanding of their responsibilities, in many instances there are overlaps, which create conflicts in harmonisation or leads to gaps in implementation. The main institutions affiliated with waste management in the country are as indicated below:

- **Ministry of the Environment and Water Resources (MEWR)** under which falls the EMA.
  - **EMA**: established under the Environmental Management Act No.3 with the mandate to write and enforce laws and regulations for environmental management, to educate the public about the nation's environmental issues and to control and prevent pollution, as well as conserve natural resources (EMA, 2011).

- **Ministry of Local Government (MoLG)** which *inter alia* is tasked with conveying the policy perspectives and guidelines of Central Government and coordinating the activities of the 14 Municipal Corporations. The primary bodies which fall under the purview of the MoLG and assist in its affiliated waste management activities include:
  - **The Municipal Corporations**-The main duty of municipal corporations, under which lie two city corporations, three boroughs and nine regional corporations is the collection of MSW (MOLG, 2008).
  - **SWMCOL**-The core functions of this authority include management, collection, treatment and disposal of all waste streams; municipal, commercial, and industrial as well as establishment and operation of disposal sites including the country's three major landfills. Some subsidiary roles include resource recovery, technical services and advising and public education.

- **The Tobago House of Assembly (THA)** is the local government body charged with the administrative affairs for the island of Tobago. With regard to waste management it holds the directive for the operations of the Studley Park Landfill, the only landfill that services the island.

At the regional level, the **Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean Region** (BCRC-Caribbean) is an autonomous institution, with direct responsibility to provide technical support and training for Caribbean countries that are signatories to the Basel Convention in order that they fulfil its mandate. As Trinidad and Tobago has signed and ratified this Convention it is legally obliged to implement its directives.

3.2.3. E-waste Stakeholders in Trinidad & Tobago

The main stakeholders involved in WEEE management for the majority of the categories being generated in the country falling under the scope of this study with their relationships to each other, are indicated in Figure 5 (see next page).

Distributor/ Retailer

In comparison to developed countries, there is minimal manufacturing of EEE done locally. Local manufacturers include Consolidated Appliances Limited (Consol), manufacturer of household appliances such as stoves and refrigerators, Luxam Industries Limited, manufacturer of consumer electronics such as stereos and television sets, and CE Tang Yuk & Company Limited, manufacturer of lighting equipment. With the exception of these and other local manufacturers, distributors and retailers are the main channels and direct points of reference between local consumers and the foreign original equipment manufacturers (OEMs).

Consumer

The three main classifications of consumers are the private sector organisations, which are also responsible for direct importation from OEMs, the public sector, i.e. government ministries and other state bodies, and private consumers/individuals. Some consumers take the impetus upon themselves to have their WEEE recycled. Exports of WEEE are also done directly to international markets by some actors in the private sector.

Refurbishers

These include establishments involved in the repair and servicing of equipment. Some of the consumers previously indicated do engage in the repair and refurbishment of existing equipment rather than dispose of equipment altogether.

Waste Collectors

The primary body responsible for waste management in the country is SWMCOL. Other companies involved in general waste collection include Kaizen Environmental and Green Engineering Limited. They provide comprehensive waste management services for chemicals and compounds many of which are contained in EEE and if released into the environment could cause debilitating effects to ecosystem and human health.

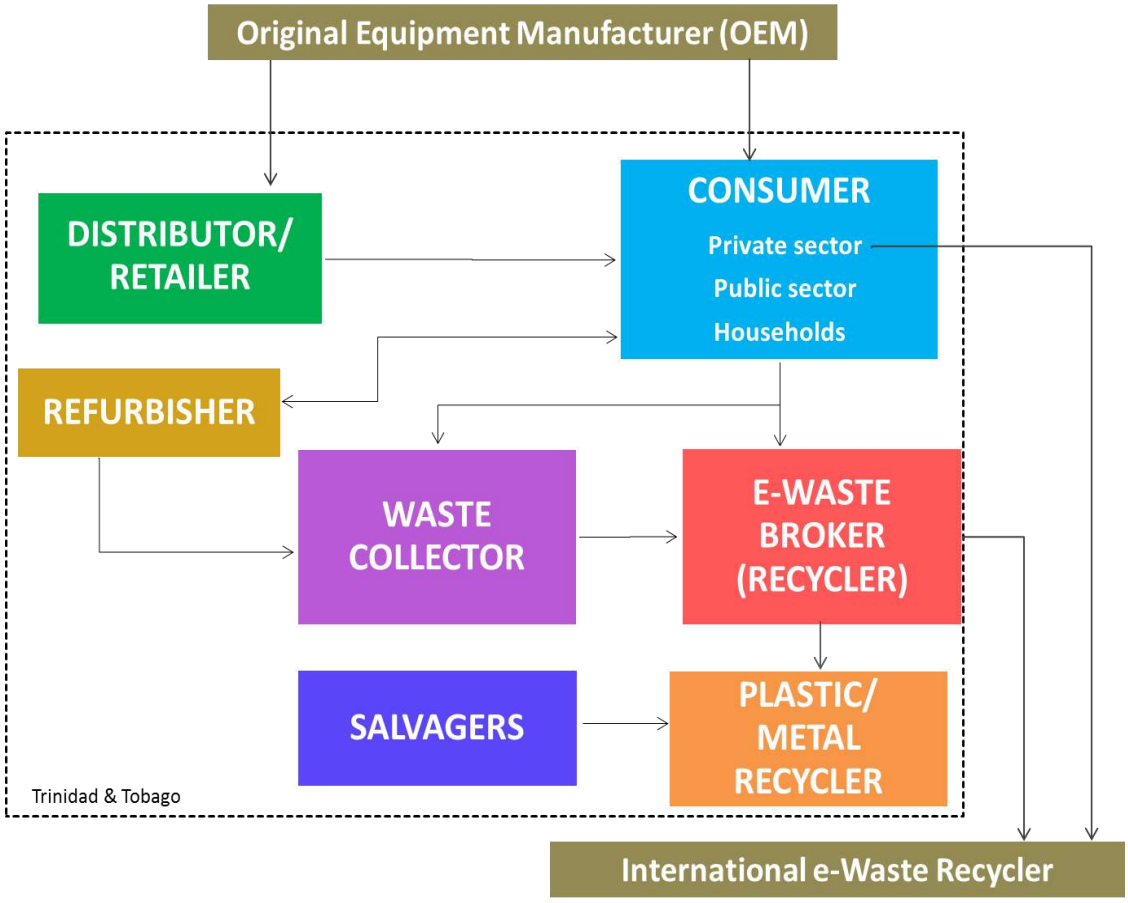


Figure 5: Stakeholders involved in the management of most categories of WEEE being generated in Trinidad and Tobago. Adapted from: Garraway & Ott, 2010.

E-Waste Broker (Recycler)

With restrictions in place against the disposal of WEEE at local landfills and given the unavailability of other facilities to enable sound management of used and EoL equipment, some local companies have taken up the mantle to assist in the treatment and management of EEE that has approached its end of life cycle. These e-waste brokers act as intermediaries to facilitate the proper transfer of WEEE away from the local waste stream to international markets, where it is expected to be treated and processed in certified facilities according to international standards. Two of the main companies that operate locally are Piranha International and Caribbean Tech Disposers Limited, both of which were the primary stakeholders for this group.

Piranha International is a certified electronic waste recycler that has been recognized by the Basel Action Network through its e-Stewards Pledge Initiative prior to 2011. The company is also a member of the Microsoft Registered Refurbisher Program. The company offers EoL computer collection, repair and recycling services to its clientele depending on the results of a series of system tests. If the equipment is deemed irreparable it is de-manufactured and the plastics and metals are recovered and recycled, with the metal components being sold to the local steel mill or exported. The residue components are packaged and exported to other e-Steward processing and disposal companies and the company adheres to a zero percentage to landfill policy (Garraway & Ott, 2010; Piranha,

2008). This is authenticated via reports that detail the proportion of each type of material recycled which are relayed to clients (Piranha, 2008) as part of a manifest system which promotes transparency. The recycling sites and processes are audited to ensure treatment has been in accordance with environmentally safe practices and legislation. According to Garraway and Ott (2010), the company estimates that it processes less than 10% of PCs and other e-waste generated by the country.

Caribbean Tech Disposals Limited also specialises in the disposal of computer and other obsolete EEE. The company offers collection and handling services including packaging in protective plastic, transportation or shipment to external markets and full inventorying of all equipment recycled from collection to the point of recycling. Additionally, they provide data security via the targeted destruction of data storage hardware. A certificate of disposal is issued on completion of the recycling process to assure clients that disposal has been in compliance with local laws.

Scrap Metal Deals and Plastic Recyclers

The stakeholders in this category provide an additional downstream demand for e-waste aside from the e-waste brokers, but to a lesser extent. While their operations are usually not developed with consideration of the special characteristics and risks posed by WEEE, they will accept and recover both ferrous and non-ferrous metals of value from such equipment, if available. According to Garraway & Ott (2010), the component recycling following de-manufacturing of WEEE is limited to metals, which is then sold to accessible markets, while the plastics are shredded for proper treatment abroad. No plastic recyclers were directly studied, but interviews were conducted with two scrap metal dealers.

Salvagers

These parties intercept the valuable waste that arrive at the landfill and extract them for monetary gain. These materials are then sent to local recyclers. This activity has a very strong community-based orientation. This group was also not directly surveyed but did emerge from discussions with other stakeholders.

4.0 METHODOLOGY

4.1 Strategy

This study was based on a mixed method approach with a combination of quantitative and qualitative research strategies. A single case study design was used, based on Trinidad and Tobago at the country scale. Primary and secondary data collection was accomplished by triangulation using four main sources of evidence: documentation, archival records, interviews and direct observations (Yin, 2009). The use of multiple sources ensured completeness and credibility, collection of a stronger array of evidence and increased the construct validity of data (Bryman, 2008; Yin, 2009). The study was conducted over a six month period.

4.2 Methods & Techniques

A variety of methods were used to garner information for this study including interviews, observations and reviews of the existing literature, documents and databases.

4.2.1.1. Secondary Data collection

Literature review - Case Studies

Case studies of WEEE assessments in both developed and developing countries were studied inclusive of the Garraway & Ott, 2010 e-Waste Assessment on Trinidad and Tobago. These studies were used to guide the methodology for this study as well as to gain insight on the existing situation as well as e-waste management strategies adopted in various countries worldwide.

Database review-Trade Data

Using the list of e-waste categories outlined under Annex IB of the WEEE Directive (Appendix I) as a reference point, the corresponding products were extracted from the 2007 Harmonized System (HS) Tariff Codes for Trinidad and Tobago. Archival records sourced online from the International Trade Centre was then used as the primary database to acquire both the import and export quantities and weights for the products abstracted from the 2007 HS Codes. The trade data was classified at the level of the 8 digit HS codes for the period 2007-2010 and this information was compiled in an excel database, as well as in a separate listing along with their code descriptions (Appendix II). Statistics for the period 2007-2010 were used to evaluate trends as 2011-2012 statistics were not available. Prior to 2007, a different coding system was used and the information would have been too outdated to depict current trends and evolution in the EEE stream.

4.2.1.2. Primary data collection

Identification of stakeholders

A list of major stakeholders with their contact information was compiled (See Appendix III) using the telephone directory, internet searches and membership listings of the Chambers of Industry, Commerce and Manufacturing. The Garraway & Ott (2010) study was also used as a guide for identifying possible stakeholders.

The stakeholders identified were those involved at one point or more of the product life chain of EEE, whether at the distribution end, usage or final disposal. Selections for the distributors were based on the size of the operations i.e. establishments which had multiple locations across Trinidad and Tobago or if they were the main suppliers of a product. This was done to increase the geographical scope of the data.

Questionnaires & Interviews

Questionnaires were then generated and tailored to suit these respective sectors and stakeholders (Appendix IV). Semi-structured interviews were conducted after this point either directly at the respective offices of the interviewees or at BCRC-Caribbean, on the telephone or indirectly via email correspondence. Semi-structured interviews were useful as they allowed data to be captured on the array of questions on the interview schedule, whilst still allowing freedom in the responses, comparisons amongst different interviewees and the flexibility to include additional questions where further insights were deemed necessary (Bryman, 2008). A total of 32 stakeholders were interviewed and a list of these participants can be viewed in Figure 6. Snowball sampling came into effect as feedback from the initial set of interviewed stakeholders allowed for identification of further key players who were subsequently added to the interview schedule.

4.3 Data assessment

The methods displayed in Table 1, were selected as being the most appropriate for the Trinidad and Tobago context and in light of the broad range of WEEE categories being studied. These, unlike other WEEE assessment methods do not require statistics on saturation levels, whether at the household or industry level, nor sales data, which for the scale of this study was not readily or easily accessible.

The first two methods; Market Supply and Carnegie Mellon, both require all information to be available in order to provide substantive value as they are based on calculations arising from mathematical equations. The Market Supply calculates WEEE generation based on sales data and average lifespan of a product, while the Carnegie Mellon Method utilises data on sales, typical lifespans, recycling, storage and considers EoL treatment for which options are possible: (1) reuse; (2) storage; (3) recycling and (4) landfill (UNEP-DTIE, 2007). As can be viewed from Table 1, there is outstanding data for these two methods, which therefore limits their immediate application for quantitative use in the local context. Additionally, the Carnegie Mellon method applies only to the U.S. (Widmer *et al.,* 2005) and this therefore limits its scope for usage in Trinidad and Tobago.

Figure 6: Stakeholders Interviewed for the WEEE Management Strategy

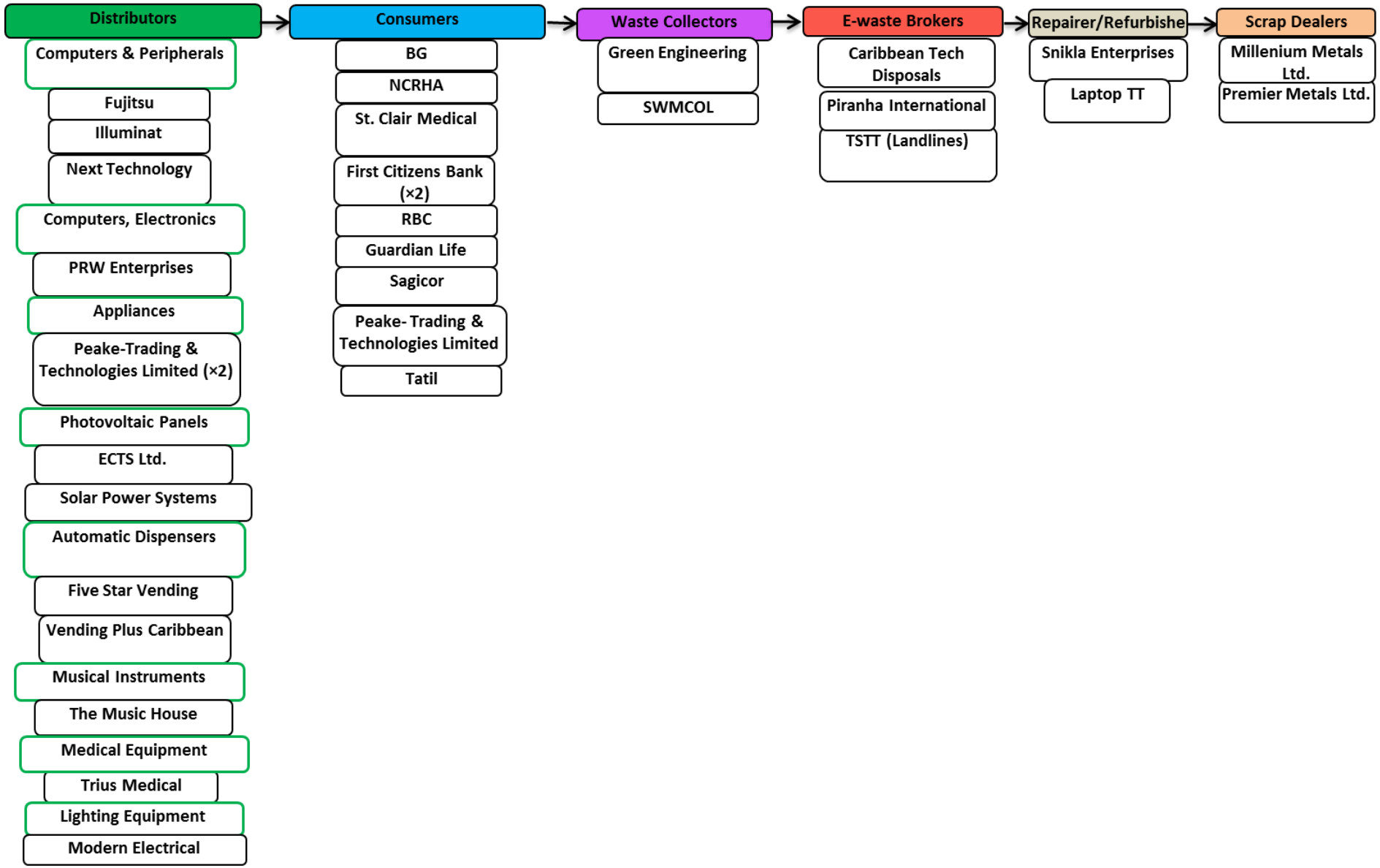


Table 1: Data requirements for T&T WEEE Data Assessment Methodologies

Methodology /Data requirement	Calculated Sales			Product Sales			Average Lifetime	Storage Data	Reuse	Repair	Recycle		Landfill
	Export Data	Import data	Manufacturing/ Production	Public	Private	Households					Local	Export	
Market Supply Method	✓*	✓*	✓				✓ *						
Carnegie Mellon Method	✓*	✓*	✓				✓ *	✓	✓		✓	✓	✓
Mass Flow Assessment	✓ *	✓ *	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓

✓	Required Data
*	Available Data

The third method as shown in Table 1, the Mass Flow Assessment, allows more flexibility as this model charts all the sources, sinks, processes and flows of products within a defined boundary. As is evident from Table 1, this method also has outstanding data however, the design of the model compensates for this as its layout and lack of mathematical formulae to ensure its functional completeness expands its applicability for providing a more holistic understanding of the WEEE situation in Trinidad and Tobago. Furthermore, the inclusion of the available data would provide a more vivid picture of the current gaps in the data set as well as highlight context-specific cases. Based on these features and the current nature of the study, the Mass Flow Assessment was chosen as the most suitable method for the WEEE assessment in Trinidad and Tobago. The EMPA e-waste Assessment Methodology Training and Reference Manual (EMPA, 2012) provides in-depth background and instructional material on the Mass Flow Assessment model.

4.4 Limitations of methodology

Data Input

The use of the 2007 HS Codes presented several challenges as their vague descriptions may have led to the inclusion of irrelevant codes or the exclusion of pertinent ones. More specifically these were the main issues:

- Firstly there was uncertainty as to whether the six digit or eight digit codes should be used. This affected the data output as at the six-digit level, different values were emerging for the weight and unit, however greater precision in the values was gained at the eight-digit level albeit at the expense of having the same figures appear for both weights and units in some instances. In this situation the researchers' discretion were used,

with a tendency to use quantities in units in preference to weights. This however led to variations amongst the data sets and thus further clarification is needed should any follow up work to this study be carried out.

- For some of the categories, a wide range of items were encompassed in corresponding HS codes, thereby making it difficult to determine just how much of the value pertained to the items being studied. For example Category 10 - (Automatic Dispensers: Automatic banknote dispensers), falls under Office supplies (Code: 8472.90.00). However, this code is broad and incorporates a range of 'other' unknown office equipment.
- Some ambiguity arose in determining whether a category may have been applicable to the study or not, i.e. whether it would be considered EEE or not. To resolve this issue the discretion of the authors were applied, which had the potential of exclusion of some groups.
- There were also instances where one data set may have had a value stated as 'mixed' kg or units or in some instances there was interchanging in the unit of measurement with either kg or units being applied for quantity and weight respectively at times. In this scenario the data was recorded and a corresponding note made.
- Within the database there were obvious discrepancies for instance in cases where World value had a figure of 0, yet the countries within that same category had figures. For example Category 6 – (Electrical and electronic tools), the exports of 'Other appliances: Mechanical application for projector /dispersing or spraying liquids or powders for agriculture or horticulture' (Code: 8424.81.00), the World value here in 2010 was 0, while the corresponding countries had figures. This was noted and adjusted accordingly.
- In one situation there was an overlap of products between two categories. For instance sewing machines fell under Category 2 - Small household appliances and Category 6 - Electrical and Electronic Tools: '8452.10.00-Sewing machines of the household type'. To avoid duplication of data, the product was made exclusive to one category, however, there is the possibility this may have occurred in other instances and gone unnoticed.

Data Collection

During the data collection segment there were some challenges which begun prior to the interview phase. The selection of representative stakeholders for each of the 10 EU WEEE categories was the first issue as gaining a wide cross-section of interviewees, with a broad geographical scope, was the aim of this study. Inevitably however, some key stakeholder may have been excluded or some either declined or were unable to participate in the study. As a result some of the WEEE categories did not have representative sample sizes, for instance the household appliances, electrical and electronic tools and monitoring equipment.

Due to time constraints there was the consequent exclusion of some important and large stakeholders such as households and the waste salvagers or informal sector. As such the study was not as all-encompassing as it should have ideally been as it only gave a partial picture of the local e-waste situation.

Additionally, during the interviews some companies were reluctant to disclose vital pieces of key information (e.g. stock data) as it may have been deemed confidential. The majority of the stakeholders were also unaware of the BCRC-Caribbean and so requested background information before providing consent to be interviewed. These terms were acceded to though support from the government could assist with expediting future assessments.

There were also issues related to seasonality, as the time period during which the study was conducted correlated with the July/ August vacation period, which meant many of the key informants were on vacation leave and thus were unavailable for interviews. Alternatively, some companies were undergoing audits and so could not spare time to facilitate the study.

Data Analysis

Inadequate and incompatible sales and recycling data, as well as incomplete import and export statistics hindered analysis of the quantities and flows of EEE and WEEE through the local system via the mass flow assessment. Adequate landfill data was unavailable for WEEE, which, according to SWMCOL, is usually categorized together with bulk waste, and there was no way of verifying quantities due to inefficiencies in waste collection and segregation. This again affected the level of analysis capable for the study, particularly with enhancing the understanding of the material sinks.

5.0 DATA ASSESSMENT

5.1. Imports & Exports

According to the trade statistics for Trinidad and Tobago for the period 2007-2010, (Table 2) the major categories of imports of EEE were consumer equipment, IT & telecommunication equipment, electronic and electrical tools and lighting equipment in that order. Based on the nature of the study and the stakeholders interviewed, the highest proportion of the analysis would be in reference to the IT & telecommunication equipment category. In regard to the exports and in reference to Table 2, electrical and electronic tools was the main category followed by IT & telecommunication equipment then lighting equipment. There is a notable stark difference between the figures of imports and exports, with all the import categories far outweighing their export counterparts. The quantities shown in table 2 however need to be verified further since the data used to calculate the totals included in some instances units that were either the same or inconsistent with their corresponding weights. This data necessitates further clarification.

Table 2: Imports & Exports for the period 2007-2010

CATEGORY	TOTAL IMPORTS	TOTAL EXPORTS
	(Units)	(Units)
1. Large Household Appliances	317,736	62,003
2. Small Household Appliances	2,197,708	13,913
3. IT & Telecommunications Equipment	15,577,687	1,153,278
4. Consumer Equipment	47,104,425	437,331
5. Electrical & Electronic Tools	10,918,145	1,352,077
6. Lighting	6,088,007	34,733
7. Toys, Leisure & Sports Equipment	226,347	1,474
8. Monitoring & Control	290,850	6,273
9. Medical Equipment	124,824	320
10. Automatic Dispensers	686,263	91,676
GRAND TOTAL	**81,459,108**	**3,153,078**

It should also be noted that the nature of exports, that is, whether they are new equipment, UEEE or equipment at their EoL, is unknown as this information was not readily available. Therefore one cannot say for certain that the export figures represent UEEE and EoL units that are disposed of or recycled outside of Trinidad & Tobago.

Figure 7: Annual quantities of the top four EEE Imported into Trinidad & Tobago for the period 2007-2010

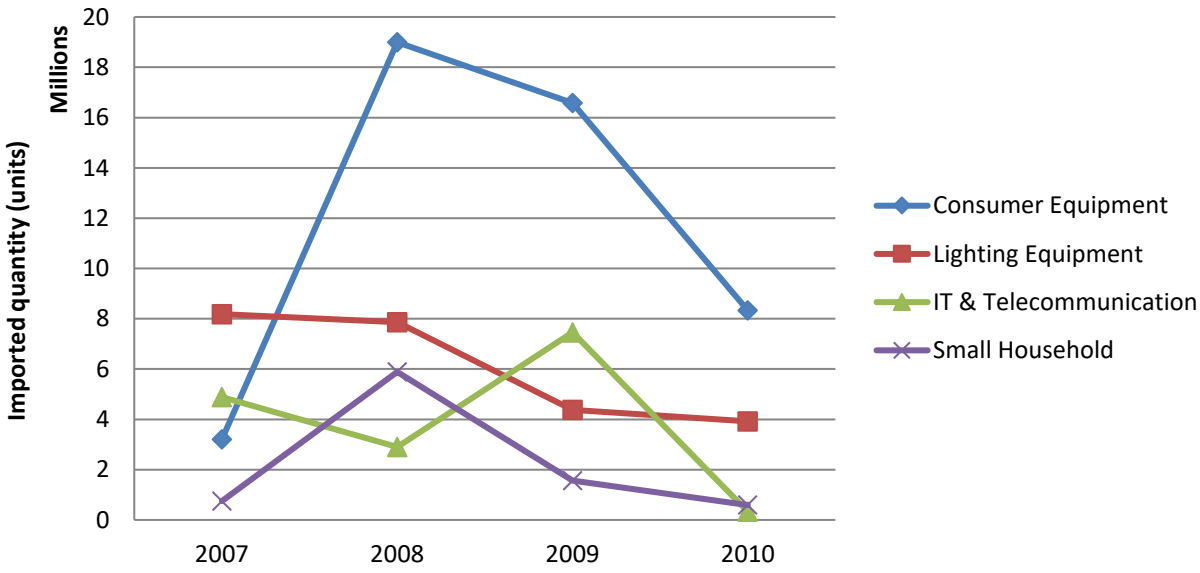


Figure 7 depicts the annual totals of the top four categories of EEE imported for the period 2007-2010. For all four categories, there seems to be a general decline towards the year 2010 suggesting that fewer imports have been coming in the latter years, possibly due to a decline in demand or increase in tariffs. In 2008, there was a peak in imports for both consumer equipment and small household appliances whereas IT and telecommunications peaked one year later in 2009.

The decline in 2008 could possibly be credited to a near saturation of the market due to the introduction of the telecommunication competitor, Digicel in 2006. While there were observable fluctuations in the quantities of imports for consumer equipment, IT and telecommunications equipment and small household appliances, lighting showed a continuous downward trend. This may possibly be attributed to a greater output by local lighting manufacturers and a greater demand for these local products over the years, thereby reducing the need to import lighting equipment from overseas manufacturers. Additionally, technological advancements could have resulted in longer life spans of the lighting products used, thereby again lowering the quantities imported.

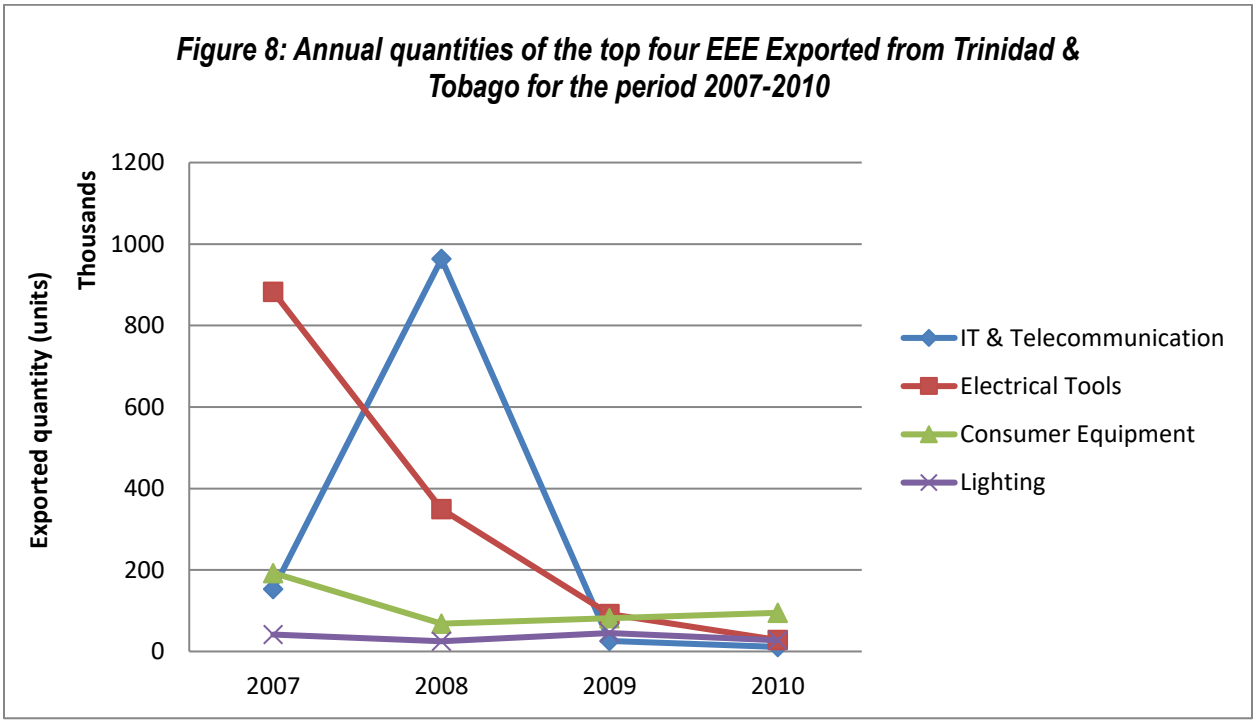
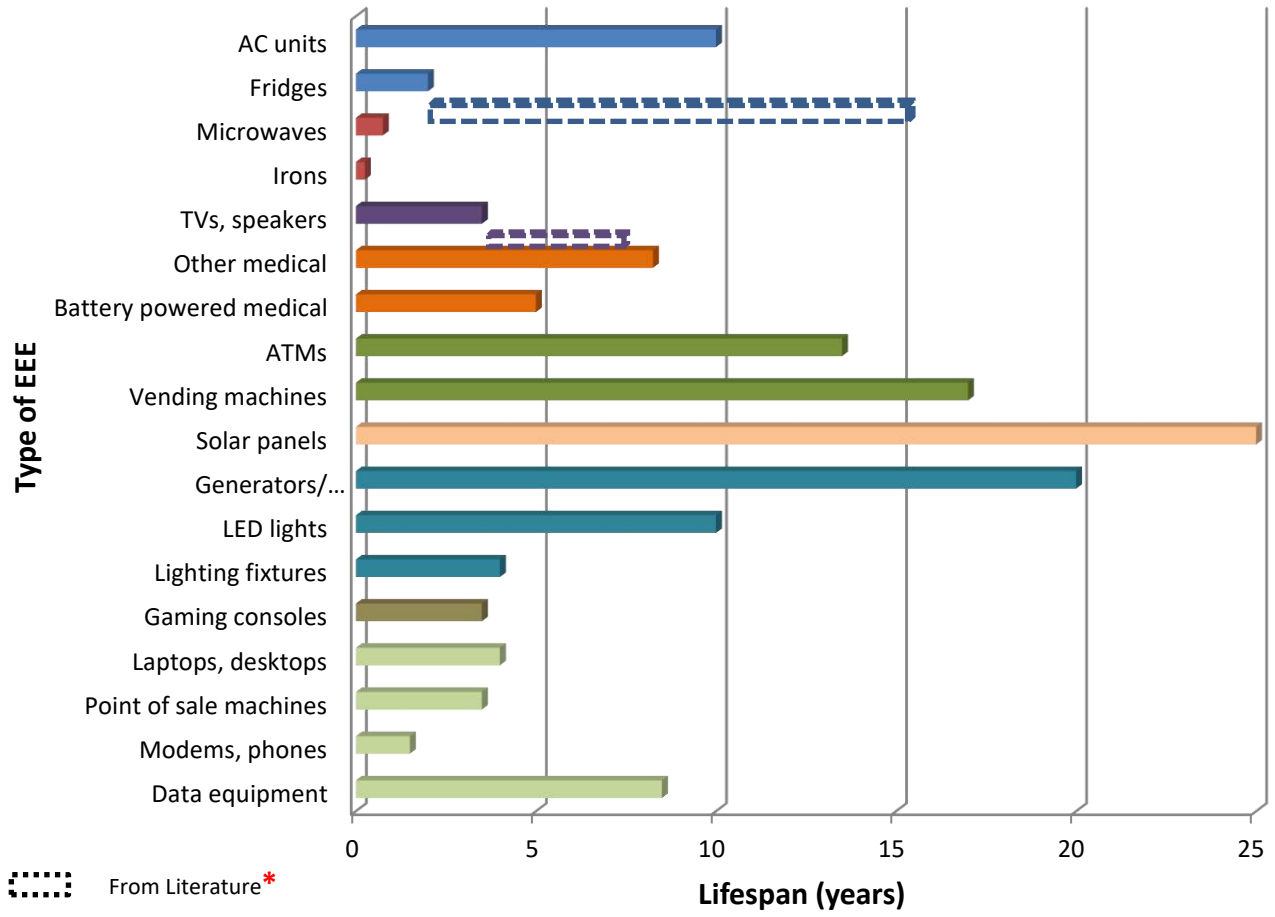


Figure 8 displays the top four categories of EEE exports for the period 2007-2010. While lighting and consumer equipment showed little fluctuation over the four year period, there was a significant peak in the quantity of IT & telecommunications equipment exported in 2008. Meanwhile, a continuous downward trend was observed for electrical tools. For all four categories, relatively low quantities of exports were observed between 2009 and 2010. If this equipment is not leaving the country, it means that they have either been disposed of in the landfill, sent to local e-waste brokers are in storage or, depending on their dates of purchase and lifespans are still in use.

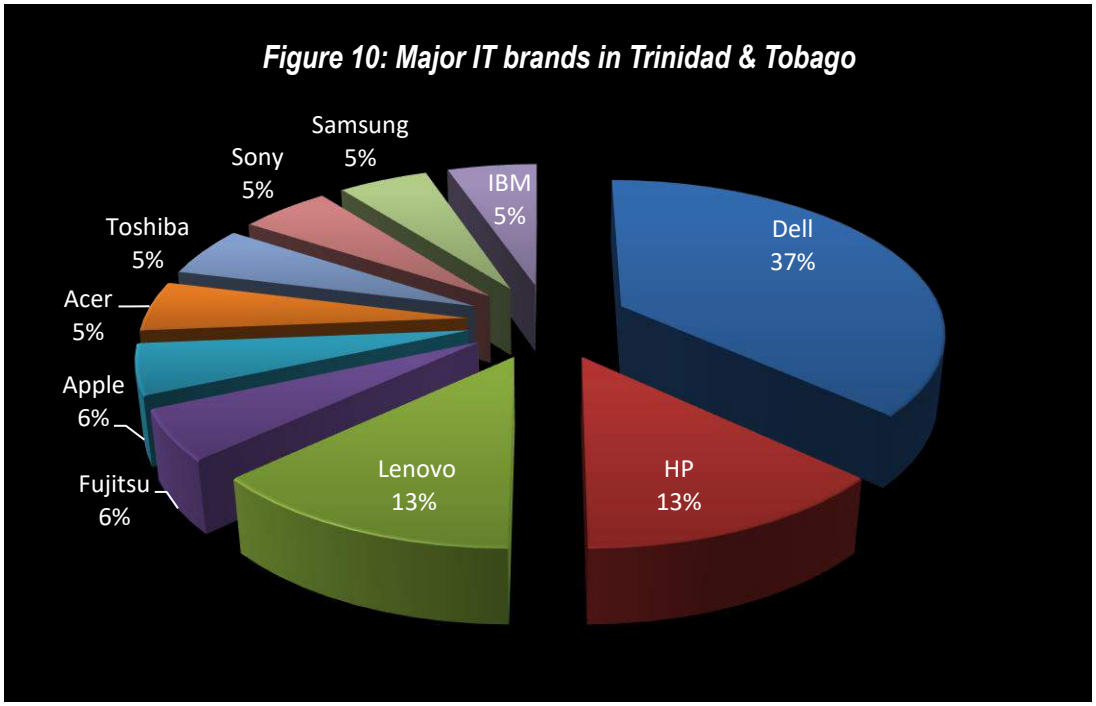
5.2.EEE & WEEE Assessments

Figure 9: Average lifespans of EEE

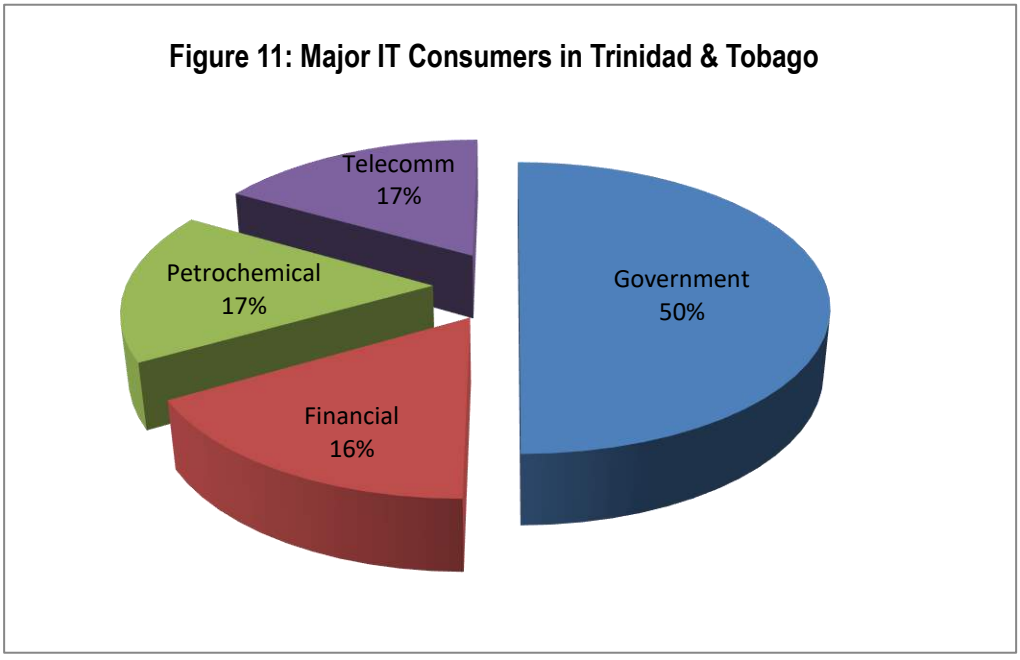


****Data Source: PAN Ethiopia & Environmental Protection Authority, 2011***

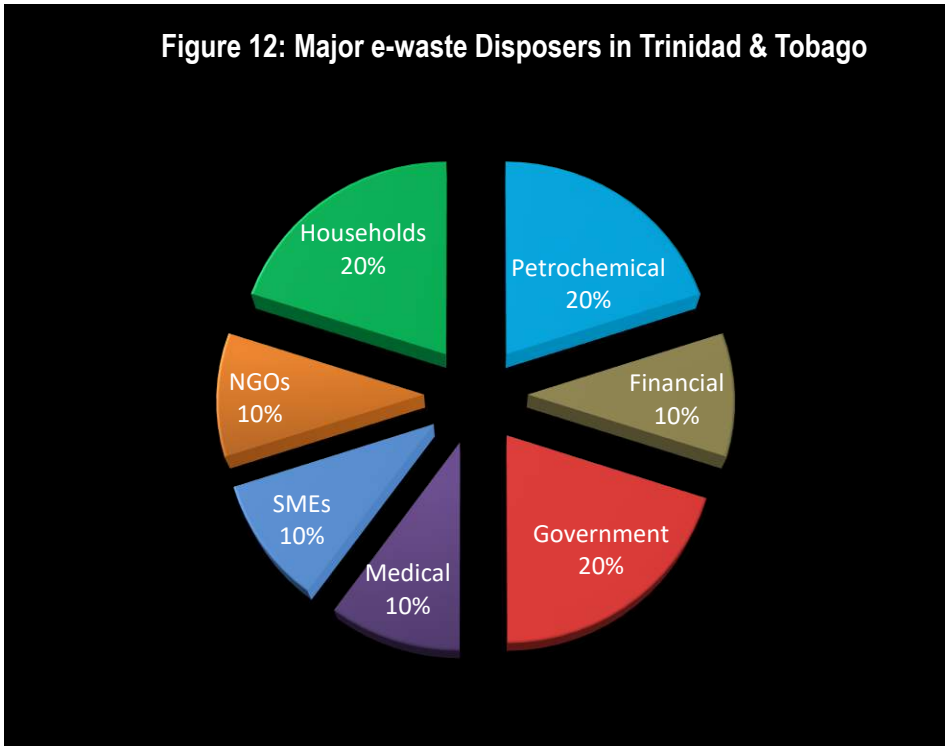
From the information provided by the interviewed stakeholders, as illustrated in Figure 9 above, small household appliances, namely microwaves and irons, appear to have the shortest lifespans while the longest lifespans belong to photovoltaic (PV) equipment namely solar panels. Generators & transformers which can fall under PV equipment or lighting equipment have the second longest lifespans, followed by automatic dispensers, namely ATM machines and vending machines. It should be noted that PV equipment have only relatively recently been introduced in Trinidad and Tobago such that the already installed systems have yet to reach their EoL. The twenty five year lifespan is therefore only an estimation based on the manufacturer's warranty. Similarly, the lifespans of the consumer equipment (TVs, large household appliances), small household appliances (microwaves, irons) and large household appliances (AC units, fridges) were inferred from the warranties provided by suppliers in the absence of consumer end information.



As indicated earlier, IT & telecommunication was one of the major categories of imports. Building on this, the survey results from both distributors of computer and peripheral equipment and consumers of such equipment indicated the leading IT brand in Trinidad and Tobago was Dell, with a sizeable difference between the next key brands HP and Lenovo. The recurring explanations for Dell's strong presence in the country were due to its affordability, good service, large number of local dealers and great after-sale support inclusive of honouring warranty claims.



Following on the analysis for the IT sub-category, from the survey results it was evident that the major consumer of computer and related equipment was the government sector, with a 50% share of the consumption. This corresponds with the findings of the Garraway & Ott (2010) study. The other three sectors, financial, telecommunication and petrochemical, represented about one third each, of the remaining consumption total. The sheer size of the government sector is one main reason that accounts for this disparity. Furthermore, the government's laptop initiative as well as equipment requirements for government schools would also result in annual purchases of equipment. In the other sectors, apart from their large operating size as well, the petrochemical and financial sectors in particular are guided by management policies which dictate when new equipment is to be purchased.



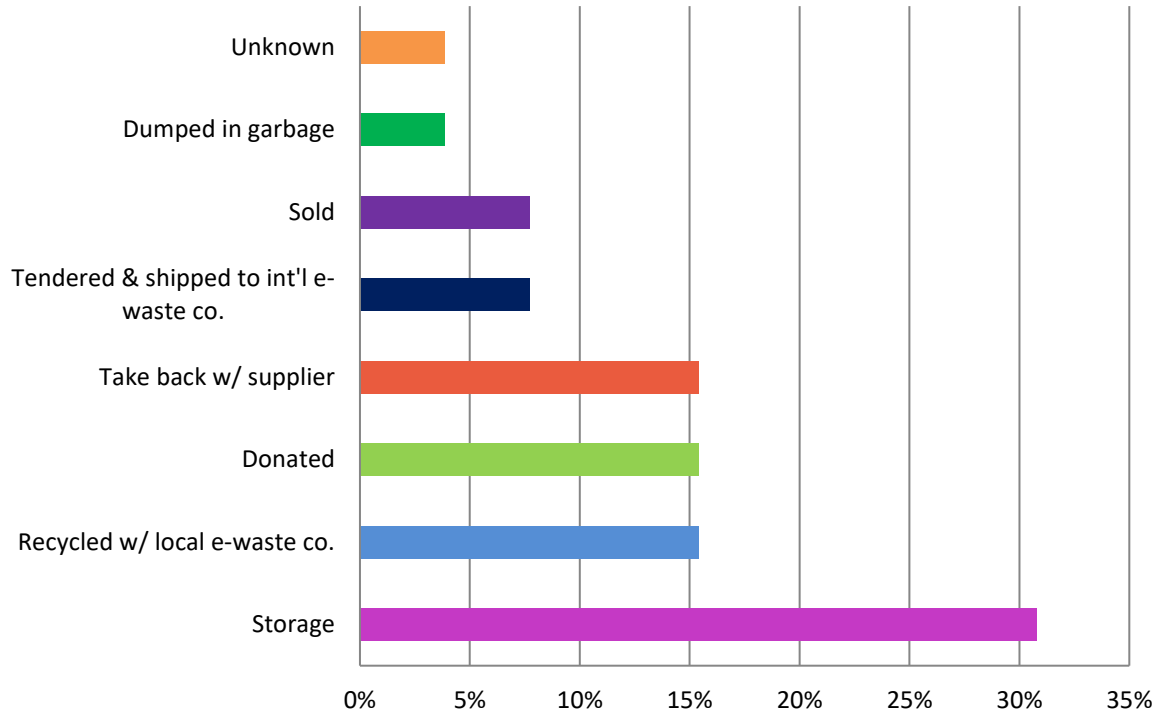
Based on the results from the feedback given by the major e-waste brokers (recyclers) in the country, government, households and the petrochemical sector were their main contributors. Similarly, Puckett & Smith (2002) reported government and individuals as the major generators of e-waste in the U.S., along with OEMs which are largely absent within the Trinidad and Tobago setting. The percentages on the pie chart however, are not representative of total quantities disposed but instead show the main sectors with the highest frequency of disposal and hence were the leaders in e-waste disposal locally. These figures though may reflect other characteristics:

i. A time lag in terms of disposal - Medical facilities for example, may not necessarily have lower quantities, but the lifespans of the equipment they utilize would result in a lower turnover rate when compared to, for

instance, those in households or the petrochemical sector, where small appliances, consumer equipment and computers may make up the bulk of these sectors' disposal, which have shorter lifespans.

ii. Quantities of equipment to be disposed - The larger percentages indicated may actually be synonymous with the greater total volumes utilized in specific sectors like the government, financial and petrochemical, as was indicated in Figure 11. In the case of the financial sector this has direct links to policies for changeover of equipment after a designated time frame. Added to this are policies that mandate disposal of WEEE, which would reduce the extent of storage time and so conversely increase the frequency of disposal.

Figure 13: Methods of treatment of EoL equipment by Consumers in Trinidad & Tobago



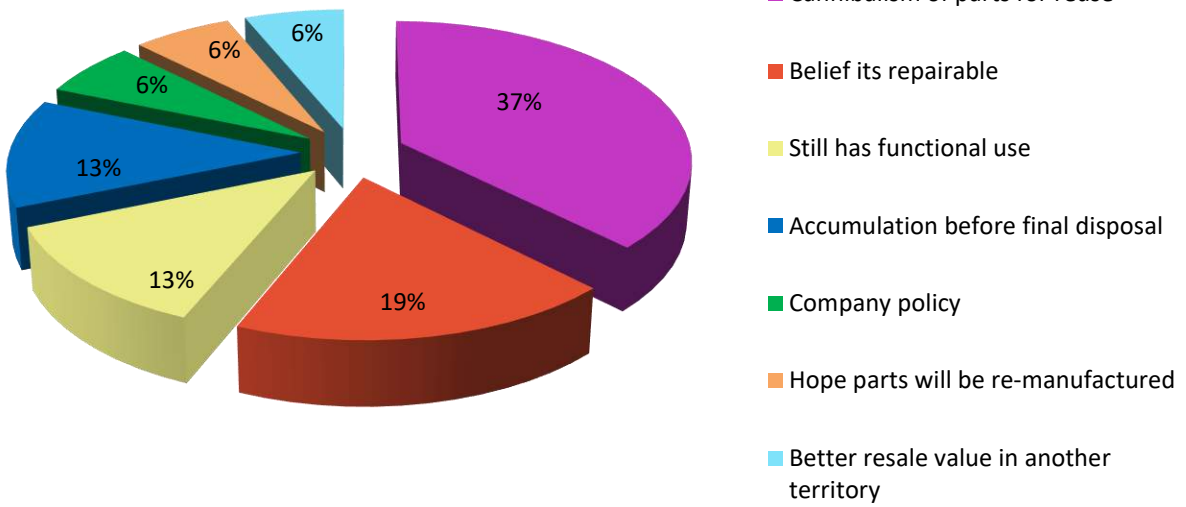
**Treatment of EoL relates to consumers of the following categories: IT telecommunications, PV, medical, automatic dispensers*

From Figure 13, it appears that apparently very little EoL equipment actually ended up in the regular waste stream. The majority of EoL equipment was mainly stored by the stakeholder, followed by a tie among the WEEE management options of being recycled, donated or taken back by the supplier. The EoL equipment stored may be in this phase for either a short or long term and may have one of 3 eventual fates:

i. Dumped in garbage
ii. Recycled with local e-waste management service providers
iii. Tendered out for international shipping

This value then is more ephemeral as it is not a permanent treatment solution.

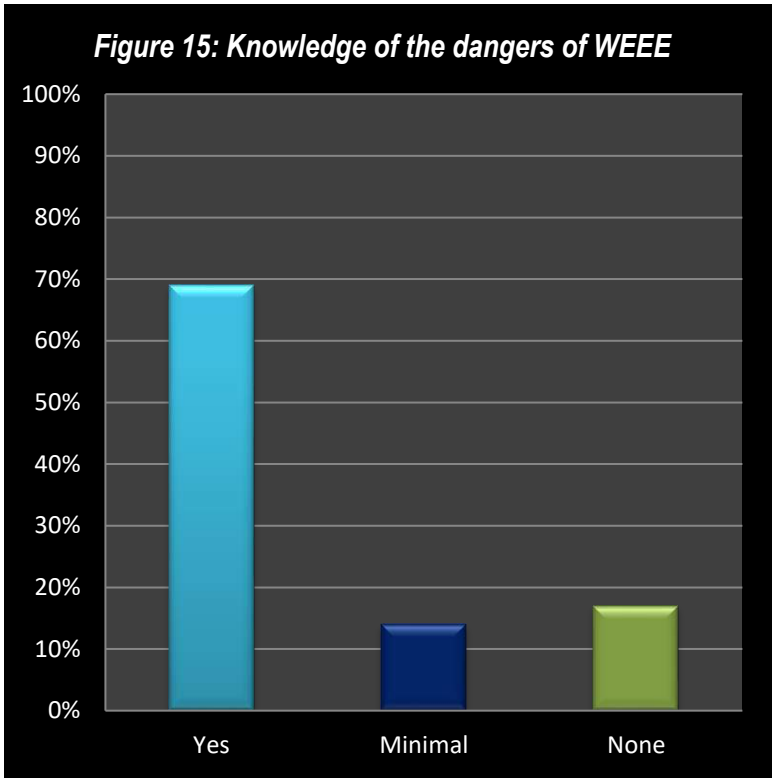
Figure 14: Main reasons for storage of UEEE by Consumers in Trinidad & Tobago



The main reason behind retention of non-functional/obsolete/EoL equipment was to facilitate cannibalism of parts, followed by a belief that the device was repairable. One should note that the motive behind cannibalisation was to reduce the need to purchase new parts and/or equipment and to therefore save on expenditure, rather than the need to cut down on e-waste generation. However, as it is clearly a popular in-house arrangement, it would be profitable and logical to create a more formalized system on a larger scale.

The next major reasons were because either the WEEE was on its way for disposal or the operating system of the device had been recently upgraded and was no longer compatible with the existing system. The rapid rate of technological changes has rendered some items obsolete.

This is a great problem as it leads to the premature disposal of items, whether immediately or after an extensive period in storage during which time the majority of its parts become dysfunctional or unreceptive to newer systems. A company policy of storage, found in the lower percentile, may arise due to lack of knowledge of proper or available methods for disposal. An equal percentage of participants stated that they store EoL equipment in the hope that manufacturers will restart production on parts that are no longer manufactured but that are needed for their used EEE (UEEE). This is again to reduce expenditure on purchasing new equipment.



The majority of participants in the survey had some form of knowledge of the dangers of improper disposal of WEEE as shown in Figure 15. This status can be attributed primarily to their work background.

Figure 16 shows that 37% of the respondents obtained their knowledge on the threats posed by e-waste because they were directly involved in the handling of obsolete equipment, whether in the IT Department of their respective companies, or at recycling or electronic companies. The knowledge of the survey pool was supplemented to a large extent (21%) by the e-waste management companies. These companies would sensitise their clientele as well as their internal staff on the issues of e-waste.

These e-waste management companies thus play a significant role in disseminating information and educating the public about the dangers of improper disposal of WEEE, regardless of whether it is primarily a part of their marketing strategy. This is a key outlet of information that is deemed trustworthy by their clients and is a repository that must be tapped into.

The minority of participants indicated the media was their source of data, but this too should be capitalized upon as an exploitable medium for the purpose of information dissemination and raising public awareness with special emphasis of course on the type and quality of information being relayed.

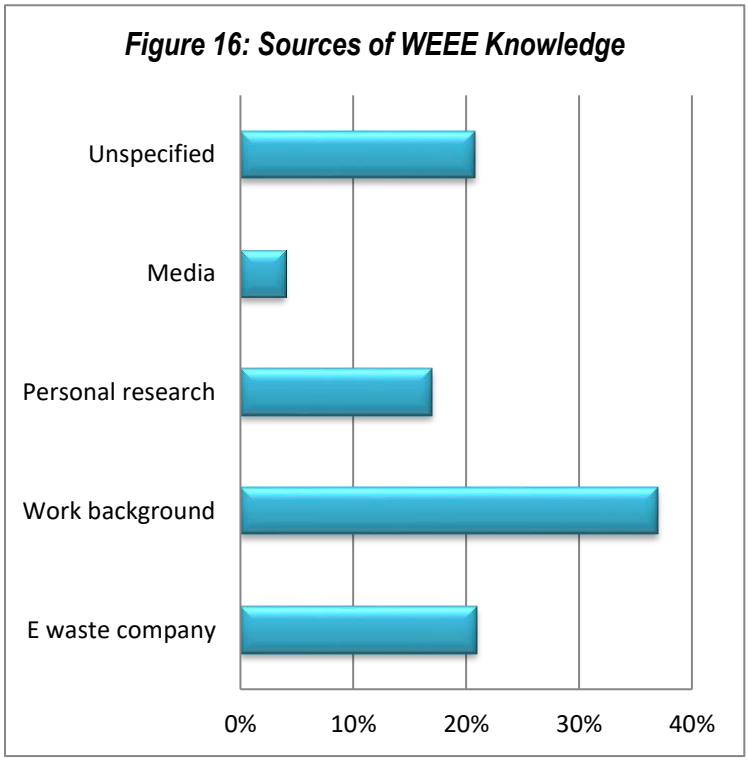
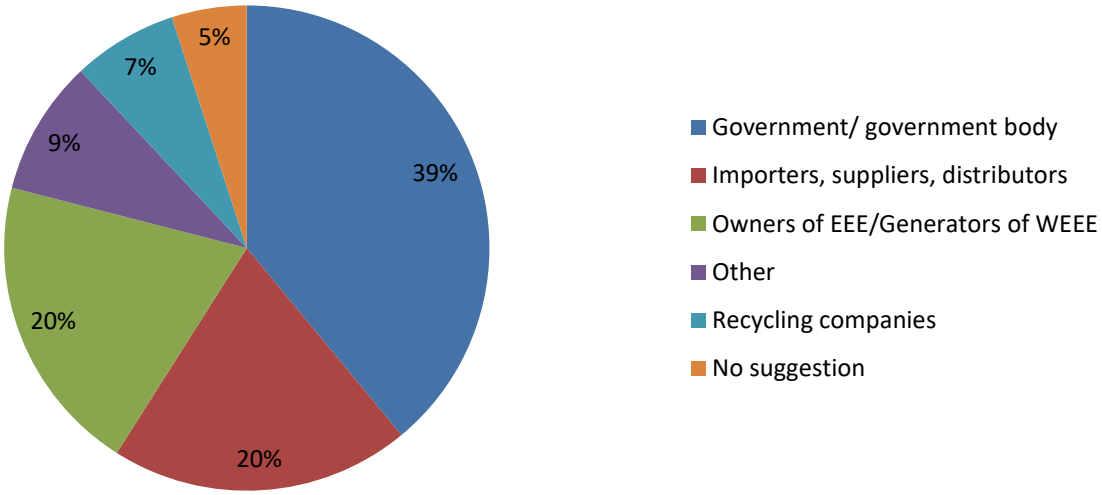


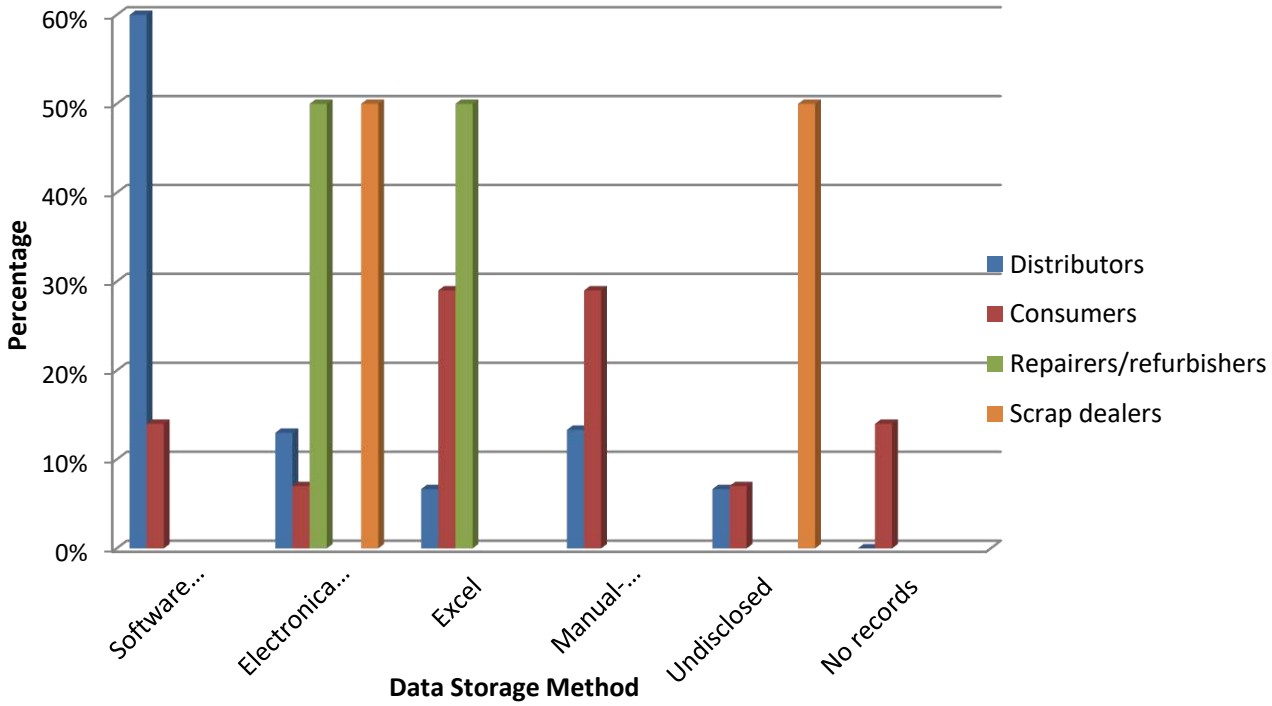
Figure 17: Opinions on where the primary responsibility should lie for dealing with WEEE in Trinidad & Tobago



According to Figure 17, the majority of respondents felt that the responsibility for dealing with WEEE lies with the government, whether for e-waste collection on a country-wide scale, for enactment and enforcement of legislation, or for establishment of a separate ministry for dealing with e-waste matters. This was followed by 20% of the respondents believing that stakeholders at the upper end of the supply chain, namely importers, suppliers and distributors, should be responsible, since these are the persons who are knowledgeable about the products being imported. An equal proportion of respondents stated that the owners of the EEE namely individuals and companies, should be responsible for disposing of the resulting WEEE in a sensible manner. 9% of respondents offered other suggestions such as establishment of a co-facility and the need for collaborative efforts, without distinctly identifying the responsible party or parties. Seven percentage of the interviewees thought that recycling companies should lower costs and provide more amenable collection services which would act as an incentive for generators to dispose of their e-waste in the proper fashion. The minority of participants could offer no suggestion as to who should be responsible as they had no prior knowledge on e-waste and the local situation.

5.3.Data Management

Figure 18: Comparison of mechanisms used for data storage by stakeholders

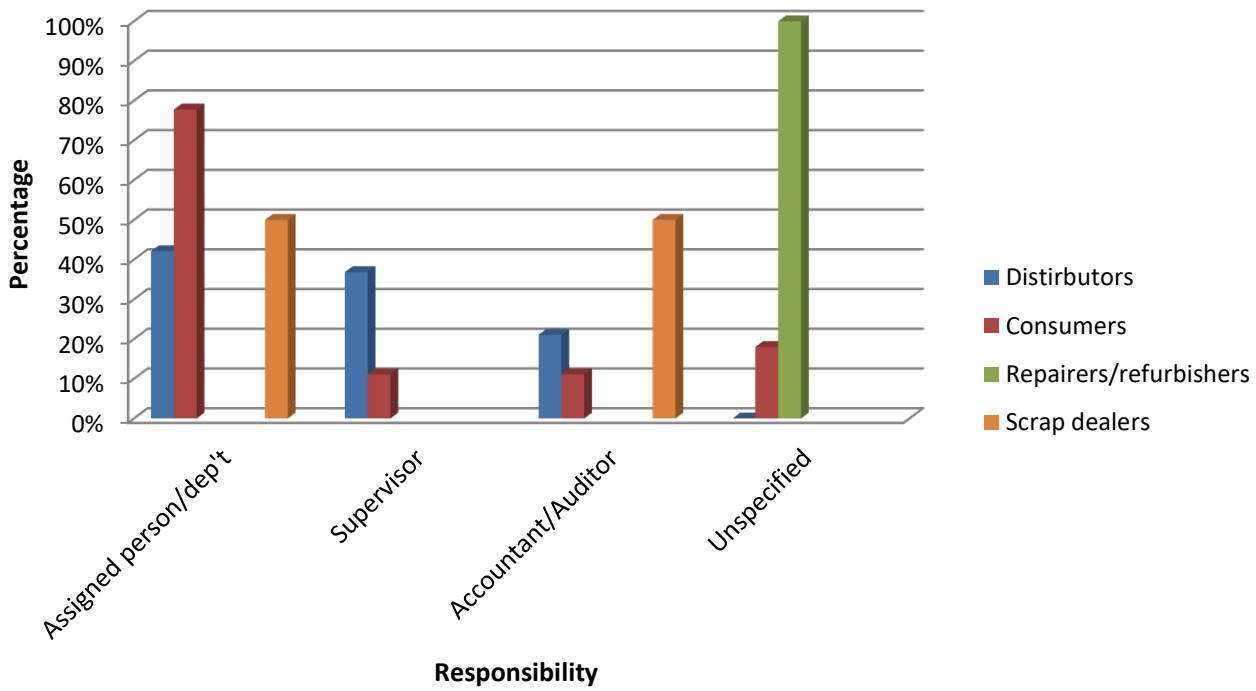


According to Figure 18, for almost 60% of the distributors of EEE surveyed, a software program was used for data storage. There were however, two key features about this data set: firstly the data stored related to an inventory of stocks and secondly in many of the instances the program in use was one geared for asset management of products as part of an accounting inventory system. The consumers of the EEE on the other hand used excel spread sheets and manual-data logs as their predominant methods of data storage. In other words very basic or simple systems were used to capture data, which in this case related to records of EoL equipment. One of the repairers also indicated use of Excel as well as Quickbooks for data storage and management. The other repairer stated that while data is stored electronically, hard copies are also kept. Electronic data storage is also used by one of the scrap dealers, who stated that a manual system was used prior. Therefore there seems to be a trend towards electronic systems and software programs rather than manual log systems, and only in some instances, supported with hard copies.

For both distributors and consumers there was an assigned individual or department tasked with maintaining the records as seen in Figure 19. This was followed by verification by a supervisor for the distributors. An interesting body emerging from the study were the accounts and audit divisions, who though are in the lower percentile, could still be potential additional sources of data for both distributors and consumers. While repairers/refurbishers were vague in their responses indicating that a member of staff handles the data, the scrap dealers interviewed

specified that clerks, the administrative department or an external accountant is responsible for data checks and inventories.

Figure 19: Comparison of parties assigned to data inventory



On reviewing the information gathered from the interviews, Table 3 below summarises the possible types of data, sources and format of the main categories of stakeholders involved in the various phases of WEEE in Trinidad and Tobago.

Table 3: Summary of the data features used by the main stakeholders involved with WEEE management in Trinidad & Tobago

STAKEHOLDER GROUP		DATA TYPE	DATA SOURCE	DATA FORMAT	EXAMPLE
DISTRIBUTORS		▪ Stock inventory: incoming & outgoing	▪ Customs & Excise Trade Data: Imports ▪ International Trade Centre: Trade Imports ▪ Purchasing Department ▪ Accountant ▪ Manager	Quantitative & qualitative	Quantitative: ▪ Stock volumes ▪ Stock turnover rates Qualitative: ▪ Brands distributed, most popular brands ▪ Major clients (by sector) ▪ Information on take-back arrangements
CONSUMERS	Public Sector	▪ EEE purchase records ▪ Asset database	▪ Purchasing Department ▪ Accountant	Quantitative & qualitative	Quantitative: ▪ Quantities of new/ second hand EEE purchased ▪ Quantities of WEEE disposed, recycled and/or stockpiled Qualitative: ▪ Fate of WEEE ▪ Information on WEEE data management
	Private Sector	▪ EEE purchase records ▪ Asset database	▪ Purchasing Department ▪ Accountant	Quantitative & qualitative	▪ *Same as for public sector*
	Households	▪ EEE quantities	▪ Household head ▪ World Bank Statistics	Quantitative & qualitative	Quantitative: ▪ Same as for public and private sectors Qualitative: ▪ Fate of WEEE
REFURBISHERS*		▪ EEE records: incoming & outgoing repairs	▪ Stock keeper-business owner/repairer	Quantitative	▪ Quantities repaired ▪ Quantities refurbished ▪ Revenues earned from the sale of refurbished products
WASTE COLLECTORS	Public	▪ Incoming bulk waste *(if captured)*	▪ Company Office ▪ Waste Transporters	Quantitative	▪ Volumes of e-waste coming into the landfill
	Private	▪ Waste Inventory Log	▪ Environmental Division	Quantitative	▪ Volumes of e-waste collected and/or dropped off at facility

E-WASTE BROKERS (RECYCLERS)	▪ WEEE Inventory	▪ Customs & Excise Trade Data: Exports ▪ International Trade Centre: Trade Exports ▪ Prior Informed Consent (PIC) Forms ▪ Technicians ▪ Supervisors	Quantitative & qualitative	Quantitative: ▪ Volumes of e-waste recycled ▪ Revenues earned from recycling activities Qualitative: ▪ Major clients ▪ Types of equipment recycled ▪ Challenges faced by recyclers
SCRAP DEALERS*	▪ WEEE Inventory	▪ District Magistrate Courts ▪ Ministry of Trade	Quantitative & Qualitative	Quantitative ▪ Volumes of material sold locally ▪ Volumes of material exported ▪ Revenues earned from scrap activities Qualitative ▪ Markets for scrap metals ▪ Challenges faced by scrap dealers

5.4. Mass Flow Assessment

The Mass Flow Assessment (MFA) shown in Figure 18 shows the flows of EEE within the Trinidad and Tobago context. The main stages and processes within a product's lifecycle include importation by distributers, retailers and private households, then sale of these items (with the exclusion of the private households), consumption and storage until they lose their functional usage at which stage this used EEE (UEEE) is then converted to WEEE, and either sent to the landfill as part of the MSW stream or to local e-waste brokers who use respective methods for processing the WEEE; dismantling, recycling or packaging for export to international e-waste recyclers.

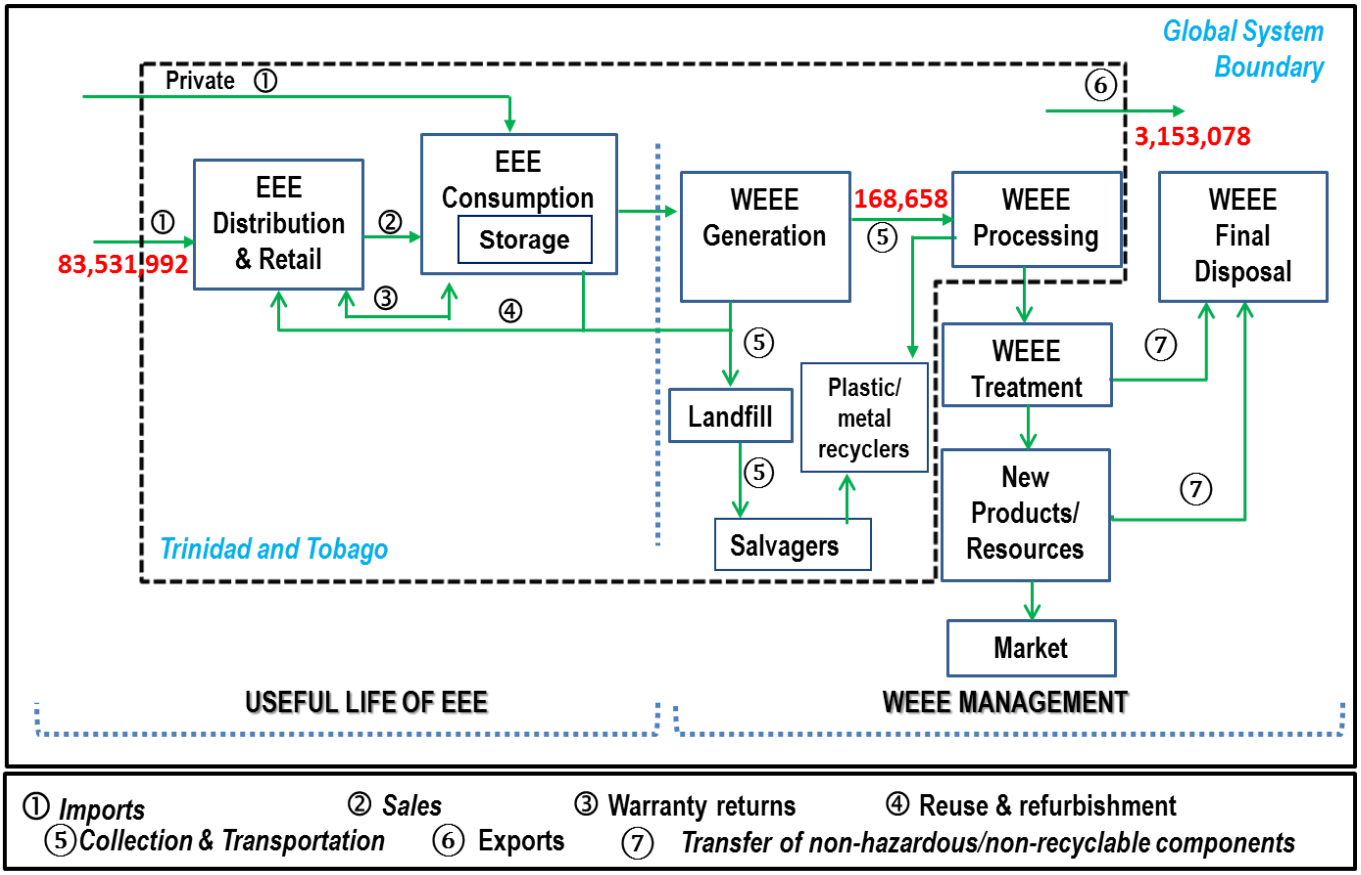


Figure 20: Mass Flow Assessment for Trinidad and Tobago showing total imports, exports and quantities of WEEE treated over the period 2007 -2010

Also shown in figure 20 are the quantities of EEE imported into the country and exported out of the country with an estimate of the WEEE that is processed by local recycling companies. These figures relate to the period 2007-2010 and were calculated using trade data and data provided by interviewed representatives of recycling companies.

5.4.1. MFA Segment – Useful Life of WEEE

As there is negligible manufacturing of EEE in Trinidad and Tobago, the predominant share of equipment arrive at the shores via importation mainly from OEMs. Over the four year period under investigation, this amounted to a total of 83,531,992 units as seen in Figure 20. The stocks of material entering via distributors and retailers are generally recorded as customs data and are therefore in an accessible format. However, private importation by individuals is more difficult to quantify as many products may be undeclared and thus unaccounted for at the borders.

The consumption phase of the MFA is comprised of private businesses, the public sector and private households. Logically, each sector has specific groups of EEE they heavily utilised. For example the business sector consumes largely IT & telecommunication equipment, while households will have a predominance of large and small appliances. There is scope for possible overlaps in some cases, for instance with IT and telecommunication. A common practice across these three stakeholder groups however, is storage of equipment at the end of its useful life. This is another repository of information that is critical for a proper understanding of the EEE situation in the country but is very difficult to accurately quantify, particularly the storage occurring in the household sector. There are also flows occurring within this phase as private companies sometimes sell or donate their equipment to employees where it goes to private consumers either in households, churches or NGOs.

One flow of particular interest and a possible source of confusion is the two-way flow indicated for equipment under warranty claims. Equipment with functionality issues is returned to the distributor or retailer, or in some cases directly back to the OEM. What is sent back may be the refurbished product or a completely new item, but this again is another figure that may be difficult to properly ascertain as the trade data would not clearly specify these features. Fortunately, these numbers may be significantly low.

There is a channel of exports of EEE out of the country, for perhaps further re-sale or otherwise. The total of this amounts to 3,153,078 units from 2007-2010. The exact status and purpose behind these shipments are unknown and necessitate further definition to understand the nature of connections within the system, particularly for determining whether these exports are comprised of only UEEE or also of e-waste.

5.4.2. MFA Segment- WEEE Management

At the point when the product has reached the end of its useful life and steps are initiated to have the product disposed of the WEEE may have several outcomes. It may form part of the MSW stream and be collected and transported by collectors on behalf of regional corporations and carried to the landfill. SWMCOL has initiated an internal policy that dissuades what they term ‘bulky waste’, as well as e-waste from being dumped at the landfill unless prior approval is given. The lack of or minimal data recording at the landfills make extraction of data on any relevant waste streams near impossible. There is also another phenomenon at the landfills which involves the removal of valuable resources from the MSW stream by salvagers for monetary gain as the materials recovered; plastics and metals are sent to the respective local recyclers and dealers. Resource extraction occurs in some

instances even before the waste transporters, who in some instances may be private contractors, enter the compound. Such a scenario would impact on the totals captured if data management was a priority for SWMCOL, but also imparts the role the waste collectors can play, particularly private ones, as a potential source of information.

Emerging from the research was another significant group, the scrap dealers. Although they may be categorized under the metal recyclers, the scale of their operations warrants special, separate attention and deeper investigation. There is a high possibility that these scrap dealers may be coming into contact with various categories of WEEE, especially those of Category 1 and 2, large and small household appliances respectively, information for which is currently absent and which in addition to the other WEEE they interact with is definitely needed to feed into a larger WEEE assessment to gain a better understanding of their interconnection within the system.

There is also the other possibility of the WEEE receiving proper EoL treatment and being sent to e-waste processors either locally or internationally through a tendering process. This is another potential source of data as inventories of the WEEE are maintained by the companies. Figures from these local e-waste recycling companies indicate that an estimated figure of 168,658 units of WEEE were sent to them from 2007 to 2010 for treatment and eventual shipment overseas where it is presumably appropriately destroyed. A nexus exists between these e-waste brokers and local recycling companies as indicated in Figure 20. The remaining components of the WEEE are exported internationally for further treatment, the exact details of which fall outside the purview of this study.

Using trade statistics and the volumes provided by two major e-waste management companies (waste brokers), for the period 2007-2010, an attempt was made to estimate the level of success in the recovery of various WEEE categories in Trinidad and Tobago. Given the time constraints, this estimation did not consider time lags to account for the useful life span of these pieces of equipment; rather it compared the EoL fraction recouped by recyclers versus the equivalent imports for the study years. Table 4 below compiles and presents the respective volumes and percentage of units recovered per WEEE category. The data presented was provided by one of the two companies, following which the volumes were segregated into their respective WEEE categories while the other categories for which no data was available were omitted.

Table 4: Percentages of WEEE recovered in Trinidad and Tobago for the period 2007-2010 by category

Category	Total Units of EEE Imported	Number of Units Recovered	% Recovered
IT & Telecommunications Equipment	15,577,687	112,245	0.72055
Consumer Equipment	47,104,425	402	0.00085
Monitoring & Control Instruments	1,163,399	41	0.00352

The table shows that the IT & telecommunications equipment category possessed the highest recovery rates by the company. The category least recovered is that of consumer equipment. This may be partially due to a lack of awareness by household consumers on proper disposal practices and on the local waste brokers that exist in the country. It may also be attributed to the relatively longer lifespans of items such as musical instruments, televisions and audio equipment that fall under this category in comparison with the laptops and telephones that fall under the IT and telecommunications category. Furthermore, the absence of any national framework to mandate and collected household-generated WEEE may be another reason for this occurrence.

The greater success in the recovery of the IT and telecommunications equipment category can be attributed to the fact that computing equipment falls within this category. This is directly linked to the relatively high turnover of such equipment within government ministries, industries and large private sector businesses – the major customer groups of this particular waste broker from whom the data was received. Several of these businesses and industries belong to international organizations that have disposal standards and guidelines that the companies must follow and adhere to. These companies based in Trinidad and Tobago therefore contract local waste brokers to dispose of their used and EoL equipment in order to meet the international standards set out by their respective international organizations. As such the local waste brokers receive a large quantity of IT and telecommunications equipment from these businesses and industries on a fairly regular basis.

Table 5: Percentages of WEEE recovered in Trinidad and Tobago for the period 2007-2010 by category

Total Units of EEE Imported	Number of Units Recovered	% Recovered
83,531,992	168,658	0.202

Table 5 above goes on to display the total volumes and percentages of WEEE recovered by both waste brokers collectively in comparison to the national imports of EEE. This provided a snapshot of the state of advanced WEEE management occurring in the country and demonstrates that only a minute percentage of total WEEE in the country is actually recovered for the purposes of advanced processing and recycling. However, as is the case with the data in Table 4, the estimates shown do not accurately depict the total quantities of WEEE recovered in Trinidad and Tobago as figures were not received from other recycling companies in the country.

On deeper examination of the data presented in Figure 20, it is evident that the difference between the EEE entering the country and WEEE and EEE exiting gives a difference of 80,378,914 units of electronic equipment still on the country's shores. Subtracting the total number of equipment received by e-waste brokers from this figure leaves a total of 80,210,256 units. This striking figure relates to the quantity of equipment still in the country. This can be accounted for by several factors as the equipment could still be in use, in storage, sent to other e-waste brokers not interviewed, or disposed as part of the MSW stream. Apart from the scenarios where there was some form of disposal (whether through safe channels or illegally dumped); this remaining quantity vividly reflects that there still exists an immense pool of equipment necessitating ESM presently or in the near future.

5.5. WEEE Generation Snapshot

Figure 21 displays the expected (not projected) generation of WEEE for selected EEE items based on their corresponding imports for the period 2007 to 2010. The year of generation was ascertained primarily from the responses provided from stakeholder feedback on the average lifespan of the EEE items they imported, distributed or used, as displayed in figure 9 and elaborated in Section 5.2 (see page 36). In figure 21, the waste generated from the selected EEE items imported for the study period commenced from 2008 and can be expected to continue until the year 2027. Therefore, the time segments presented simply provides a snapshot of WEEE generation in Trinidad and Tobago in the short to medium term, which will occur continuously over time and evolve based on the economic, technological and social drivers that influence EEE imports over time.

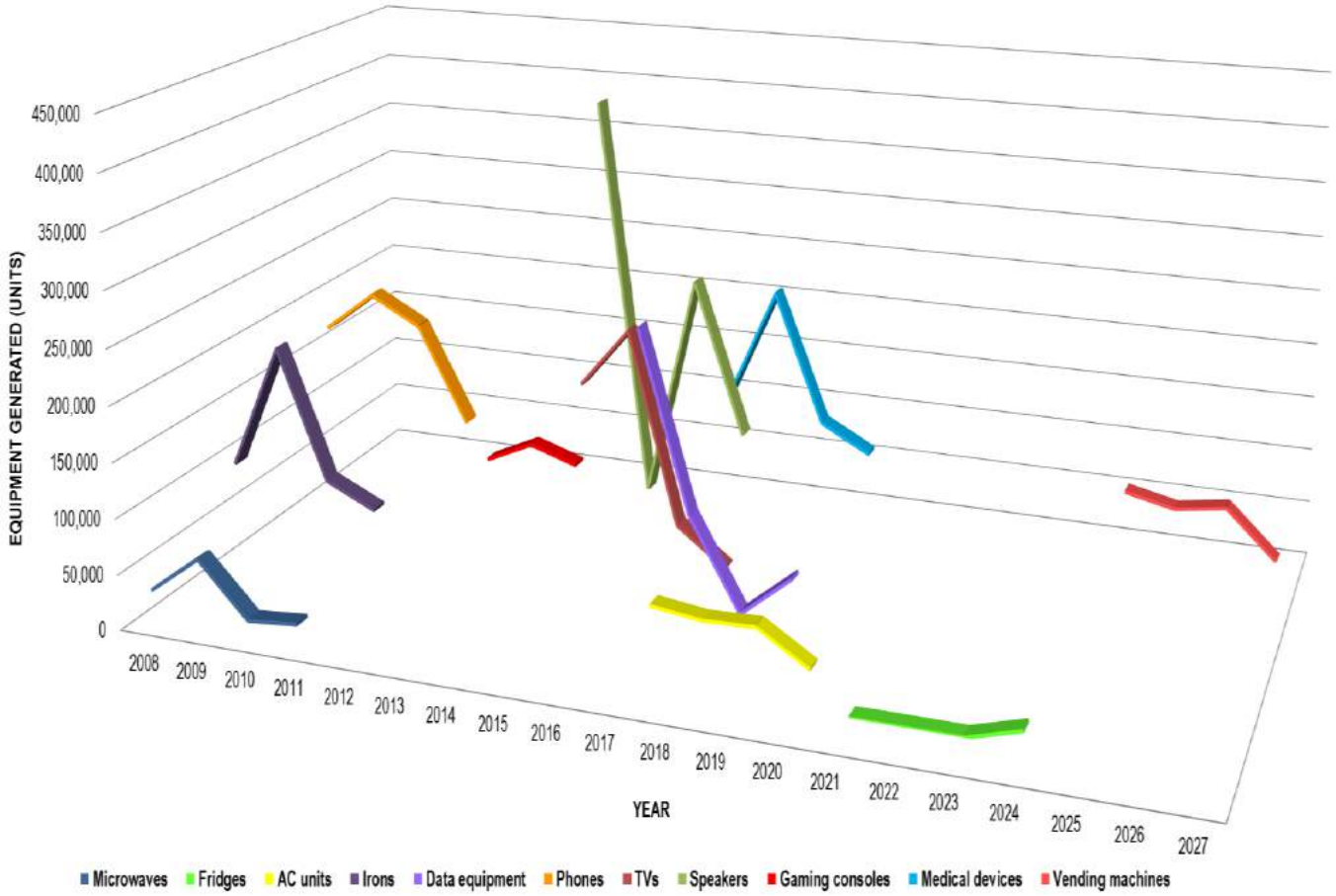


Figure 21: Expected generation of EoL EEE from imports into the local system from 2007 to 2010 based on the average lifespans of these items

Figure 22 also shows the expected generation of WEEE from desktops and laptops imported during the study period in relation to that generated from other EEE, namely TVs, data equipment and phones. It demonstrates that these items, which is encompassed in the IT and Telecommunications Equipment category, are of key concern for e-waste management in the country. This importance is not only attributed to their volumes based on the level of imports, but also given their fairly short average lifespan according to respondents.

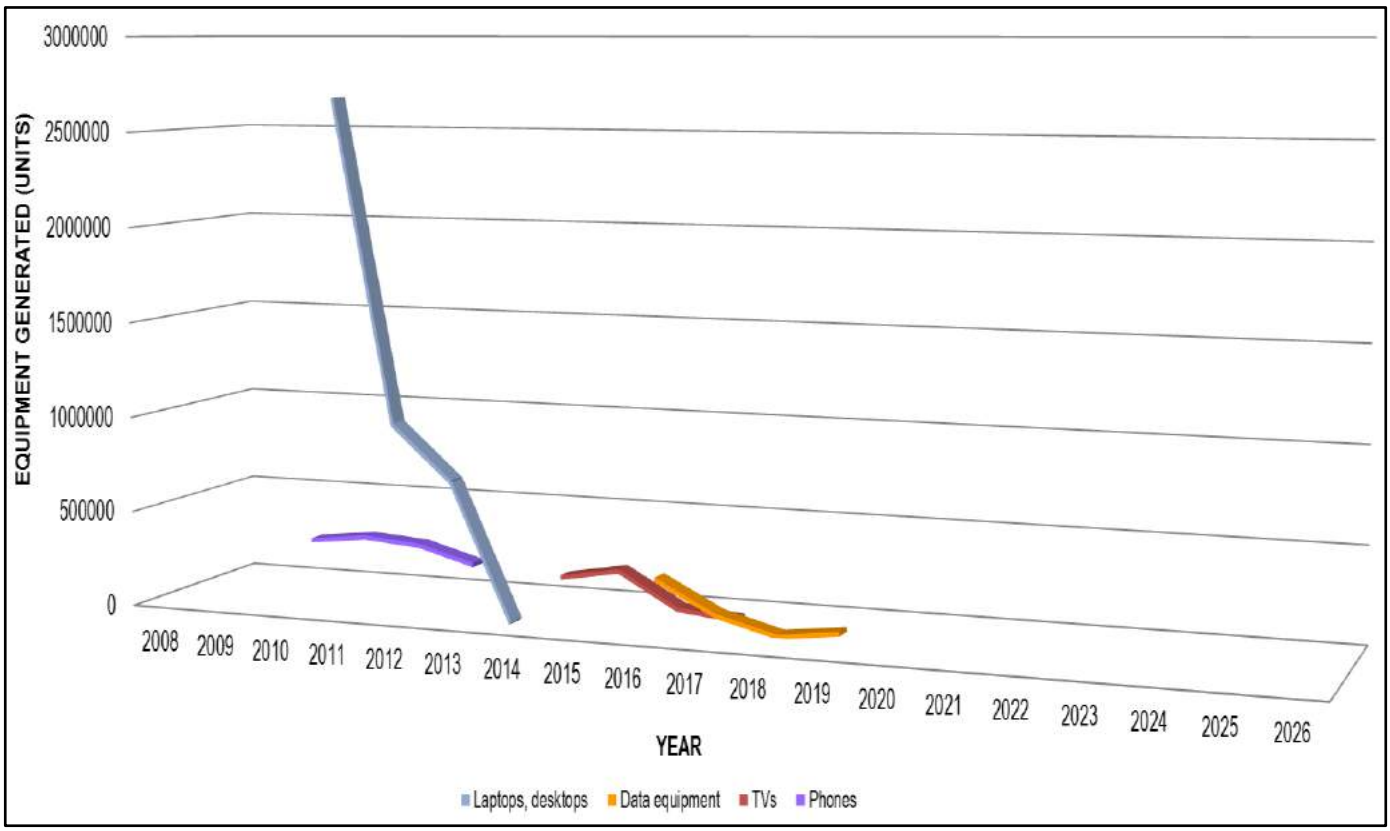


Figure 22: Comparison of the expected generation of WEEE from imports of laptops and desktops with that of other selected EEE items

6.0 DISCUSSION

The results presented in this study have highlighted some key trends and issues that can be reflected across the broad spectrum of the WEEE waste stream and its key stakeholders.

From the study, figures 9 (page 36), 21 (page 51) and 22 (page 52) show that the priority areas for immediate treatment would be the EEE with a lifespan of 5-10 years, such as computing/digital equipment, LED lights and some household appliances and consumer equipment. These pieces of equipment would require disposal within a shorter time frame than those with longer lifespans such as vending machines and ATMs. These low lifespan EEE demonstrate a pattern of high import quantities as shown in figures 7 (page 34), 21 (page 51) and 22 (page 52); further driving home the point of the need for immediate action.

The first major category of imports was consumer appliances. This could be attributed to the high demand for such products in addition to the large quantity and sizes of the department stores that sell these appliances in the country. Their short lifespans as highlighted earlier indirectly points to the high turnover as well as the quantity of imports that would be necessary to renew stocks. For this investigation only a few of these distributors and retailers were interviewed and while they were unable to release details on the quantities they imported, their response on the procedure for replenishing stocks indicated that it occurred over a very short time-frame (every six weeks to three months). Unfortunately, investigations into the next phase of the life cycle of these products i.e. consumption were unable to be conducted as the largest stakeholder user group, households, could not be facilitated in the research.

Moving the products into the EoL phase, the feedback from the private waste collectors and e-waste brokers indicated that rarely (or not at all) did this category of EEE arrive for treatment. This is a serious concern as based on the lifespan and time period under investigation, these large quantities of appliances would either be nearing or already at their EoL. From the interviews with the respective stakeholders, it can be assumed that some may simply be in storage while in other cases the EoL equipment has entered the MSW stream and the nation's landfills. However, larger, more conspicuous metal-based appliances like fridges and washing machines, which require special permission from SWMCOL, seem to be dealt with more and more by scrap deals and possibly salvagers. While none of the scrap metal dealers indicated that such equipment make up a great deal of their incoming material, SWMCOL may refer disposers of such equipment who approach the landfill to scrap metal dealers. Furthermore, it may be assumed that the informal waste salvagers that operate at these sites may handle the equipment that actually enters the landfill.

The second largest category of imports was IT & telecommunication equipment, which according to the results was primarily the brand Dell for IT equipment and used predominantly by the government sector. Based on these findings these two would be great focal points to direct WEEE management activities as a life-cycle management (LCM) system could be initiated, with Dell's role at the distribution and post-consumption phase, particularly in light of the fact that the company has a robust e-waste management policy and a take-back system in place in various regions across the globe. On the other hand, the government sector could ensure that they utilize responsible options for WEEE disposal and in so doing lead by example for the wider public and in particular the

household and petrochemical sectors, which were identified as the other frequent e-waste disposers as shown in figure 12 (page 38).

This 'responsible action' is critical to close the loop in the materials cycling process, by reducing the amount of equipment stockpiling, as well as booster a potentially lucrative local WEEE recycling industry. Past studies have indicated that the greatest challenge faced by the formal WEEE recycling sector is that they cannot get enough WEEE to maintain normal operations (Jinglei *et al.,* 2009 as cited in Ongondo *et al.,* 2011), a fact confirmed by local e-waste brokers during the interviews. These focal points would also provide a great basis for manifestation of the survey findings on where the primary responsibility lies for dealing with WEEE (figure 17, page 42) as it effectively interconnects the three main sectors that the interviewees underscored: government, importers/distributors and owners/generators of WEEE.

However, dealing with the WEEE situation in the country can only be properly addressed if firstly, there is a general, national level understanding of the issue. While the survey did indicate some knowledge did exist in this regard, this was drawn from a minute section of the wider population, who already had some sort of direct involvement with the waste stream and subject matter. However, the interviewees were not probed in order to ascertain the level of this knowledge, so it may very well have been that it ranged across a broad spectrum from miniscule to extensive.

As can be seen from figure 20 (page 47), mapping the flows of WEEE in Trinidad and Tobago is achievable to an extent once the data is provided. Unfortunately, the lack of sufficient quantitative data impeded the level of analysis for the MFA. In its current incarnation, the MFA can be used for highlighting the critical areas where data deficits exist for the country and that are important for making informative calculations like postulations on future flows, which require accurate and holistic preliminary data. The main difficulty would be acquiring data from all the relevant sectors as a collaborative effort would be required to supply figures that can be used to feed into this particular model. However, doing this would prove to be a critical step in guiding the management strategies and monitoring this waste stream.

As demonstrated from the survey, this data is available locally and directly from the primary sources, but it is captured and stored in varying formats depending on the stakeholder category. In order to transform such data into creating a synchronised national data management system and a guide for national-level action, what would be required would be some sort of harmonised system that bridges the technological disparities that currently exists. Roll-out of a pre-developed, quasi-publicly accessible database and data-recording templates tailored for entry by each stakeholder group based upon the sort of information provided can allow for a seamless transition that expedites the process and creates as minimal disruption and opposition as possible.

There are key features that cannot be directly translated into the MFA model, but has a strong bearing on the flows through the system, one prime example of which is government policy. The mandate by the Government since 2010 which ensures that all successful SEA students receive free laptops from the State, as part of the government's 'eConnect and Learn' program, means there has been a higher influx of EEE entering the local system, reflected as imports. Undoubtedly, this necessitates an effective national e-waste management plan to be instituted in a timely manner as these systems will reach their EoL in a matter of years. Furthermore, this is

expected to be an on-going program and these quantities are in addition to the desktop computers already installed in primary and secondary schools and tertiary institutions.

The e-waste situation in Trinidad and Tobago is certainly manageable but requires definitive, coordinated and multi-sectorial action. Below outlines major limitations encountered during the research and some key recommendations to overcome these as well as for addressing the local situation on a whole and thereby act as an aid in expediting the transition process.

7.0 RECOMMENDATIONS FOR IMPROVEMENT OF THE LOCAL E-WASTE SITUATION

7.1. Education & Awareness

7.1.1. National Definition of WEEE

Clarity of what WEEE is and what WEEE constitutes is a must for all stakeholders. This would facilitate a harmonious system of data recording, information exchange and proper WEEE management across all sectors, of course accompanied by the appropriate guidelines. There needs to be a national definition of WEEE within a national policy context so that everyone has a common understanding of the concept.

This definition should clearly identify the characteristics that equipment and devices should possess to be classified as WEEE. Additionally, just as the EU Directive outlines 10 categories of WEEE, a national categorisation system should be devised to fit the local context. This activity should take precedence above all others as it is fundamental for all activities aimed at addressing the management of this waste stream.

7.1.2. Sector Specific Workshops

Previously, SWMCOL has been at the forefront in organizing e-waste symposiums to promote a greater understanding of the local, regional and global e-waste situation among stakeholders in Trinidad and Tobago. More recently, the BCRC-Caribbean has also been instrumental in bringing the issue of WEEE to the fore, including the hosting of a regional workshop on the ESM of WEEE in July 2012.

Using these workshops as a guide, national e-waste workshops targeted to specific sectors in the country can be held. The key ones would be those directly involved with WEEE management as identified in figure 5 (page 23). This rapid assessment identified gaps in knowledge across different sectors. With this in mind, the material for the e-waste workshops can be tailored to address these knowledge gaps according to the sector that the particular workshop is targeting.

7.1.3. Public Exhibitions and Awareness Campaigns

Given the fact that the stakeholders interviewed reiterated that greater awareness among the general public is needed, this is a critical aspect of any actions geared towards better and sustainable management of WEEE in Trinidad and Tobago. E-waste exhibitions featuring recycling companies and stakeholders from the public and private sector could act as a forum for information exchange with respect to best practices for e-waste management. Such exhibitions would allow stakeholders to share information with each other and would allow them to impart their knowledge to the general public.

For recycling companies, this is an opportunity to promote their organisations and increase the flow of their incoming materials while educating the public on proper e-waste disposal. The findings of this assessment

revealed that a large proportion of businesses relied on the information provided by disposal and recycling companies to gain a better insight into e-waste and the hazards associated with its mismanagement.

Other media-based initiatives can be used for information dissemination including the mass media, the ever-popular social media and our local cultural art forms like our music, art and festivals.

The aim of this multi-faceted sensitization drive would be to create a more informed society, armed with a wealth of information on the paradox that is e-waste, especially the human health implications involved, methods available for disposal and reputable, certified companies. With this, the intention is that the general public would adopt more responsible, environmentally sound WEEE disposal practices and ensure collective national action.

Additionally, this could indirectly increase the pressure on OEMs to create products designed for reuse or recycling, with longer lifespans and on national authorities to implement country-wide management systems, or even on a smaller scale clamour for improved WEEE disposal policies at their workplaces with reduced storage time. Going one step further in the longer term, this education could shift the public mentality away from the perception that there is no value in proper WEEE management and, by extension, waste in general and instead lead to more permanent, positive and voluntary behavioural changes.

7.2. Capacity building

7.2.1. Training of High-Level Officials and Port Authority Personnel

Ports are the points of entry of EEE into the country and the points of exit of both EEE and used and EoL EEE. On discovering the multiplicity of unclear descriptions and inadequate records related to imports and exports of EEE from the trade data, it became evident that training of customs and port authority personnel as well as other national trade officers is essential.

Port authorities need to be versed in keeping proper records of incoming and outgoing quantities, accompanied by adequate yet comprehensive descriptions. As per the issue raised on page 30 (section 4.4), concerning missing values and duplication of numbers for both quantities and weights, there needs to be clarification with customs personnel on how data is initially recorded, how the data can be used and applied, and its implication for further national monitoring of EEE and WEEE. As such this training should revolve around employees increasing their capacity to clearly identify the incoming and outgoing EEE and to differentiate between EEE at various stages of its life-cycle, namely the beginning and the end. This will include identification of hazardous or illegal components based on a nationally-agreed definition of WEEE. The training should also seek to ensure that such officers are well informed on what type of data should be collected and recorded and in what format, based on a standardised database and templates as previously discussed (see Discussion section on page 54).

Other key parties to be trained include politicians and adjudicators whose roles in financing and law creation and prosecution respectively are critical in ensuring that a holistic WEEE management system is created. With an understanding of the importance of proper e-waste management, this would increase the political will allowing for

budgetary allocations, designing and implementation of laws while from the legal end, encourage penalisation of breaches to international conventions and local regulations.

7.3. Institutional Strengthening

7.3.1. Revised Regulatory Framework & Legislation

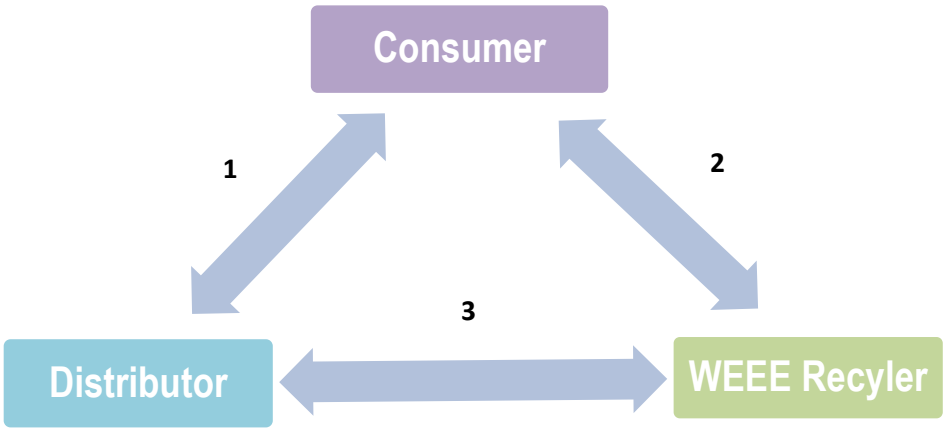
As no local legislation specific to e-waste currently exists, examples in other territories where specific e-waste regulations have been developed can be used as a template for integrating similar legislation relating to proper e-waste collection, used and EoL treatment, import and export controls and incentives for better management of such equipment based on a life-cycle approach, with adjustments made to suit the local realities. In addition, enactment of new laws and implementation of existing legal documents such as the Draft Waste Management Rules (2008) and the Litter Act can be used as stepping stones in this regard. Equally important is the harmonisation of existing and draft policies in order to avoid any conflicts. This would also assist with guaranteeing the necessary flows for optimal e-waste brokerage operations as well as further development of advanced treatment of WEEE and a local e-waste management industry.

Furthermore, policies with respect to take-back arrangements should also be incorporated into the country's legislative framework; not only from a waste management perspective but also from the point of view of importers and manufacturers. Such mandatory mechanisms would form the basis from which a principle of extended producer responsibility (EPR) can be engendered in the country. This would increase the impetus for overseas manufacturers such as Dell, Hewlett Packard (HP), Toshiba, Nokia, Samsung, Blackberry and Motorola that implement take-back programmes in their home countries and other regions across the globe to initiate such programs in Trinidad and Tobago, and by extension the wider Caribbean region.

7.3.2. Establishment of Networks

As mentioned above, the EPR principle in the form of take-back programs should apply to manufacturers selling their products in Trinidad and Tobago. In addition to this, networks for consumer-distributor-recycler interaction should be developed and strengthened since there are few local OEMs present on the local market. This network need not be rigidly dictated by law but should be guided by appropriate guidelines for e-waste stakeholder interaction outlined by the local regulating authority. By applying this concept to the local context, it is almost akin to the implementation of an extended distributor responsibility principle, as the onus would be on local distributors and retailers to liaise with OEMs to ensure ESM of used and EoL electronic equipment. This too can work towards closing the loops in the system. This network can be modelled after one such as is illustrated in figure 23 below.

If necessary and with reference to guidelines developed by the OECD (2011) and otherwise, the take back arrangement between consumer and distributor/manufacturer can be mandated by law and the EPR policy can be supported or reinforced by mandated recycling or disposal bans.



1 The distributor sells new equipment to the consumer as well as provides information on the options available for ESM of WEEE and the consumer has the possibility of returning the equipment at its EoL.

2 The recycler provides e-waste management information to the consumer and the consumer has the option of directly carrying their EoL equipment to the recycler rather than through the distributor

3 The distributor sends EoL equipment to the recycler on behalf of the consumer and the recycler provides the certificate of disposal and other e-waste management information to the distributor

Figure 23: Conceptual depiction of an E-waste network proposed for Trinidad and Tobago

7.3.3. Monitoring and Enforcement

In light of the limited legal and regulatory framework currently in place to support enhanced management of WEEE in Trinidad and Tobago, the existing monitoring and enforcement stakeholders should be further sensitised on their roles and responsibilities in ensuring the proper management of WEEE at the national level and be guided in their duties as such. These would include the previously mentioned customs and port officials as well as environmental and waste management and public health officials. These officials should have a comprehensive understanding of the local and international legislation governing WEEE management and should make regular inspections to ensure that the policies are adhered to and that currently applicable laws are not violated.

In light of the development of a national framework to support the ESM of WEEE, the mobilisation of monitoring officials and compliance officers is important following the establishment of rules and regulations governing WEEE

management. In order to enforce a law, there must be clear penalties outlined. These penalties should be explicitly stated in the drafting of WEEE legislation to avoid any misinterpretation of the law or delay in punishment for non-compliance. There should also be a clear-cut differentiation between EEE that is considered to be waste versus EEE which is non-waste.

7.3.4. Harmonisation of Responsibilities

Part of this process of WEEE management in the country and the sectoral workshops would be to ensure that there is coordination and clear delegation of the roles and responsibilities to the respective entities. In this way there would be no undermining, double-counting and omission of work. Regional authorities that are charged with waste collection would not divert WEEE that should be routed to e-waste managers or have been controlled by SWMCOL and is not readily accepted in the national landfills. Furthermore, there should be inter and intra-sectoral coordination as even within and across some Ministries there may be divergent activities and decisions that could subvert the entire process.

This harmonisation could be best facilitated by the development of a national, holistic strategy to manage WEEE with an initial focus on the categories that demonstrate high levels of import, low-life spans and rapid rates of generation as previously mentioned (refer to Discussion section on page 53). This strategy should be developed and implemented by a singular entity guided by and in collaboration with all key national stakeholders in WEEE generation and management.

7.4. Data Management

7.4.1. Data recording

A comprehensive national database for e-waste quantities and descriptions should be compiled and updated regularly. However prior to this collation of information, there must be a standardised format for stakeholders to record and store their information. As it stands now, varying degrees of data recording and management hinders information exchange and comparisons across different sectors. A uniform format and electronic templates developed based on the information provided in Table 3 (page 45) would facilitate cross-sectoral comparisons and would allow ease of analysis in future assessments and monitoring of WEEE. The major sectors would be, but not limited to, the customs division, distributors, retailers, refurbishers, waste collectors, e-waste brokers, registered scrap metal dealers and/or their trade association.

The templates and database developed should guide stakeholders in knowing what types of data should be recorded. For example, such data would include quantities and weights of EEE purchased locally or imported quantities and weights of WEEE disposed, refurbished and/or recycled, and product descriptions inclusive of HS codes and manufacturer or source information. The recording of the final destination of post-consumer equipment should also be facilitated in this database.

7.4.2. Data Storage and Management

The data should be stored appropriately via a common system that can accommodate and process large quantities of e-waste data and information. This system should be user-friendly as some stakeholders that were interviewed indicated that there is a high turnover of temporary workers who do not have the time to learn the complex in-house data management programs.

An online database system would be best to expedite this process as it would be an accessible means of storage, with a user friendly interface that could integrate the various technological levels of data systems currently in use by all stakeholders. However, the system of data collection and entry should also be designed in order to accept hard versions of these templates and data to facilitate interim uptake. A data hub where all the information is collated and safely stored and verified would be vital and could be designed and rolled-out by an autonomous body such as the BCRC-Caribbean in conjunction with the Central Statistical Office and/or another agency with a role in implementing the Basel Convention locally.

7.5. Facilitation of WEEE Collection and Treatment

7.5.1. Community Collection Points

According to SWMCOL (2007) there is no efficient collection system for WEEE in Trinidad and Tobago. Municipal collection of e-waste can be facilitated, for example, by the establishment of community collection points. These points would have bins specifically designated for e-waste such that this waste is not mixed with the regular MSW stream. Community-based collection has already been piloted in community by a regional corporation in Trinidad and this pilot can be assessed for national roll-out in other communities. Possible sites for establishment of such collection points include gas stations and community centres.

By having bins installed at accessible yet controlled locations such as these, the likelihood of residents disposing of their old and obsolete electronic items in the proper way is increased. As a consequence, the quantity of e-waste going to recycling and processing facilities rather than to landfills after collection will be greater and this could lead to lowered recycling costs for recycling companies, and by extension, for customers, in the medium to long term.

Consideration should also be made for periods when there may be a peak in WEEE disposal by compensating for this through increasing the system's capacity by either providing additional bins or increasing the frequency of waste collection. From this study some distributors indicated there were times when sales peaked, for instance around the Christmas season and in September in anticipation of the new school term. It can be assumed that peak sales could lead to increase disposal of unwanted or dysfunctional EEE, although this is not definitive. In other instances seasonal influences like the heat during the dry season compromised the integrity of some EEE, leading to damage and eventual disposal by the rainy season. Holding of pilot collection drives during these transitional periods may serve to solidify these assumptions as well as assess the need for the timing of such drives nationally.

7.5.2. Establishment of an Advanced WEEE Treatment Facility and Associated Collection Systems

A pilot treatment facility could also be established locally that deals with collection, refurbishment, de-manufacturing and packaging of the WEEE for international treatment. This too would be another source of employment and revenue generation. This would be pivotal for treatment of the large volumes of WEEE from both large corporations and private consumers highlighted in the MFA (figure 20, page 47) that reside in the country. This pilot facility should also serve as an additional sink for WEEE generated in the country and elsewhere in the Caribbean where options for used and EoL EEE are mainly limited to stockpiling, landfilling and incineration. Furthermore, the pilot facility can also establish ESM processes and practices for WEEE categories not presently handled by the existing waste brokers. This is also a long-term solution for dealing with the problem.

Such a facility should establish and expand its operations in collaboration with the existing stakeholders in WEEE management, including the development of networks as displayed in figure 23 (page 59). There are several effective recycling models already in existence globally and those like Taiwan's 4-in-1 Recycling Program, which is a noteworthy model, can be adjusted to suit our local situation. The Taiwanese model integrates community residents, recycling industries, local authorities, each with distinct responsibilities, and a recycling fund financed by producers, into one national scale mechanism. Similarly, an integrated model that includes local residents, waste brokers, government authorities and NGOs, each with their own designated roles and responsibilities, can be adopted in Trinidad and Tobago.

Regionally, within Latin America and the Caribbean, there are opportunities for collaboration for information and resource sharing and the adoption of best available technologies and practices from already established facilities and organisations. Locally, there is the opportunity to capitalize on the informal community-based waste interception systems currently operating at the landfills and other functioning structures like the e-waste brokers and regulatory agencies to catalyse this process.

Furthermore, such a facility should be accompanied with the design and establishment of sound logistical transportation and collection systems for WEEE, with special considerations being given to the Tobago situation. This is necessary to ensure that all used and EoL equipment arrive at the pilot facility in a condition that they can be safely accepted and treated, and that there are no costly time lags between the point in time when EEE becomes WEEE, thereby maximising the potential of WEEE as a resource.

7.5.3. Streamlining of Stakeholders with Key Roles in the Management of UEEE and EoL EEE

A concerted effort and programme of action items must be made and executed with the existing e-waste brokers, scrap dealers, repairers/refurbishers and informal waste salvagers at the national level. With respect to the WEEE managers, there must be enhanced training and monitoring of their activities in order to ensure that environmentally sound practices are indeed taking place and to promote a level playing field in the WEEE/scrap trade. In spite of the absence of a holistic legal and regulatory framework, a monitoring framework can be

developed with consideration being given to existing laws that may apply to these activities, such as the Certificate of Environmental Clearance (CEC) Rules 2001 for example. Moreover, inculcating a culture of data collection and management within these sectors, which is quite necessary in supporting the monitoring and management of used and EoL EEE, must also be performed at the national level.

With respect to the informal waste salvagers and collectors, responses by stakeholders suggest that they play an important role in e-waste management – a role that is yet to be properly defined or understood. The problem however, is that many of these collectors either intercept the waste before arrival at landfills or may illegally enter landfills in order to salvage and 'recycle' such wastes. These informal 'recycling' activities are typically performed through unsafe disassembly and smelting activities as well as via informal scrap metal dealings. The quantities of e-waste and metals that are intercepted consequently go unrecorded and the activities of these informal collectors and dealers are untaxed.

Registering these collectors and their activities will not only assist in the formal collection of e-waste in the country but will also allow for additional data collection with respect to the quantities of WEEE that these stakeholders collect and process. Registering these informal stakeholders also opens a window for the Government to earn revenue by taxing their activities – revenue which can be diverted by toward enabling and monitoring activities in the WEEE management as well as the broader waste management sectors at the national level.

In the case of the scrap metal dealers, there needs to be regularisation of the industry, both from the formalised and informal dealers. According to information provided by the Ministry of Trade and Industry upon request for information under the ambit of this study, there are almost one hundred scrap metal businesses operating in the country. It should be noted that this figure excludes those dealers who are engaged in the informal sector. Responses emanating from this stakeholder group indicated that a greater degree of enforcement is needed in this particular industry as a result of the high level of illegal scrap activities occurring locally.

The inability of the scrap metal companies that were interviewed in this survey to provide quantitative data either due to a lack of knowledge on what exactly constitutes WEEE or due to an absence of records specific to WEEE materials, was not only a limitation in this study but also signifies the need to work specially with the stakeholders of this sector. While the aforementioned sector-specific workshops and activities to enhance public awareness and data collection are necessary, it is also critical that there is enhancement of the monitoring and control of the operational activities of and incoming supplies to these dealers are performed in order to ensure that the hazardous WEEE and WEEE-related generated in the country are channelled to the proper operations. This can be bolstered through the strengthening and greater enforcement of the Old Marine and Metal Stores Act (1904), which allows a split and unclear explanations in the enforcement duties among the Magistrate's Court of Trinidad and Tobago, the Trinidad and Tobago Police Service and the Trade Licensing Unit of the Ministry of Trade, Industry and Investment. This will lend further assistance to identifying and limiting the major categories of WEEE that pose a threat to human and environmental health to the non-environmentally sound management operations of WEEE treatment occurring unknowingly under such operations.

Finally, repairing and refurbishing companies currently in operation in the country can also be streamlined into a national life cycle management approach to EEE and WEEE given the fact that these companies currently receive

low but steady streams of equipment from walk-in customers and government institutions. Vocational-level training geared towards honing the skills of repairers and refurbishers as well as promotion and adherence to applicable certification schemes to ensure that they handle and manage used EEE in a safe manner as well as channel EoL EEE in their possession to sound facilities will ensure that all areas of the EEE life cycle aid in enhancing the ESM of WEEE in the country in a sustainable manner.

8.0 CONCLUSION

The digital revolution has led to the proliferation of ICTs, with the attendant development of extensive quantities of waste electronic and electrical materials. Trinidad and Tobago, a newly emerging developed nation has become increasingly consumed by this technological wave and this investigation sought to determine the status of WEEE in the country. This rapid assessment, though having some shortfalls in terms of scope and quantitative data collection, identified important gaps in knowledge and weaknesses of the current local e-waste management system via semi-structured interviews and the use of a modified mass flow assessment. Data management, education and awareness, e-waste infrastructure and local legislation have all been identified as areas in need of urgent improvement.

Development of a national database, uniform record keeping, e-waste public awareness campaigns, further establishment of adequate e-waste infrastructure and collection to address already existing stockpiles of WEEE and those being generated presently, and revision of local legislation to create an enabling environment were just some of the suggestions identified to improve the local e-waste situation.

This study as a country level life-cycle analysis of electrical and electronic products is a useful starting point for steering definitive action on e-waste management. This work can prove beneficial in other territories, particularly in other small island developing states (SIDS) like Trinidad and Tobago, which share many inherent characteristics, and in states where work to examine and address e-waste issues have not commenced. As such, the methodology utilised in this assessment can be transferred and act as a guide for mapping a similar investigation and is flexible enough to be adjusted to the respective local environments to which it is applied. Major organisations may also find the research replicable for constructing smaller scale models that chart the flows of EEE under their authorization, which in many events aligns with tenants of their corporate social responsibility (CSR) policies of ensuring responsible disposal.

There is now scope for building upon this foundation study with the development of a comprehensive national management strategy and system that encompasses all of the major stakeholders that were identified in this study. With an estimation of recovery being less than 1% of WEEE imports observed in concurrent years reaching operations geared towards managing the national WEEE stream in an appropriate manner, there is clearly a significant gap to fill and the urgent need for such a system to be implemented.

In addition to building upon the recommendations made, this system development should be supplemented with a more in-depth inventory of WEEE in addition to improving the understanding and further refinement of the roles and responsibilities of the key stakeholders within an enhanced framework environment. There should also be inclusion of household and community-based surveys and consumer assessment to assist in filling in the existing gaps in the consumption information that exists for EEE and solve the ESM issues that exist within this particular sub-system in the national WEEE landscape. Furthermore, this national strategy should include further development of the aforementioned pilot WEEE management infrastructure, including advanced treatment options for a broad range of WEEE categories, while recognising and supporting the role of private sector development of the e-waste management potential in Trinidad and Tobago and by extension other parts of the Caribbean.

Collectively, these steps will create a pathway for integrated and environmentally sound management of WEEE to be firmly developed in Trinidad and Tobago. Such a system will not only aid in minimising any negative human and environmental health impacts associated with the mismanagement of WEEE, but will also ensure that the focus of this waste stream at the national level is shifted away from the bottom of the waste management hierarchy to the higher levels (Phillips & Thorne, 2011).

While there is scope for improving this work and overcoming the limitations identified, it still highlights the prime opportunity for Trinidad and Tobago to capitalise on an already burgeoning yet opportunity filled issue. Consequently, this study and its recommendations form the basis from which concrete policy and management actions can be implemented in order to safeguard the health of the nation's environment and people while creating a sustainable pathway to achieving the environmentally sound management of WEEE in Trinidad and Tobago.

REFERENCES

Abdoelrazak, F. (2013). *Strengthening Waste Management in Suriname*. Presentation at the BCRC-Caribbean/PACE Workshop for Capacity Development in the Environmentally Sound Management of Waste Electrical & Electronic Equipment in the Caribbean, Hyatt Regency Hotel and Conference Centre, Trinidad and Tobago.

Alonso, R. (2012). [online] Image available at: http://ralonso.com/?works=arte [Accessed: 13th August 2013].

Armstrong, T. (2013). *National Status of WEEE & its Management, Barbados*. Presentation at the BCRC-Caribbean/PACE Workshop for Capacity Development in the Environmentally Sound Management of Waste Electrical & Electronic Equipment in the Caribbean, Hyatt Regency Hotel and Conference Centre, Trinidad and Tobago.

Artana, D., S. Auguste, R. Moya, S. Sookram, and P. Watson. (2007). Trinidad & Tobago: *Economic Growth in a Dual Economy*. An IDB Research Project.

Basel Action Network (BAN). 2008-2010. About us: background and history. Available at: http://e-stewards.org/about/ [Accessed: 22nd July 2013].

Basel Convention. (2010). *Mobile Phone Partnership Initiative (MPPI) – Guideline on the Collection of Used Mobile Phones.* Geneva: Secretariat of the Basel Convention.

Basel Convention. (2011). *Text and Annexes of the Basel Convention on the Control of the Transboundary Movement of Hazardous Wastes and their Disposal*. [online] Available at: http://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf [Accessed: 29th October 2013].

Boeni, H., U. Sila, & D. Ott. (2008). *E-Waste Recycling in Latin America: Overview, Challenges and Potential.* Paper presented at the Global Symposium on Recycling, Waste Treatment and Clean Technology, Cancun, Mexico.

Bilbao-Osorio,B., Dutta, S. & Lanvin, B. (2013). T*he Global Information Technology Report 2013. Growth and Jobs in Hyperconnected World.* Geneva: World Economic Forum.

Bryman, A. (2008). *Social Research Methods* (3rd ed.). Oxford: Oxford University Press.

CIA. (2013). *The World Factbook. Trinidad and Tobago, Economy Overview-Labour Force by occupation*. [online] Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/td.html [Accessed: 18th July 2013].

CIA. (2007). *The World Factbook. Trinidad and Tobago, Nationality Overview-Population*. [online] Available at https://www.cia.gov/library/publications/the-world-factbook/geos/td.html . [Accessed: 18th July 2013].

Draft Waste Management Rules [DWMR] (2008). Republic of Trinidad and Tobago. Port-of-Spain: GORTT.

Environmental Management Authority [EMA]. (2011). *History of the Environmental Management Authority*. [online] Available at: http://www.ema.co.tt/cms/index.php?option=com_content&task=view&id=35&Itemid=42 [Accessed: 19th July 2013].

EM Act (2001). *Environmental Management Act. Republic of Trinidad & Tobago*. Port-of-Spain: GORTT.

EMPA, Basel Convention & UNEP. (2012). *e-Waste Assessment Methodology Training & Reference Manual. E-Waste Africa Project of the Secretariat of the Basel Convention*. Geneva: UNEP.

EPA (2012). *Americium*. Available at: http://www.epa.gov/radiation/radionuclides/americium.html [Accessed 16th July 2013].

European Union (EU). (2003). *Directive 2002/96/EC of The European Parliament and of The Council* of 27 January 2003 on waste electrical and electronic equipment (WEEE). Official journal of the European Union, 37 pp. 24-38. [online] Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0024:0038:en:PDF [Accessed: July 19, 2013].

Garraway, E. and D. Ott. (2010). *e-Waste Assessment in Trinidad & Tobago – A situation analysis of e-waste management and generation with special emphasis on personal computers*. EMPA: Geneva.

Government of the Republic of Trinidad and Tobago (GORTT). (2006). *National Environmental Policy (NEP) of the Republic of Trinidad and Tobago*. Port-of-Spain: EMA.

Government of the Republic of Trinidad and Tobago (GORTT). (2010). Review of the Economy 2010. [online] Available at: http://www.finance.gov.tt/content/Review%20of%20the%20Economy%202010.pdf [Accessed: 15th August 2013].

Government of the Republic of Trinidad and Tobago (GORTT). (2013). Trinidad and Tobago Diversity. [online] Available at: http://www.biodiversity.gov.tt/home/trinidad-a-tobago-biodiversity.html [Accessed: 15th August 2013].

Heimbuch, J. (2010). *Adorable Sculptures Created from e-Waste*. [online] Available at: http://www.treehugger.com/clean-technology/adorable-sculptures-created-from-e-waste.html [Accessed: 13th August 2013].

Institute of Scrap Recycling Industries (ISRI). (2011). *New study shows scrap recycling industry supports more than 450,000 American jobs while generating $10.3 billion in revenue for federal, state and local governments.* [online] Available at: http://www.isri.org/ISRI/Whats_New/New_Study_Shows_Scrap_Recycling_Industry_Supports_More_than_450_000_American_Jobs.aspx [Accessed: 19th July 2013].

Kimani, J.W. (2009.). Hi-tech yet highly toxic: Electronics and E-waste. *Journal of Language, Technology & Entrepreneurship in Africa*. Vol. 1 (2): pp. 46-6.

Laissaoui, S. & Rochat, D. (2008). *Technical Report on the Assessment of E-Waste Management in Morocco.* [online] Available at: http://www.empa.ch/plugin/template/empa/*/80257/---/l=1 [Accessed: 13 May 2013].

Lau, W., S. Chung, and C. Zhang. (2013). A material flow analysis on current electrical and electronic waste disposal from Hong Kong households. *Waste Management.* Vol. 33 pp. 714–721.

Lay, R. (2013). *OECS WEEE Status*. Presentation at the BCRC-Caribbean/PACE Workshop for Capacity Development in the Environmentally Sound Management of Waste Electrical & Electronic Equipment in the Caribbean, Hyatt Regency Hotel and Conference Centre, Trinidad and Tobago.

Lepawsky, J. and C. McNabb. (2010). Mapping international flows of electronic waste. *Canadian Geographer.* Vol. 54 (2), pp. 177–195.

Lundgren (2012). *The global impact of e-waste: Addressing the challenge*. Geneva: International Labour Organization (ILO).

Ministry of Energy and Energy Affairs of the Republic of Trinidad and Tobago (MEEA). (2011). *Framework for Development of a Renewable Energy Policy for Trinidad and Tobago*. *A Report of the Renewable Energy Committee*. [online] Available at: http://energy.gov.tt/content/266.pdf [Accessed: 3 June 2013].

Ministry of Local Government of the Republic of Trinidad and Tobago (MoLG). (2012). *An Integrated Solid Waste/Resource Management Policy for Trinidad and Tobago. Final draft*. [online] Available at: http://www.localgov.gov.tt/~/media/Resource%20Library/TT%20MOLG%20SWM%20Policy%20-%20Final%20Draft%20Integrated%20Policy%2014%2011%2011.ashx [Accessed: 14th August 2013].

Mohammed, A. (2010, September 16). Deadly toxins in garbage soup at the Beetham Dump. *The Trinidad & Tobago Guardian Online*. [online] Available from: http://test.guardian.co.tt/?q=news/general/2010/09/16/deadly-toxins-garbage-soup-beetham-dump [Accessed: 19 July 2013].

Ministry of Local Government of the Republic of Trinidad and Tobago (MoLG). (2008). *Ministry of Local Government Overview*. [online] Available at: http://www.localgov.gov.tt/About%20the%20Ministry/Overview.aspx#.UelcrI03saA [Accessed: 19th July 2013].

Morrison, B. (2013). *Jamaica's Initiatives to Manage Waste Electrical & Electronic Wastes.* Presentation at the BCRC-Caribbean/PACE Workshop for Capacity Development in the Environmentally Sound Management of Waste Electrical & Electronic Equipment in the Caribbean, Hyatt Regency Hotel and Conference Centre, Trinidad and Tobago.

Ministry of Trade, Industry and Investment of the Republic of Trinidad and Tobago (MTII). (2012*). Ministry of Trade, Industry and InvestmentTrade Licencing Unit: Guidelines to apply for export licences*. [online] Available at: http://www.tradeind.gov.tt/Portals/0/Documents/TLU/TLU/TLU%20BROCHURE%20MAY%202012.pdf [Accessed: 19th July 2013].

Nordbrand, S. (2009). *Out of control: E-waste trade flows from the EU to developing countries* (*SwedWatch)*. [online] Available at: http://www.swedwatch.org/en/reports/e-waste-export-outcontrol [Accessed: 16 July 2013].

Observatory of Economic Complexity. (2011). *Learn More About: Trade in Trinidad and Tobago*. [online] Available at: http://atlas.media.mit.edu/country/tto/ [Accessed: 18 July 2013].

Ogunseitan, O.A., J.M. Schoenung, J.M. Saphores, & Shapiro, A.A.(2009). The Electronics Revolution: From E-Wonderland to E-Wasteland. *Science*. Vol. 326, pp. 670-671.

Ongondo, F.O., Williams, I.D. &. Cherrett, T.J. (2011). How are WEEE doing? A global review of the management of electrical and electronic wastes. *Waste Management*, Vol. 31, pp. 714-730.

Osibanjo, O . (2011). *Understanding E-waste*. Presentation at the International Summit on the Regulation and

Management of E-Waste in Nigeria : Eko E-Waste Summit 24-25 February 2011, Oriental Hotel, Lagos, Nigeria.

Osibanjo, O. (2009). Electronic Waste: A Major Challenge to Sustainable Development in Africa. *Proceedings of the R'09 World Congress*. [online] Available at: http://ewasteguide.info/files/Osibanjo_2009_R09.pdf [Accessed 10 July 2013].

Pesticide Action Nexus Association (PAN-Ethiopia & Environmental Protection Authority). (2011). *E-Waste Inventory in Four Cities of Ethiopia in 2011.*Addis Ababa: PAN-Ethiopia.

Peterson, J., M. MacDonell, L. Haroun & F. Monette. (2007). *Radiological and Chemical Fact Sheets to Support Health Risk Analyses for Contaminated Areas. Argonne National Laboratory*. [online] Available at: http://www.gonuke.org/ComprehensiveTeachingToolkits/Radiation%20Protection/ChSCC_RP/Columbia%20Basin%20RPT-111/Supplementary%20materials/ANL_ContaminantFactSheets_All_070418.pdf [Accessed 16 July 2013].

Phillips, W. and Thorne, E. (2011). Municipal solid waste management in the Caribbean – A benefit-cost analysis. *ECLAC Studies and Perspectives series No. 22*. ECLAC: Port-of-Spain.

Pickford-Gordon, L. (2012). Ministry distributes 17,400 laptops. *Trinidad & Tobago Newsday*. [online] Available at: http://www.newsday.co.tt/news/0,166800.html [Accessed: 16th July 2013].

Piranha. (2008). *Piranha International Limited. E-waste, Plastics, Software. Services - Computer recycling & IT equipment disposal with 0% to Landfill*. [online] Available at: http://piranhatt.com/ewaste-services-recycling.html. [Accessed: 22nd July 2013]. Phillips, W. and Thorne, E. (2011). Municipal solid waste management in the Caribbean – A benefit-cost analysis. ECLAC Studies and Perspectives series No. 22. ECLAC: Port-of-Spain.

Prakash, S. & Manhart, A. (2010). *Socio-economic assessment and feasibility study on sustainable e-waste management in Ghana*. Freiburg: Öko-Institut.

Puckett, J. & Smith, T (2002). *Exporting harm: the high-tech trashing of Asia*. The Basel Action Network. Seattle: Silicon Valley Toxics Coalition.

Raghupathy, L., Krüger, C., Chaturvedi, A., Arora, R., & Henzler, M.P. (2010). *E-waste recycling in India: Bridging the gap between the informal and formal sector*. [online] Available: http://www.iswa.org/fileadmin/galleries/General%20Assembly%20and%20WC%202010%2011%20Hamburg/Presentations/Krueger.pdf [Accessed: 16 July 2013].

Rambarran, J. (2012). *The Current State of the Trinidad and Tobago Economy and the Outlook for 2013*. Feature address at the Trinidad and Tobago Chamber of Industry and Commerce Luncheon Meeting. Available at: http://chamber.org.tt/wp-content/uploads/2012/11/Governor-Jwala-Rambarran-_Central-Bank-Address-to-Chamber-of-Commerce-Outlook-of-the-Economy-2013.pdf [Accessed: 18th July 2013].

Strategic Approach to International Chemicals Management (SAICM). (2013*). SAICM Emerging Policy Issues; Hazardous substances within the life cycle of electrical and electronic products.* [online] Available at: http://www.saicm.org/index.php?option=com_content&view=article&id=455&Itemid=690 [Accessed: 16th July 2013].

Scrap metals: A billion-dollar industry. (2008, September 15). *The Trinidad & Tobago Guardian Online*. [online] Available at: http://www.guardian.co.tt/business-guardian/2011/09/15/scrap-metals-billion-dollar-industry [Accessed: 19th July, 2013].

Singh, K., Kelly, S. & Sastry, M.K.S. (2009). Municipal Solid Waste to Energy: Potential for Application in Trinidad and Tobago. *The Journal of the Association of Professional Engineers of Trinidad and Tobago*, 38(1), pp. 42-49.

Singh, R.H., Rankine L.B. & Seepersad. G. (2005). A Review of Agricultural Policies: Case Study of Trinidad and Tobago. Trinidad: University of the West Indies, Department of Agricultural Economics and Extension. [online] Available at: http://www.caricom.org/jsp/community/agribusiness_forum/agri_policy_trinidad_tobago.pdf [Accessed: 18 July, 2013].

Solving the e-waste Problem Initiative (StEP). 2013[a]. *The initiative & our 5 principles*. [online] Available at: http://www.step-initiative.org/index.php/Initiative_Principles.html [Accessed: July 22nd 2013].

Solving the e-waste Problem Initiative (StEP). 2013[b]. *Our Five Taskforces*. [online] Available at: http://www.step-initiative.org/ [Accessed: July 22 2013].

Stockholm Convention. (2011). *Text of the Stockhom Convention on Persistent Organic Pollutants (POPs)*. [online] Available at: http://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx [Accessed: 29th October 2013].

The Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL). (2007). *A study on the existing e-waste problem in Trinidad and Tobago*. Unpublished Report.

The Telecommunications Authority of Trinidad and Tobago (TATT). (2012). Annual Market Report: Telecommunications and Broadcasting Sectors. January to December 2011. [online] Available at: https://tatt.org.tt/Portals/0/documents/Annual%20Market%20Report%20January%20to%20December%202011.pdf [Accessed: 12th July 2013]

United Nations Environment Programme (UNEP) (2006). *Call for Global Action on E-waste*. Geneva: UNEP.

United Nations Children's Fund (UNICEF). (n.d.). *Definitions - Education.* [online] Available at: http://www.unicef.org/infobycountry/stats_popup5.html [Accessed: 15th August 2013].

United Nations Environment Programme Division of Technology, Industry and Economics [UNEP-DTIE]. (2007). *E-waste – Volume I: Inventory Assessment Manual*. Osaka: UNEP.

United Nations Statistics Division [UNSD]. (2013). *World Statistics Pocketbook*. [online] Available at: http://data.un.org/CountryProfile.aspx?crName=Trinidad%20and%20Tobago [Accessed 18 July, 2013]

United Nations Statistics Division [UNSD]. (2012). *UNSD Statistical Databases: Social Indicators*. [online] Available at: http://unstats.un.org/unsd/demographic/products/socind/default.htm [Accessed: 17th July 2013].

Widmer, R.,. Oswald-Krapf, H Sinha-Khetriwal, DSchnellmann, , M. & Böni. H. (2005). Global perspectives on e-waste. *Environmental Impact Assessment Review*, Vol. 25, (5), pp.436–458.

World Bank Group. (2013a). *Data: Trinidad and Tobago*. Available at: http://data.worldbank.org/country/trinidad-and-tobago [Accessed: 17th July 2013].

World Bank Group. (2013b). *World Development Indicators: Education completion and outcomes*. [online] Available at: http://wdi.worldbank.org/table/2.13 [Accessed: 17th July 2013].

World Bank Group (2013c). *School enrolment, tertiary (% gross)*. [online] Available at: http://data.worldbank.org/indicator/SE.TER.ENRR [Accessed: 15th August 2013].

Yin, R. (2009). *Case Study Research: Design and Methods* (4th Ed.). Applied Social Research Methods Series, Vol. 5. London: Sage.

Yla-Mella, Y., E. Pongracz, & Keiski, RL. (2004). Recovery of waste electrical and electronic Equipment

(WEEE) in Finland. In: Pongracz E, editor. *Proceedings of the waste minimization and resource use optimization conference* pp. 83-92.

Yu, J., M. Ju, & Williams, E. (2009). Waste electrical and electronic equipment recycling in China: Practices and strategies. *2009 IEEE International Symposium on Sustainable Systems and Technology, ISSST '09*. Cooperation with 2009 IEEE International Symposium on Technology and Society, ISTAS.

Yu, J., Welford, R.& Hills, P. (2006). Industry responses to EU WEEE and ROHS Directives: Perspectives from China. *Corporate Social Responsibility and Environmental Management*, Vol. 13, (5) pp. 286–299.

Zumbuehl, D. (2006). *Mass Flow Assessment (MFA) And Assessment of Recycling Strategies for Cathode Ray Tubes (CRTs) for The Cape Metropolitan Area (CMA), South Africa*. South African Project "Knowledge Partnerships in E-Waste Recycling". Dissertation.

APPENDIX I:

ANNEX IA AND IB OF THE EU WEE DIRECTIVE 2002/96/EC

(Source: Official Journal of the European Union)

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

1. Large household appliances

2. Small household appliances

3. IT and telecommunications equipment

4. Consumer equipment

5. Lighting equipment

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

7. Toys, leisure and sports equipment

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

9. Monitoring and control instruments

10. Automatic dispensers

Annex IB. List of products which shall be taken into account for the purpose of this Directive and which fall under the categories of Annex IA

1. Large house hold appliances

Large cooling appliances

Refrigerators

Freezers

Other large appliances used for refrigeration, conservation and storage of food

Washing machines

Clothes dryers

Dish washing machines

Cooking

Electric stoves

Electric hot plates

Microwaves

Other large appliances used for cooking and other processing of food

Electric heating appliances

Electric radiators

Other large appliances for heating rooms, beds, seating furniture

Electric fans

Air conditioner appliances

Other fanning, exhaust ventilation and conditioning equipment

2. Small household appliances

Vacuum cleaners

Carpet sweepers

Other appliances for cleaning

Appliances used for sewing, knitting, weaving and other processing for textiles

Irons and other appliances for ironing, mangling and other care of clothing

Toasters

Fryers

Grinders, coffee machines and equipment for opening or sealing containers or packages

Electric knives

Appliances for hair-cutting, hair drying, tooth brushing, shaving, massage and other body care appliances

Clocks, watches and equipment for the purpose of measuring, indicating or registering time

Scales

3. IT and telecommunications equipment

Centralised data processing:

Mainframes

Minicomputers

Printer units

Personal computing:

Personal computers (CPU, mouse, screen and keyboard included)

Laptop computers (CPU, mouse, screen and keyboard included)

Notebook computers

Notepad computers

Printers

Copying equipment

Electrical and electronic typewriters

Pocket and desk calculators

and other products and equipment for the collection, storage, processing, presentation or communication of information by electronic means

User terminals and systems

Facsimile

Telex

Telephones

Pay telephones

Cordless telephones

Cellular telephones

Answering systems

and other products or equipment of transmitting sound, images or other information by telecommunications

4. Consumer equipment

Radio sets

Television sets

Video cameras

Video recorders

Hi-fi recorders

Audio amplifiers

Musical instruments

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

5. Lighting equipment

Luminaires for fluorescent lamps with the exception of luminaires in households

Straight fluorescent lamps

Compact fluorescent lamps

High intensity discharge lamps, including pressure sodium lamps and metal halide lamps

Low pressure sodium lamps

Other lighting or equipment for the purpose of spreading or controlling light with the exception of filament bulbs

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

Drills

Saws

Sewing machines

Equipment for turning, milling, sanding, grinding, sawing, cutting, shearing, drilling, making holes, punching,

folding, bending or similar processing of wood, metal and other materials

Tools for riveting, nailing or screwing or removing rivets, nails, screws or similar uses

Tools for welding, soldering or similar use

Equipment for spraying, spreading, dispersing or other treatment of liquid or gaseous substances by other means

Tools for mowing or other gardening activities

7. Toys, leisure and sports equipment

Electric trains or car racing sets

Hand-held video game consoles

Video games

Computers for biking, diving, running, rowing, etc.

Sports equipment with electric or electronic components

Coin slot machines

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

Radiotherapy equipment

Cardiology

Dialysis

Pulmonary ventilators

Nuclear medicine

Laboratory equipment for in-vitro diagnosis

Analysers

Freezers

Fertilization tests

Other appliances for detecting, preventing, monitoring, treating, alleviating illness, injury or disability

9. Monitoring and control instruments

Smoke detector

Heating regulators

Thermostats

Measuring, weighing or adjusting appliances for household or as laboratory equipment

Other monitoring and control instruments used in industrial installations (e.g. in control panels)

10. Automatic dispensers

Automatic dispensers for hot drinks

Automatic dispensers for hot or cold bottles or cans

Automatic dispensers for solid products

Automatic dispensers for money

All appliances which deliver automatically all kind of products

APPENDIX II:

Tables of Products and HS Codes

Category	HS Code	Description
1. Large household appliances	7321.11.10	Gas and other fuel stoves and ranges
	7321.11.20	Gas and other fuel cookers
	7321.11.30	Gas and other fuel barbecues
	7321.11.90	Other gas and other fuel cooking appliances
	7321.12.10	Liquid fuel stoves and ranges
	7321.12.20	Liquid fuel cookers
	7321.12.30	Liquid fuel barbecues
	7321.12.90	Other liquid fuel cooking appliances
	7321.19.10	Solid fuel stoves and ranges
	7321.19.20	Solid fuel cookers
	7321.19.30	Solid fuel barbecues
	7321.19.90	Other solid fuel cooking appliances
	7321.89.00	Stoves, heaters, grates, fires, wash boilers, braziers and similar appliances
	7321.90.00	Parts
	7322.11.00	Radiators of cast iron
	7322.19.00	Iron or steel radiators
	7322.90.00	Other; Air heaters, hot air distributors, iron or steel*
	8415.10.00	Window or wall types, self-contained or "split-system" air conditioning machines
	8415.81.00	Air conditioning machines incorporating a refrigerating unit and a valve for reversal of the cooling/heat cycle (reversible heat pumps)

	8415.82.00	Other air conditioning machines incorporating a refrigerating unit
	8415.83.00	Other air conditioning machines not incorporating a refrigerating unit
	8415.90.00	Parts of air conditioning machines
	8418.21.10	Household refrigerators, compression-type, frost free, electrical
	8418.21.20	Other electrical fridges for domestic use
	8418.21.30	Non-electrical fridges for domestic use
	8418.29.10	Other electrical household type refrigerators
	8418.29.20	Other non-electrical household type refrigerators
	8418.30.00	Freezers of the chest type, not exceeding 800L capacity
	8418.40.00	Freezers of the upright type, not exceeding 900L capacity
	8418.61.00	Heat pumps other than air conditioning machines of heading 8415
	8418.69.00	Other refrigerating or freezing equipment
	8418.99.00	Parts of refrigerating or freezing equipment
	8421.12.10	Clothes dryers for domestic use
	8422.11.00	Dish washing machines of the household type
	8450.11.10	Household washing machines of a dry linen capacity not exceeding 10kg, fully-automatic
	8450.12.10	Household machines with built in centrifugal dryer
	8450.19.10	Other domestic washers
	8450.20.10	Household washing machines of a dry linen capacity exceeding 10kg
	8450.90.00	Parts of household or laundry-type washing machines
	8516.10.10	Electric instantaneous or storage water heaters
	8516.10.20	Electric instantaneous or storage immersion heaters

	8516.21.00	Electric storage heating radiators
	8516.50.00	Microwave ovens
	8516.60.10	Stoves and cookers
	8516.60.90	Other ovens, cookers, cooking plates, grillers, roasters, etc

Category	HS Code	Description
2. Small household appliances	8508.11.00	Vacuum cleaners with self-contained electric motor of a power not exceeding 1500 W and having a dust bag or other receptacle capacity not exceeding 20L
	8508.19.00	Other vacuum cleaners with self-contained electric motor
	8508.60.00	Vacuum cleaners without a self-contained electric motor
	8508.70.00	Parts for above
	8509.40.00	Food grinders and mixers; fruit or vegetable juice extractors
	8509.80.00	Other electro-mechanical domestic appliances with self-contained electric motor
	8509.80.10	Blenders
	8509.80.20	Floor polishers
	8509.80.30	Kitchen waste disposers
	8509.80.90	Other electro-mechanical domestic appliances
	8509.90.00	Parts for electro-mechanical domestic appliances
	8510.10.00	Shavers
	8510.20.00	Hair clippers
	8510.30.00	Hair removing appliances

	8510.90.00	Parts for above
	8516.31.00	Hair dryers
	8516.40.00	Electric smoothing irons
	8516.71.00	Coffee or tea makers
	8516.72.00	Toasters
	8516.79.00	Other domestic electro-thermic appliances
	8452.10.00	Sewing machines of the household type
	9101.11.00	Wrist watches, electrically operated with mechanical display only
	9101.19.00	Other electrically operated wrist watches
	9101.21.00	Wrist watches with automatic winding
	9101.29.00	Other wrist watches with a case of precious metal
	9101.91.00	Other pocket watches and other watches battery or accumulator powered & with a case of precious metal
	9101.99.00	Other pocket watches and other watches with a case of precious metal
	9102.11.00	Wrist-watches, pocket-watches and other watches, including stop-watches, other than those of heading 91.01: Other wrist watches, electrically operated with mechanical display only
	9102.12.00	With opto-electronic display only
	9102.19.00	Other electrically operated wrist watches
	9102.21.00	Other wrist watches with automatic winding
	9102.29.00	Other
	9102.91.00	Other pocket watches and other watches battery or accumulator powered
	9102.99.00	Other pocket watches and other watches

	9103.10.00	Clocks with watch movements, excluding clocks of heading 9104.00.00, electrically operated
	9103.90.00	Other clocks with watch movements, excluding clocks of heading 9104.00.00
	9105.11.00	Alarm clocks, electrically operated
	9105.19.00	Other alarm clocks
	9105.21.00	Electrically operated wall clocks
	9105.29.00	Other electrically operated wall clocks
	9105.91.00	Other clocks, battery, accumulator or mains powered
	9105.99.00	Other clocks
	9106.10.00	Time-registers; time recorders
	9106.90.00	Other time of day recording apparatus
	9107.00.00	Time switches with clock or watch movement or with synchronous motor
	9108.11.00	Watch movements with mechanical display only or with a device to which a mechanical display can be incorporated
	9108.12.00	Watch movements with opto-electronic display only
	9108.19.00	Other electrically operated watch movements
	9108.20.00	With automatic winding
	9108.90.00	With hand winding only
	9109.11.00	Electrically operated clock movements of alarm clocks
	9109.19.00	Other electrically operated clock movements
	9109.90.00	Other
	9110.11.00	Complete watch movements, unassembled or partly assembled (moving parts)

	9110.12.00	Incomplete watch movements, assembled
	9110.19.00	Rough watch movements
	9110.90.00	Rough clock movements
	9114.10.00	Clock or watch springs, including hair springs
	9114.30.00	Dials
	9114.40.00	Plates and bridges
	9114.90.10	Other clock parts
	9114.90.20	Other watch parts

Category	HS Code	Description
3. IT & Telecomm-unications Equipment	8443.12.00	Offset printing machinery, sheet fed, office type (using sheets with one side not exceeding 22 cm and the other side not exceeding 36 cm in the unfolded state)
	8443.13.00	Other offset printing machinery
	8443.14.00	Letterpress printing machinery, reel fed, excluding Flexographic printing
	8443.15.00	Letterpress printing machinery, other than reel fed, excluding flexographic printing
	8443.16.00	Flexographic printing machinery
	8443.17.00	Gravure printing machinery
	8443.19.00	Other
	8443.31.00	Other printers, copying machines and facsimile machines, whether or not combined: Machines which perform two or more of the functions of printing, copying or facsimile transmission, capable of connecting to an automatic data processing machine or to a network
	8443.32.00	Other, capable of connecting to an automatic

		data processing machine or to a network
	8443.39.00	Other
	8443.91.00	Parts and accessories: Parts and accessories of printing machinery used for printing by means of plates, cylinders and other printing components of heading84.42
	8443.99.00	Other
	8469.00.00	Typewriters other than printers of heading 84.43; word processing machines
	8470.10.00	Electronic calculators capable of operation without an external source of electric power and pocket-size data recording, reproducing and displaying machines with calculating functions
	8470.21.00	Other electronic calculating machines: Incorporating a printing device
	8470.29.00	Other
	8471.30.00	Portable automatic data processing machines, weighing not more than 10 kg, consisting of at least a central processing unit, a keyboard and a display Other automatic data processing machines:
	8471.41.00	Comprising in the same housing at least a central

		processing unit and an input and output unit, whether or not combined
	8471.49.00	Other, presented in the form of systems
	8471.50.00	Processing units other than those of sub-heading 8471.41.00 or 8471.49.00, whether or not containing in the same housing one or two of the following types of unit: storage units, input units, output units
	8471.60.00	Input or output units, whether or not containing storage units in the same housing
	8471.70.00	Storage units
	8471.80.00	Other units of automatic data processing machines
	8471.90.00	Other
	8517.11.00	Telephone sets including telephones for cellular networks or for other wireless networks: Line telephone sets with cordless handsets
	8517.12.90	Other
	8517.18.00	Other
	8517.61.00	Other apparatus for transmission or reception of voice, images or other data, including apparatus for

		communication in a wired or wireless network (such as a local or wide area network): Base stations
	8517.62.00	Machines for the reception, conversion and transmission or regeneration of voice, images or other data, including switching and routing apparatus
	8517.69.00	Other
	8517.70.00	Parts
	8519.50.00	Telephone answering machines

Category	HS Code	Description
4. Consumer Equipment	8518.10.00	Microphones and stands therefore
	8518.21.00	Loudspeakers, whether or not mounted in their enclosures: Single loudspeakers, mounted in their enclosures.
	8518.22.00	Loudspeakers, whether or not mounted in their enclosures Multiple loudspeakers, mounted in the same enclosure
	8518.29.00	Other
	8518.30.00	Headphones and earphones, whether or not combined with a microphone, and sets consisting of a microphone and one or more loudspeakers
	8518.40.00	Audio-frequency electric amplifiers
	8518.50.00	Electric sound amplifier sets
	8518.90.00	Parts

	8519.20.00	Apparatus operated by coins, banknotes, bank cards, tokens or by other means of payment
	8519.20.10	Coin- or disc-operated record-player
	8519.20.90	Other
	8519.30.00	Turntables (record-decks)
	8519.81.00	Other apparatus: Using magnetic, optical or semiconductor media:
	8519.81.10	Transcribing machines
	8519.81.20	Pocket-size cassette-players
	8519.81.30	Dictating machines not capable of operating without an external source of power
	8519.81.40	Other magnetic tape recorders incorporating sound reproducing apparatus
	8519.81.90	Other
	8519.89.00	Other
	8521.10.00	Magnetic tape-type
	8521.90.00	Other
	8522.10.00	Pick-up cartridges
	8522.90.00	Other
	8523.21.00	Magnetic media: Cards incorporating a magnetic stripe:
	8523.21.10	Unrecorded
	8523.21.90	Recorded
	8523.29.00	Other:

	8523.29.10	Unrecorded audio tapes
	8523.29.20	Recorded audio tapes
	8523.29.30	Unrecorded video tapes
	8523.29.40	Recorded video tapes
	8523.29.50	Unrecorded magnetic discs
	8523.29.60	Magnetic tapes for reproducing phenomena other than sound or image
	8523.29.90	Other
	8523.40.20	Discs for laser reading system for reproducing phenomena other than sound only
	8523.40.30	Other discs for laser reading system
	8523.40.40	Audio compact discs
	8523.40.50	Other compact discs
	8523.40.60	Unrecorded Audio compact discs DVD's
	8523.40.70	Recorded DVD's
	8523.40.90	Other
	8525.50.00	Transmission apparatus

	8525.60.00	Transmission apparatus incorporating reception apparatus
	8525.80.00	Television cameras, digital cameras and video camera recorders
	8526.10.00	Radar apparatus
	8526.91.00	Radio navigational aid apparatus
	8526.92.00	Radio remote control apparatus
	8527.12.00	Radio-broadcast receivers capable of operating without an external source of power: Pocket-size radio cassette-players
	8527.13.00	Other apparatus combined with sound recording or reproducing apparatus
	8527.19.00	Other
	8527.21.00	Radio-broadcast receivers not capable of operating without an external source of power, of a kind used in motor vehicles: Combined with sound recording or reproducing apparatus
	8527.29.00	Other
	8527.91.00	Combined with sound recording or reproducing apparatus
	8527.92.00	Not combined with sound recording or reproducing apparatus but combined with a clock
	8527.99.00	Other
	8528.41.00	Cathode-ray tube monitors: Of a kind solely or principally used in an automatic data processing system of heading 84.71
	8528.49.00	Other
	8528.51.00	Of a kind solely or principally used in an automatic data processing system of heading 84.71

	8528.59.10	Monitors incorporating television reception apparatus
	8528.61.00	Projectors: Of a kind solely or principally used in an automatic data processing system of heading 84.71
	8528.69.00	Other
	8528.71.00	Reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus: Not designed to incorporate a video display or Screen
	8528.72.00	Other, colour
	8528.73.00	Other, black and white or other monochrome
	8540.11.00	Cathode-ray television picture tubes, including video monitor cathode-ray tubes: Colour
	8540.12.00	Cathode-ray television picture tubes, including video monitor cathode-ray tubes: Black and white or other monochrome
	8540.20.00	Television camera tubes; image converters and intensifiers; other photo-cathode tubes
	8540.40.00	Data/graphic display tubes, colour, with a phosphor dot screen pitch smaller than 0.4 mm
	8540.50.00	Data/graphic display tubes, black and white or other monochrome
	8540.60.00	Other cathode-ray tubes
	8540.81.00	Receiver or amplifier valves and tubes
	8540.89.00	Other
	8540.91.00	Parts: Of cathode-ray tubes
	8540.99.00	Parts: Other

	8541.40.00	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes
	9201.10.00	Upright pianos
	9201.20.00	Grand pianos
	9201.90.00	Other
	9202.10.00	Played with a bow
	9202.90.00	Other
	9205.10.00	Brass-wind instruments
	9205.90.00	Other:
	9205.90.10	Harmoniums
	9205.90.20	Mouth organs
	9205.90.90	Other
	9206.00	Percussion musical instruments (for example, drums, xylophones, cymbals, castanets, maracas).
	9206.00.10	Steel band instruments
	9206.00.90	Other
	9207.10.00	Keyboard instruments, other than accordions
	9207.90.00	Other
	9208.10.00	Musical boxes
	9208.90.00	Other
	9209.30.00	Musical instrument strings
	9209.91.00	Other: Parts and accessories for piano

	9209.92.00	Parts and accessories for the musical instruments of heading92.02
	9209.94.00	Parts and accessories for the musical instruments of heading92.07
	9209.99.00	Other

Category	HS Code	Description
5. Lighting Equipment	8512.10.00	Lighting or visual signalling equipment or a kind used on bicycles
	8512.20.00	Other lighting or visual signalling equipment
	8513.10.00	Portable electric lamps, designed to function by their own source of energy, other than lighting equipment of heading 85.12 (85.13) - Lamps
	8513.90.00	Parts for above
	8539.10.00	Sealed beam lamp units
	8539.21.00	Tungsten halogen filament lamps
	8539.22.00	Filament lamps of a power not exceeding 200W and for a voltage exceeding 100V
	8539.29.00	Other filament lamps, excluding ultra-violet or infra-red lamps
	8539.31.00	Fluorescent lamps, hot cathode
	8539.32.00	Mercury or sodium vapour lamps; metal halide lamps

	8539.39.00	Other discharge lamps other than UV lamps*
	8539.41.00	Arc lamps
	8539.49.00	Ultra-violet or infra-red lamps
	8539.90.00	Parts for ultra-violet or infra-red lamps; arc lamps
	9006.61.00	Discharge lamp ("electronic") flashlight apparatus
	9006.69.00	Other photographic flashlight apparatus

Category	HS Code	Description
6. Electrical and Electronic Tools	8424.20.00	Spray guns and similar appliances
	8424.81.00	Other appliances:
	8424.89.00	Agricultural or horticultural
	8424.90.10	Parts: Of agricultural sprayers
	8424.90.90	Other
	8432.80.10	Lawn or sports-ground rollers
	8432.80.90	Other
	8432.90.00	Parts
	8432.90.10	Of lawn or sports-ground rollers of sub-heading

		8432.80.10
	8432.90.90	Other
	8452.21.00	Other sewing machines: Automatic units
	8452.29.00	Other
	8452.90.00	Other parts of sewing machines
	8455.10.00	Tube mills
	8455.21.00	Other rolling mills: Hot or combination hot and cold
	8455.22.00	Cold
	8455.90.00	Other parts
	8458.11.00	Horizontal lathes: Numerically controlled
	8458.19.00	Other
	8458.91.00	Other lathes: Numerically controlled
	8458.99.00	Other
	8459.61.00	Other milling machines: Numerically controlled
	8459.69.00	Other
	8459.70.00	Other threading or tapping machines
	8461.20.00	Shaping or slotting machines

	8461.30.00	Broaching machines
	8461.40.00	Gear cutting, gear grinding or gear finishing machines
	8461.50.00	Sawing or cutting-off machines
	8461.90.00	Other
	8462.21.00	Bending, folding, straightening or flattening machines (including presses): Numerically controlled
	8462.29.00	Other
	8462.31.00	Shearing machines (including presses), other than combined punching and shearing machines: Numerically controlled
	8462.39.00	Other
	8462.41.00	Numerically controlled presses
	8462.49.00	Other
	8462.91.00	Other: Hydraulic
	8462.99.00	Other
	8463.20.00	Thread rolling machines
	8463.90.00	Other
	8464.10.00	Sawing machines

	8464.20.00	Grinding or polishing machines
	8464.90.00	Other
	8465.10.00	Machines which can carry out different types of machining operations without tool change between such operations
	8465.91.00	Other: Sawing machines
	8465.92.00	Planing, milling or moulding (by cutting) machines
	8465.93.00	Grinding, sanding or polishing machines
	8465.94.00	Bending or assembling machines
	8465.95.00	Drilling or morticing machines
	8465.96.00	Splitting, slicing or paring machines
	8465.99.00	Other
	8466.10.00	Tool holders and self-opening dieheads
	8466.20.00	Work holders

	8466.30.00	Dividing heads and other special attachments for machine-tools
	8466.91.00	Other: For machines of heading84.64
	8466.92.00	For machines of heading84.65
	8466.93.00	For machines of headings 84.56 to 84.61
	8466.94.00	For machines of heading 84.62 or 84.63
	8467.21.00	With self-contained electric motor: Drills of all kinds
	8467.22.00	With self-contained electric motor:Saws
	8467.29.00	Other
	8467.81.00	Other tools: Chain saws
	8467.91.00	Parts: Of chain saws
	8467.99.00	Other
	8468.10.00	Hand-held blow pipes

	8468.80.00	Other machinery and apparatus
	8468.90.00	Parts

Category	HS Code	Description
7. Toys, leisure and sports equipment	8903.99.00	Other
	9504.10.00	Video games of a kind used with a television receiver
	9504.30.00	Other games, operated by coins, banknotes, bank cards, tokens or by other means of payment, other than bowling alley equipment

Category	HS Code	Description
8. Medical devices	9011.10.00	Stereoscopic microscopes
	9011.80.00	Other microscopes, for photomicrography, cinephotomicrography or microprojection
	9011.90.00	Parts and accessories for above
	9012.10.00	Microscopes other than optical microscopes; diffraction apparatus
	9012.90.00	Parts and accessories for diffraction apparatus
	9018.11.00	Electro-diagnostic apparatus (including apparatus for functional exploratory examination or for checking physiological parameters (90.18) -

		electro-cardiographs
	9018.12.00	Ultrasonic scanning apparatus
	9018.13.00	Magnetic Resonance Imaging apparatus (MRI)
	9018.14.00	Scintigraphic apparatus
	9018.19.00	other electro-diagnostic apparatus[1]
	9018.20.00	Ultra-violet or infra-red ray apparatus
	9022.12.00	Computed tomography apparatus
	9022.13.00	X-ray apparatus for dental use
	9022.14.00	Other x-ray apparatus for medical, surgical or veterinary uses
	9022.21.00	Apparatus based on the use of alpha, beta or gamma radiations, whether or not for medical, surgical, dental or veterinary uses, including radiography or radiotherapy apparatus: For medical, surgical, cental or veterinary uses
	9022.30.00	X-ray tubes
	9022.90.00	Parts & accessories for apparatus based on the use of x-rays or other radiations

Category	HS Code	Description
9. Monitoring and Control Instruments	8531.10.00	Burglar or fire alarms and similar apparatus
	9016.00.00	Balances of a sensitivity of 5cg or better, with or without weights
	9026.10.00	Instruments and apparatus for measuring or checking the flow or level of liquids
	9026.20.00	Instruments and apparatus for measuring or checking pressure
	9026.80.00	Other instruments and apparatus for measuring or checking variables of liquids or gases

	9026.90.00	Parts of ins & app for measuring or checking variables of liquids or gases
	9030.10.00	Instruments & apparatus for measuring or detecting ionising radiations
	9030.20.00	Cathode-ray oscilloscopes and oscillographs
	9030.31.00	Multimeters
	9030.32.00	Multimeters with recording device
	9030.33.00	Instruments & app for measuring or checking voltage, current
	9030.39.00	Instruments & app for measuring or checking voltage, current etc (w/o recording device)
	9030.82.00	Instruments for measuring or checking semiconductor wafers or devices
	9030.83.00	Recording electrical measurement instruments
	9030.84.00	Instruments and appliances for measuring or checking electrical quantities
	9030.89.00	Instruments and apparatus for measuring or checking electrical quantities
	9030.90.00	Parts and accessories for instruments and apparatus for measuring or checking electrical quantities
	9031.10.00	Machines for balancing mechanical parts
	9031.20.00	Test benches
	9031.30.00	Profile projectors
	9031.40.00	Optical instruments for checking semiconductor wafers
	9031.49.00	Other optical instruments for measuring or checking
	9031.80.00	Other measuring or checking instruments, appliances and machines
	9031.90.00	Parts and accessories for measuring or checking instruments

	9032.10.00	Automatic regulating or controlling instruments and apparatus (90.32) - thermostats
	9032.20.00	Manostats
	9032.81.00	Hydraulic or pneumatic automatic regulating or controlling instruments & appliances
	9032.89.00	Automatic regulating or controlling instruments and apparatus (90.32)
	9032.90.00	Parts for above
	9033.00.00	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof

Category	HS Code	Description
10. Automatic dispensers	8472.90.00	Other
	8476.21.00	Other
	8476.29.00	Other
	8476.81.00	Other machines: incorporating heating or refrigerating devices
	8476.89.00	Other
	8476.90.00	Parts

APPENDIX III:

List of Interviewed Stakeholders

1. Distributors

- Peake Technologies Limited
- Peake Home Store
- Illuminat
- Fujitsu
- Next Technology Limited
- PRW Enterprises
- TSTT
- The Music House
- Modern Electrical Supplies Limited
- Trius Medical Sales and Services Limited
- Five Star Vending
- Vending Plus Caribbean
- ECT Solutions
- Solar Power Systems

2. Consumers

- British Gas
- First Citizens Bank Limited (ATM use and disposal)
- First Citizens Bank (IT Department)
- Guardian Life of the Caribbean Limited
- Trinidad and Tobago Insurance Limited (TATIL)
- Sagicor Life Incorporated
- Peake (IT Department)
- North Central Regional Health Authority (NCRHA)-Eric Williams Medical Complex
- St. Augustine Private Hospital
- St. Clair Medical Centre

3. Waste Collectors

- Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL)
- Green Engineering

4. E-Waste Brokers (Recyclers)

- Piranha International
- Caribbean Tech Disposals

APPENDIX IV:

Sample Questionnaires

BASEL CONVENTION REGIONAL CENTRE FOR THE CARIBBEAN

ASSESSMENT ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Questionnaire

CONSUMER (IT & Telecommunications Equipment)

1. What are the main categories of telecommunication and IT equipment used by your company?
2. What are the main brands of telecom and IT equipment used by your company? Any particular reason for the brand choice(s)?
3. Generally when the equipment is replaced is it new or second-hand?
4. On average how often is this equipment replaced? *Please separate based on type of equipment*.
5. Is there a policy that guides how often equipment should be replaced? If yes please indicate the designated timeframe and please differentiate by category of equipment if necessary.
6. What is the general procedure for replacing equipment?
7. What are the annual figures on the **quantities** of new equipment purchased**?** *Please separate based on type of equipment.*
8. What is the average lifespan of the equipment used? *Please separate based on type of equipment.*
9. What do you think is the average turnover rate of your equipment used? *Please separate based on type of equipment*.
10. Do you have any arrangements for take-back of products with **suppliers**?
    - If yes, what are the quantities returned per annum?
11. What is the definition used for the End of Life (EoL) of equipment within the company?
12. What is the general procedure for EoL equipment: stored, dumped, sold, returned to originator, repaired, donated, refurbished, recycled?

*Questions 13-15 are relevant if you selected **stored** above*

13. What are the main factors behind retention of non-functional unwanted EEEs, (select as applicable) :
    - internal parts can be used
    - belief that the e-waste is repairable and therefore functional in the future,
    - bought at a high price so that they were storing or returning back to head offices waiting for collectors to buy from them rather than having to pay for collection
    - Company policy: unsure of main reasons
    - Difficulty in writing off from the books
    - Other: *please indicate*

14. Where is this non-functional equipment stored?
    - Internally
    - Externally: e.g. warehouse
    - Other: *please indicate*

15. What are the quantities of equipment stored?

16. Can you describe the data management system for records of stored, replaced and discarded equipment?
    - Data storage mechanism: manual entries, computerized etc.
    - Procedure
    - None

17. Can you describe what kinds of information are recorded in your data management system?
    - E.g. Incoming and outgoing stock quantities? or values?

18. Would you be ready to pay for your electrical equipment to be collected and recycled? y/n
    - If yes, at what conditions? (e.g. pick-up service, guarantee of proper disposal, etc.)

19. Does your company have any environmental certifications?

20. Does your company have an e-waste policy?

21. What knowledge do you have on the outcome of WEEE locally?

22. What knowledge do you have on treating WEEE?

23. Do you have any knowledge of the dangers of WEEE?

24. Where do you think the primary responsibility lies for dealing with WEEE?

BASEL CONVENTION REGIONAL CENTRE FOR THE CARIBBEAN

ASSESSMENT ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Questionnaire

DISTRIBUTOR (General)

1. What types of products do you distribute?
2. What are the main models (brands) of products distributed?
3. On average, what is the fastest selling product?
4. What is the fastest selling model/brand?
5. Who are your major clients?
6. What is the average lifespan of the products you distribute?
7. Does the lifespan vary based on the model (brand)?
8. What are the annual figures on the **quantity** and **weights** of these products imported?
9. What are the annual figures on the **quantity** and **weights** of these products sold?
10. Is there a particular time period when sales are the highest?
    - **a.** If yes, does the time frame correlate with particular types of products?
11. Do you use a particular set of criteria when selecting which models you distribute?
    - **a.** Customer preference
    - **b.** Designs based on efficiency/quality
    - **c.** Price
    - **d.** Market forces
    - **e.** Long-standing business relationship
    - o Other: please indicate

12. What is the procedure for replenishing your stocks?
    a. Re-order based on demand?
    b. Re-order in bulk based on pre-defined time period?
    o Other: please indicate
13. How often do you need to replenish your stocks of products?
14. Who is responsible for keeping stock inventories and how is the data stored?
15. What type of information is stored?
16. What is the procedure for dealing with unsold products?
17. Do you have any arrangements for take-back of any products with **suppliers** and/or **customers**?
18. Are there any additional services your company provides to customers with regard to maintenance and care of the product (s)? If yes, please expand.
    If refurbishment/repair:
    -Where are parts sourced from?
    -What happens to unwanted parts?
    -What happens to irreparable products?
19. Does your company have any environmental certifications?
20. Does your company have a policy for the management of e-waste?
    - If not, does your company plan to adopt a policy of e-waste management?
21. What knowledge do you have on the outcome of WEEE locally?
22. What knowledge do you have on treating WEEE?
23. Do you have any knowledge of the dangers of improper disposal of electronic equipment?
24. Where do you think the primary responsibility lies for dealing with WEEE?

BASEL CONVENTION REGIONAL CENTRE FOR THE CARIBBEAN

ASSESSMENT ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Questionnaire

RECYCLER

1. What's the general background of the company?
    - Types of waste material?
    - Why this specific waste stream chosen?
    - Quantities of waste received annually?
    - Treatment procedure?
    - Is there a system for determining or defining End of Life (EoL) for waste?

2. Who are your major clients?

3. What is the general trend of WEEE received?
    - Any reasons that may account for this?

4. Can you describe the data collection procedure, in terms of:
    - What general type of information is collected?
    - How often is data collected?
    - Who holds the responsibility for collection?

5. Can you describe the data management system, in terms of:
    - Storage mechanism
    - Procedure
    - Type of system employed: standard/international/ in-house

6. Can you describe the end of life activity for WEEE in terms of:
    - Volumes shipped?
    - Final market?
    - Do you have any knowledge of the WEEE after shipment?

7. What is the staff size?

8. What general qualifications are required for employment?

9. Are there training sessions during the employment term? More specifically for :

- Dealing with current waste stream?
- Dealing with shifts in the waste stream?
- How frequently are these training sessions carried out?

10. **What** are the service charges for WEEE generators and **how** are they determined?

11. What method is used to attract clients:
    - Advertising/marketing campaign
    - Networking
    - None: companies take their own initiative
    - Other

12. What are the main challenges your company experiences w.r.t. waste collection and treatment?
    - Costs
    - Lack of public awareness
    - Infrastructure
    - Government
    - Technical capacity: company size/ limited qualifications etc.
    - Other

13. Does your company have any relevant local or global certifications?

14. If yes, are there any challenges related to gaining certification: E-Steward, MAR?
    a. For e.g. requirements, timeframe

15. Does your company have a WEE policy?

16. Can you expand on the manifest system: is there genuine interest from clients in the EoL activity of WEEE?

17. Why was Trinidad and Tobago selected as a location site for the company:
    a. High WEEE generation rates?
    b. Strategic location: hub-point?
    c. Government incentives?
    d. Local impetus?

18. Do you believe there is potential for expansion of the WEEE treatment market locally (esp. w.r.t volume generation rates) or is it still a niche sector?

19. Where do you think the primary responsibility lies for dealing with WEEE?

20. What do you think is the general public perception of WEEE?

21. What small-scale activities can be implemented to reduce the WEEE generation locally?

22. What are your thoughts on the future WEEE trend locally and globally?

23. Do you have knowledge of alternative data sources of WEEE generation rates for T&T?

24. What policies or systems do you believe should be implemented to improve the existing WEEE management system?

BASEL CONVENTION REGIONAL CENTRE FOR THE CARIBBEAN

ASSESSMENT ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Questionnaire

SCRAP DEALER

1. What activities are carried out at your establishment? *(please tick all that apply)*

    - Scrap purchase
    - Sorting
    - Dismantling
    - Recovery
    - Sale of useable components to repair shops
    - Sale to other scrap dealers
    - Export
    - Other_____ *(please specify)*

2. What types of WEEE/scrap material does your establishment receive and sell?

3. How many persons are employed at your establishment?

4. How many persons are delegated per activity?

5. Please provide a brief description of each activity, including the processes, materials and safety measures that are involved.

6. What was the motivation for getting into the scrap metal business?

7. For how long have you been in operation?

8. From where do you obtain/collect your scrap material?

9. How often does purchase/collection take place? (daily/weekly/other)

10. On average, what weight and quantity of material is collected/ received? (per week/month/year)

11. On average, how much do you offer to pay (per unit/per kg) for the WEEE/scrap material that you receive? *(Please separate according to types of scrap material where possible)*

12. Do you import any scrap material to be sold locally? If yes, from which country/countries and in what quantities?

13. What factors determine how much you pay for the scrap material? *(please tick all that apply)*
    - Condition of the material
    - Market price
    - Market demand
    - Other_____*(please specify)*

14. What factors determine the prices at which you sell the scrap material? *(please tick all that apply)*
    - Condition of the material
    - Market price
    - Market demand
    - Other_____*(please specify)*

15. On average, what are the selling prices (per unit/per kg) of your locally sold scrap material? *(Please separate according to types of scrap material where possible)*

16. Who are your main clientele?

17. On average, what weight and quantity of material is sold locally? (per week/month/year)

18. What is the average monthly/annual revenue earned from scrap material sold locally?
    (*If possible, please provide a breakdown of this total figure according to type of scrap material*)

19. What is the average time period between date of purchase and date of sale for your materials?

20. What factors influence the retention time? *(please tick all that apply)*
    - Demand
    - Depreciation (i.e. sell items before they depreciate to a non-profitable value)
    - Market Price (eg. keep items until market prices increase)
    - Other _____ *(please specify)*

21. Is any of the material exported? Yes/No

Questions 22-28 apply if answered yes to question 21.

22. To which countries do you export?

23. Why did you choose these countries to export to? *(please tick all that apply)*
    - High demand
    - High Price
    - Guaranteed Market
    - Other_____(*please specify*)

24. What types of overseas establishments purchase your scrap material?

25. Do the materials fetch a higher price overseas compared to when they are sold locally?
    Yes/No. If yes, what factors account for this?

26. On average, what are the selling prices (per unit/per kg) of your exported scrap material? [If different from the responses given to question 15]
    (Please separate according to types of scrap material where possible)

27. What is the average monthly or annual weight and/or quantity of scrap material exported?

28. What is the average monthly/annual revenue earned from exported scrap material?
    (*If possible, please provide a breakdown of this total figure according to type of scrap material*)

29. Who is responsible for keeping inventories and how is the data stored?

30. What types of information are recorded?

31. How often are the inventories updated?

32. Are there any specific qualifications or training that persons need to have before they can be considered for employment at your company? If yes, which?

33. Does the company provide training to employees? If yes, what types of training?

34. How often are these training sessions carried out?

35. Are you in possession of an Old Metal and Marine Stores Dealer's License from the District Magistrate's Court of your area? Yes/No

36. If yes, how often is it renewed?

37. What information do you provide to the District Magistrate's Court when applying for license renewal?

38. Have you ever been investigated by the Ministry of Trade and Industry? If yes, when and for what reason(s)? What information, if any, was requested of you?

39. Does your establishment have any environmental certification? If yes, which?

40. Does your establishment have a WEEE policy? (e.g. to describe how WEEE items received have to be treated and handled). If yes, please state this policy.

41. Do you have any knowledge on the dangers of improperly treated WEEE? *(If yes, please specify).* How did you come across this information?

42. Aside from scrap metal activities, do you have any knowledge on what happens to WEEE locally? *(If yes, please specify)*

43. In your opinion, do you think the average person is aware of the environmental and health risks associated with improper disposal of WEEE? Yes/No

44. What reasons do you think account for this?

45. Where do you think the primary responsibility lies for dealing with WEEE?

46. Do you have any suggestions for improving the waste management system in the country?

47. Do you have any knowledge of other scrap metal dealers operating in the country?

48. What are the main challenges that your company faces as a scrap metal business? *(please tick all that apply)*
    - Lack of markets/low demand for certain scrap materials
    - Low or unstable market prices for certain materials
    - Local competition
    - Competition from overseas
    - High operational costs
    - High shipping costs
    - Obtaining certification
    - Other _____*(please specify)*

BASEL CONVENTION REGIONAL CENTRE FOR THE CARIBBEAN

ASSESSMENT ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Questionnaire

REPAIRER/REFURBISHER

1. For how long has your company been in operation?

2. What was the motivation for offering repair services for computers and other related equipment?

3. What e-waste activities does the company carry out? *(please tick all that apply)*
    - Collection
    - Refurbishment
    - Sale of refurbished products
    - Repair
    - Dismantling/Recycling
    - Export
    - Other _____ *(please specify)*

4. Which electrical and electronic products are refurbished/repaired at your company?

5. Is your company certified? E.g ISO, STOW. If yes, which, and what challenges, if any, did you face in acquiring certification?

6. If not, are there plans to become certified?

7. By which strategies and channel does your company receive the equipment to be repaired/refurbished?

8. Do you do your own collection or do you cooperate with other companies/authorities for collection purposes? If you cooperate with other companies, which, and what kind of arrangement do you have with them?

9. Approximately how many units are refurbished/repaired per month?
   Our assessment covers the period from 2007 to 2012. Will it be possible to provide quantities for this time period? Or, if not, quantities over the most recent years for which records are available?

10. Please provide a breakdown of the products you repair/refurbish, the quantities repaired/refurbished per month and average repair charges.

11. From whom do you receive most of the products to be repaired/refurbished? E.g. Industries, private businesses, government, households?

Questions 12-16 apply to refurbishers only

12. What is the average purchase price you pay for a product that you will refurbish? *(If possible please provide a breakdown by product type)*

13. What factors determine the price that you will pay for a product to be refurbished?
    - Condition of the equipment
    - Market demand for the product
    - Market price
    - Other_____ (please specify)

14. What is the average sales price you get for your refurbished products? *(If possible please provide a breakdown by product type)*

15. What factors determine the price at which you will sell a refurbished product?
    - Condition of the equipment
    - Market demand for the product
    - Market price
    - Other_____ (please specify)

16. To whom do you sell most of your refurbished products? Do you export any? If yes, to which countries?

17. By what means do you attract new clientele?
    - Active advertising
    - Word of mouth/referrals
    - Other _____(please specify)

18. What is done with parts or products which cannot be repaired/ used for refurbishment?
    - They are given back to the customer
    - The irreparable product/parts are accepted from the customer
    - Recommendations are made on alternate places where the customer may be able to repair/refurbish or dispose of the damaged equipment
    - Other (please specify) _____

19. What criteria are used for checking if something can or cannot be repaired/refurbished? Is there a particular person who is responsible for determining this?

20. How many workers are engaged in the repair/refurbishment operation?

21. Are there any special requirements/qualifications which persons must have before they can be employed as a technician at your company?

22. Does the company provide any training to its employees? If yes, which, and how often are these training sessions conducted?

23. What is the ratio of mechanical to manual labour utilized in repair/refurbishment operations?

24. What health and safety measures are undertaken by the company to protect persons who are physically involved in the refurbishment/repair process?

25. What environmental measures does your company undertake to prevent the release of hazardous substances?

26. What parameters are used for recording information on goods that are repaired/refurbished? Will you be willing to provide a sample template of your record sheets?

27. How is the data stored and how often is it updated?

28. Who is responsible for data recording and management?

29. What are the main challenges faced by your business?

- Low demand for repair services
- High operational costs
- Low or unskilled labour
- Difficulty in obtaining specialised equipment
- Other (please specify) _____

30. Does your establishment have a WEEE policy? (e.g. to describe how WEEE items received have to be treated and handled). If yes, please state this policy.

31. Do you have any knowledge on the dangers of improperly treated WEEE? (If yes, please specify). How did you come about this information?

32. In your opinion, do you think the average person is aware of the environmental and health risks associated with improper disposal of WEEE? Yes/No

33. What reasons do you think account for this?

34. Do you have any knowledge on what happens to WEEE locally? (If yes, please specify).

35. Where do you think the primary responsibility lies for dealing with WEEE?

36. Do you have any suggestions for improving the waste management system in the country?

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BASEL CONVENTION UNEP

Appendix I

ANNEX IA AND IB OF THE EU WEE DIRECTIVE 2002/96/EC

(Source: Official Journal of the European Union)

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

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

Annex IB. List of products which shall be taken into account for the purpose of this Directive and which fall under the categories of Annex IA

1. Large house hold appliances

Large cooling appliances

Refrigerators

Freezers

Other large appliances used for refrigeration, conservation and storage of food

Washing machines

Clothes dryers

Dish washing machines

Cooking

Electric stoves

Electric hot plates

Microwaves

Other large appliances used for cooking and other processing of food

Electric heating appliances

Electric radiators

Other large appliances for heating rooms, beds, seating furniture

Electric fans

Air conditioner appliances

Other fanning, exhaust ventilation and conditioning equipment

2. Small household appliances

Vacuum cleaners

Carpet sweepers

Other appliances for cleaning

Appliances used for sewing, knitting, weaving and other processing for textiles

Irons and other appliances for ironing, mangling and other care of clothing

Toasters

Fryers

Grinders, coffee machines and equipment for opening or sealing containers or packages

Electric knives

Appliances for hair-cutting, hair drying, tooth brushing, shaving, massage and other body care appliances

Clocks, watches and equipment for the purpose of measuring, indicating or registering time

Scales

3. IT and telecommunications equipment

Centralised data processing:

Mainframes

Minicomputers

Printer units

Personal computing:

Personal computers (CPU, mouse, screen and keyboard included)

Laptop computers (CPU, mouse, screen and keyboard included)

Notebook computers

Notepad computers

Printers

Copying equipment

Electrical and electronic typewriters

Pocket and desk calculators

and other products and equipment for the collection, storage, processing, presentation or communication of information by electronic means

User terminals and systems

Facsimile

Telex

Telephones

Pay telephones

Cordless telephones

Cellular telephones

Answering systems

and other products or equipment of transmitting sound, images or other information by telecommunications

4. Consumer equipment

Radio sets

Television sets

Videocameras

Video recorders

Hi-fi recorders

Audio amplifiers

Musical instruments

And other products or equipment for the purpose of recording or reproducing sound or images, including signals

or other technologies for the distribution of sound and image than by telecommunications

5. Lighting equipment

Luminaires for fluorescent lamps with the exception of luminaires in households

Straight fluorescent lamps

Compact fluorescent lamps

High intensity discharge lamps, including pressure sodium lamps and metal halide lamps

Low pressure sodium lamps

Other lighting or equipment for the purpose of spreading or controlling light with the exception of filament bulbs

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

Drills

Saws

Sewing machines

Equipment for turning, milling, sanding, grinding, sawing, cutting, shearing, drilling, making holes, punching,

folding, bending or similar processing of wood, metal and other materials

Tools for riveting, nailing or screwing or removing rivets, nails, screws or similar uses

Tools for welding, soldering or similar use

Equipment for spraying, spreading, dispersing or other treatment of liquid or gaseous substances by other means

Tools for mowing or other gardening activities

7. Toys, leisure and sports equipment

Electric trains or car racing sets

Hand-held video game consoles

Video games

Computers for biking, diving, running, rowing, etc.

Sports equipment with electric or electronic components

Coin slot machines

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

Radiotherapy equipment

Cardiology

Dialysis

Pulmonary ventilators

Nuclear medicine

Laboratory equipment for in-vitro diagnosis

Analysers

Freezers

Fertilization tests

Other appliances for detecting, preventing, monitoring, treating, alleviating illness, injury or disability

9. Monitoring and control instruments

Smoke detector

Heating regulators

Thermostats

Measuring, weighing or adjusting appliances for household or as laboratory equipment

Other monitoring and control instruments used in industrial installations (e.g. in control panels)

10. Automatic dispensers

Automatic dispensers for hot drinks

Automatic dispensers for hot or cold bottles or cans

Automatic dispensers for solid products

Automatic dispensers for money

All appliances which deliver automatically all kind of products

Appendix II

Tables of Products and HS Codes

Category	HS Code	Description
1. Large household appliances	7321.11.10	Gas and other fuel stoves and ranges
	7321.11.20	Gas and other fuel cookers
	7321.11.30	Gas and other fuel barbecues
	7321.11.90	Other gas and other fuel cooking appliances
	7321.12.10	Liquid fuel stoves and ranges
	7321.12.20	Liquid fuel cookers
	7321.12.30	Liquid fuel barbecues
	7321.12.90	Other liquid fuel cooking appliances
	7321.19.10	Solid fuel stoves and ranges
	7321.19.20	Solid fuel cookers
	7321.19.30	Solid fuel barbecues
	7321.19.90	Other solid fuel cooking appliances
	7321.89.00	Stoves, heaters, grates, fires, wash boilers, braziers and similar appliances
	7321.90.00	Parts
	7322.11.00	Radiators of cast iron
	7322.19.00	Iron or steel radiators
	7322.90.00	Other; Air heaters, hot air distributors, iron or steel*
	8415.10.00	Window or wall types, self-contained or "split-system" air conditioning machines
	8415.81.00	Air conditioning machines incorporating a refrigerating unit and a valve for reversal of the cooling/heat cycle (reversible heat pumps)
	8415.82.00	Other air conditioning machines incorporating a refrigerating unit
	8415.83.00	Other air conditioning machines not incorporating a refrigerating unit
	8415.90.00	Parts of air conditioning machines
	8418.21.10	Household refrigerators, compression-type, frost free, electrical
	8418.21.20	Other electrical fridges for domestic use
	8418.21.30	Non-electrical fridges for domestic use
	8418.29.10	Other electrical household type refrigerators
	8418.29.20	Other non-electrical household type refrigerators
	8418.30.00	Freezers of the chest type, not exceeding 800L capacity
	8418.40.00	Freezers of the upright type, not exceeding 900L capacity
	8418.61.00	Heat pumps other than air conditioning machines of heading 8415
	8418.69.00	Other refrigerating or freezing equipment
	8418.99.00	Parts of refrigerating or freezing equipment

	8421.12.10	Clothes dryers for domestic use
	8422.11.00	Dish washing machines of the household type
	8450.11.10	Household washing machines of a dry linen capacity not exceeding 10kg, fully-automatic
	8450.12.10	Household machines with built in centrifugal dryer
	8450.19.10	Other domestic washers
	8450.20.10	Household washing machines of a dry linen capacity exceeding 10kg
	8450.90.00	Parts of household or laundry-type washing machines
	8516.10.10	Electric instantaneous or storage water heaters
	8516.10.20	Electric instantaneous or storage immersion heaters
	8516.21.00	Electric storage heating radiators
	8516.50.00	Microwave ovens
	8516.60.10	Stoves and cookers
	8516.60.90	Other ovens, cookers, cooking plates, grillers, roasters, etc

Category	HS Code	Description
2. Small household appliances	8508.11.00	Vacuum cleaners with self-contained electric motor of a power not exceeding 1500 W and having a dust bag or other receptacle capacity not exceeding 20L
	8508.19.00	Other vacuum cleaners with self-contained electric motor
	8508.60.00	Vacuum cleaners without a self-contained electric motor
	8508.70.00	Parts for above
	8509.40.00	Food grinders and mixers; fruit or vegetable juice extractors
	8509.80.00	Other electro-mechanical domestic appliances with self-contained electric motor
	8509.80.10	Blenders
	8509.80.20	Floor polishers
	8509.80.30	Kitchen waste disposers
	8509.80.90	Other electro-mechanical domestic appliances
	8509.90.00	Parts for electro-mechanical domestic appliances
	8510.10.00	Shavers
	8510.20.00	Hair clippers
	8510.30.00	Hair removing appliances
	8510.90.00	Parts for above
	8516.31.00	Hair dryers
	8516.40.00	Electric smoothing irons
	8516.71.00	Coffee or tea makers
	8516.72.00	Toasters
	8516.79.00	Other domestic electro-thermic appliances
	8452.10.00	Sewing machines of the household type
	9101.11.00	Wrist watches, electrically operated with mechanical display only
	9101.19.00	Other electrically operated wrist watches
	9101.21.00	Wrist watches with automatic winding
	9101.29.00	Other wrist watches with a case of precious metal

	9101.91.00	Other pocket watches and other watches battery or accumulator powered & with a case of precious metal
	9101.99.00	Other pocket watches and other watches with a case of precious metal
	9102.11.00	Wrist-watches, pocket-watches and other watches, including stop-watches, other than those of heading 91.01: Other wrist watches, electrically operated with mechanical display only
	9102.12.00	With opto-electronic display only
	9102.19.00	Other electrically operated wrist watches
	9102.21.00	Other wrist watches with automatic winding
	9102.29.00	Other
	9102.91.00	Other pocket watches and other watches battery or accumulator powered
	9102.99.00	Other pocket watches and other watches
	9103.10.00	Clocks with watch movements, excluding clocks of heading 9104.00.00, electrically operated
	9103.90.00	Other clocks with watch movements, excluding clocks of heading 9104.00.00
	9105.11.00	Alarm clocks, electrically operated
	9105.19.00	Other alarm clocks
	9105.21.00	Electrically operated wall clocks
	9105.29.00	Other electrically operated wall clocks
	9105.91.00	Other clocks, battery, accumulator or mains powered
	9105.99.00	Other clocks
	9106.10.00	Time-registers; time recorders
	9106.90.00	Other time of day recording apparatus
	9107.00.00	Time switches with clock or watch movement or with synchronous motor
	9108.11.00	Watch movements with mechanical display only or with a device to which a mechanical display can be incorporated
	9108.12.00	Watch movements with opto-electronic display only
	9108.19.00	Other electrically operated watch movements
	9108.20.00	With automatic winding
	9108.90.00	With hand winding only
	9109.11.00	Electrically operated clock movements of alarm clocks
	9109.19.00	Other electrically operated clock movements
	9109.90.00	Other
	9110.11.00	Complete watch movements, unassembled or partly assembled (moving parts)
	9110.12.00	Incomplete watch movements, assembled
	9110.19.00	Rough watch movements
	9110.90.00	Rough clock movements
	9114.10.00	Clock or watch springs, including hair springs
	9114.30.00	Dials
	9114.40.00	Plates and bridges
	9114.90.10	Other clock parts
	9114.90.20	Other watch parts

Category	HS Code	Description
3. IT & Telecomm-unications Equipment	8443.12.00	Offset printing machinery, sheet fed, office type (using sheets with one side not exceeding 22 cm and the other side not exceeding 36 cm in the unfolded state)
	8443.13.00	Other offset printing machinery
	8443.14.00	Letterpress printing machinery, reel fed, excluding Flexographic printing
	8443.15.00	Letterpress printing machinery, other than reel fed, excluding flexographic printing
	8443.16.00	Flexographic printing machinery
	8443.17.00	Gravure printing machinery
	8443.19.00	Other
	8443.31.00	Other printers, copying machines and facsimile machines, whether or not combined: Machines which perform two or more of the functions of printing, copying or facsimile transmission, capable of connecting to an automatic data processing machine or to a network
	8443.32.00	Other, capable of connecting to an automatic data processing machine or to a network
	8443.39.00	Other
	8443.91.00	Parts and accessories: Parts and accessories of printing machinery used for printing by means of plates, cylinders and other printing components of heading84.42
	8443.99.00	Other
	8469.00.00	Typewriters other than printers of heading 84.43; word processing machines
	8470.10.00	Electronic calculators capable of operation without an external source of electric power and pocket-size data recording, reproducing and displaying machines with calculating functions
	8470.21.00	Other electronic calculating machines: Incorporating a printing device
	8470.29.00	Other
	8471.30.00	Portable automatic data processing machines, weighing not more than 10 kg, consisting of at least a central processing unit, a keyboard and a display Other automatic data processing machines:
	8471.41.00	Comprising in the same housing at least a central

		processing unit and an input and output unit, whether or not combined
	8471.49.00	Other, presented in the form of systems
	8471.50.00	Processing units other than those of sub-heading 8471.41.00 or 8471.49.00, whether or not containing in the same housing one or two of the following types of unit: storage units, input units, output units
	8471.60.00	Input or output units, whether or not containing storage units in the same housing
	8471.70.00	Storage units
	8471.80.00	Other units of automatic data processing machines
	8471.90.00	Other
	8517.11.00	Telephone sets including telephones for cellular networks or for other wireless networks: Line telephone sets with cordless handsets
	8517.12.90	Other
	8517.18.00	Other
	8517.61.00	Other apparatus for transmission or reception of voice, images or other data, including apparatus for communication in a wired or wireless network (such as a local or wide area network): Base stations
	8517.62.00	Machines for the reception, conversion and transmission or regeneration of voice, images or other data, including switching and routing apparatus
	8517.69.00	Other
	8517.70.00	Parts
	8519.50.00	Telephone answering machines

Category	HS Code	Description
4. Consumer Equipment	8518.10.00	Microphones and stands therefore
	8518.21.00	Loudspeakers, whether or not mounted in their enclosures: Single loudspeakers, mounted in their enclosures.
	8518.22.00	Loudspeakers, whether or not mounted in their enclosures Multiple loudspeakers, mounted in the same enclosure
	8518.29.00	Other
	8518.30.00	Headphones and earphones, whether or not combined with a

		microphone, and sets consisting of a microphone and one or more loudspeakers
	8518.40.00	Audio-frequency electric amplifiers
	8518.50.00	Electric sound amplifier sets
	8518.90.00	Parts
	8519.20.00	Apparatus operated by coins, banknotes, bank cards, tokens or by other means of payment
	8519.20.10	Coin- or disc-operated record-player
	8519.20.90	Other
	8519.30.00	Turntables (record-decks)
	8519.81.00	Other apparatus: Using magnetic, optical or semiconductor media:
	8519.81.10	Transcribing machines
	8519.81.20	Pocket-size cassette-players
	8519.81.30	Dictating machines not capable of operating without an external source of power
	8519.81.40	Other magnetic tape recorders incorporating sound reproducing apparatus
	8519.81.90	Other
	8519.89.00	Other
	8521.10.00	Magnetic tape-type
	8521.90.00	Other
	8522.10.00	Pick-up cartridges
	8522.90.00	Other
	8523.21.00	Magnetic media: Cards incorporating a magnetic stripe:
	8523.21.10	Unrecorded
	8523.21.90	Recorded
	8523.29.00	Other:
	8523.29.10	Unrecorded audio tapes
	8523.29.20	Recorded audio tapes
	8523.29.30	Unrecorded video tapes
	8523.29.40	Recorded video tapes
	8523.29.50	Unrecorded magnetic discs
	8523.29.60	Magnetic tapes for reproducing phenomena other than sound or image
	8523.29.90	Other
	8523.40.20	Discs for laser reading system for reproducing phenomena other than sound only
	8523.40.30	Other discs for laser reading system
	8523.40.40	Audio compact discs

	8523.40.50	Other compact discs
	8523.40.60	Unrecorded Audio compact discs DVD's
	8523.40.70	Recorded DVD's
	8523.40.90	Other
	8525.50.00	Transmission apparatus
	8525.60.00	Transmission apparatus incorporating reception apparatus
	8525.80.00	Television cameras, digital cameras and video camera recorders
	8526.10.00	Radar apparatus
	8526.91.00	Radio navigational aid apparatus
	8526.92.00	Radio remote control apparatus
	8527.12.00	Radio-broadcast receivers capable of operating without an external source of power: Pocket-size radio cassette-players
	8527.13.00	Other apparatus combined with sound recording or reproducing apparatus
	8527.19.00	Other
	8527.21.00	Radio-broadcast receivers not capable of operating without an external source of power, of a kind used in motor vehicles: Combined with sound recording or reproducing apparatus
	8527.29.00	Other
	8527.91.00	Combined with sound recording or reproducing apparatus
	8527.92.00	Not combined with sound recording or reproducing apparatus but combined with a clock
	8527.99.00	Other
	8528.41.00	Cathode-ray tube monitors: Of a kind solely or principally used in an automatic data processing system of heading 84.71
	8528.49.00	Other
	8528.51.00	Of a kind solely or principally used in an automatic data processing system of heading 84.71
	8528.59.10	Monitors incorporating television reception apparatus
	8528.61.00	Projectors: Of a kind solely or principally used in an automatic data processing system of heading 84.71
	8528.69.00	Other
	8528.71.00	Reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus: Not designed to incorporate a video display or Screen
	8528.72.00	Other, colour
	8528.73.00	Other, black and white or other monochrome
	8540.11.00	Cathode-ray television picture tubes, including video monitor cathode-ray tubes: Colour
	8540.12.00	Cathode-ray television picture tubes, including video monitor cathode-ray tubes: Black and white or other monochrome

	8540.20.00	Television camera tubes; image converters and intensifiers; other photo-cathode tubes
	8540.40.00	Data/graphic display tubes, colour, with a phosphor dot screen pitch smaller than 0.4 mm
	8540.50.00	Data/graphic display tubes, black and white or other monochrome
	8540.60.00	Other cathode-ray tubes
	8540.81.00	Receiver or amplifier valves and tubes
	8540.89.00	Other
	8540.91.00	Parts: Of cathode-ray tubes
	8540.99.00	Parts: Other
	8541.40.00	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes
	9201.10.00	Upright pianos
	9201.20.00	Grand pianos
	9201.90.00	Other
	9202.10.00	Played with a bow
	9202.90.00	Other
	9205.10.00	Brass-wind instruments
	9205.90.00	Other:
	9205.90.10	Harmoniums
	9205.90.20	Mouth organs
	9205.90.90	Other
	9206.00	Percussion musical instruments (for example, drums, xylophones, cymbals, castanets, maracas).
	9206.00.10	Steel band instruments
	9206.00.90	Other
	9207.10.00	Keyboard instruments, other than accordions
	9207.90.00	Other
	9208.10.00	Musical boxes
	9208.90.00	Other
	9209.30.00	Musical instrument strings
	9209.91.00	Other: Parts and accessories for piano
	9209.92.00	Parts and accessories for the musical instruments of heading92.02
	9209.94.00	Parts and accessories for the musical instruments of heading92.07
	9209.99.00	Other

Category	HS Code	Description
5. Lighting Equipment	8512.10.00	Lighting or visual signalling equipment or a kind used on bicycles
	8512.20.00	Other lighting or visual signalling equipment
	8513.10.00	Portable electric lamps, designed to function by their own source of energy, other than lighting equipment of heading 85.12 (85.13) - Lamps
	8513.90.00	Parts for above
	8539.10.00	Sealed beam lamp units
	8539.21.00	Tungsten halogen filament lamps
	8539.22.00	Filament lamps of a power not exceeding 200W and for a voltage exceeding 100V
	8539.29.00	Other filament lamps, excluding ultra-violet or infra-red lamps
	8539.31.00	Fluorescent lamps, hot cathode
	8539.32.00	Mercury or sodium vapour lamps; metal halide lamps
	8539.39.00	Other discharge lamps other than UV lamps*
	8539.41.00	Arc lamps
	8539.49.00	Ultra-violet or infra-red lamps
	8539.90.00	Parts for ultra-violet or infra-red lamps; arc lamps
	9006.61.00	Discharge lamp ("electronic") flashlight apparatus
	9006.69.00	Other photographic flashlight apparatus

Category	HS Code	Description
6. Electrical and Electronic Tools	8424.20.00	Spray guns and similar appliances
	8424.81.00	Other appliances:
	8424.89.00	Agricultural or horticultural
	8424.90.10	Parts: Of agricultural sprayers
	8424.90.90	Other
	8432.80.10	Lawn or sports-ground rollers
	8432.80.90	Other
	8432.90.00	Parts
	8432.90.10	Of lawn or sports-ground rollers of sub-heading 8432.80.10
	8432.90.90	Other

	8452.21.00	Other sewing machines: Automatic units
	8452.29.00	Other
	8452.90.00	Other parts of sewing machines
	8455.10.00	Tube mills
	8455.21.00	Other rolling mills: Hot or combination hot and cold
	8455.22.00	Cold
	8455.90.00	Other parts
	8458.11.00	Horizontal lathes: Numerically controlled
	8458.19.00	Other
	8458.91.00	Other lathes: Numerically controlled
	8458.99.00	Other
	8459.61.00	Other milling machines: Numerically controlled
	8459.69.00	Other
	8459.70.00	Other threading or tapping machines
	8461.20.00	Shaping or slotting machines
	8461.30.00	Broaching machines
	8461.40.00	Gear cutting, gear grinding or gear finishing machines
	8461.50.00	Sawing or cutting-off machines
	8461.90.00	Other
	8462.21.00	Bending, folding, straightening or flattening machines (including presses): Numerically controlled
	8462.29.00	Other
	8462.31.00	Shearing machines (including presses), other than combined punching and shearing machines: Numerically controlled
	8462.39.00	Other
	8462.41.00	Numerically controlled presses
	8462.49.00	Other
	8462.91.00	Other: Hydraulic
	8462.99.00	Other
	8463.20.00	Thread rolling machines
	8463.90.00	Other
	8464.10.00	Sawing machines

	8464.20.00	Grinding or polishing machines
	8464.90.00	Other
	8465.10.00	Machines which can carry out different types of machining operations without tool change between such operations
	8465.91.00	Other: Sawing machines
	8465.92.00	Planing, milling or moulding (by cutting) machines
	8465.93.00	Grinding, sanding or polishing machines
	8465.94.00	Bending or assembling machines
	8465.95.00	Drilling or morticing machines
	8465.96.00	Splitting, slicing or paring machines
	8465.99.00	Other
	8466.10.00	Tool holders and self-opening dieheads
	8466.20.00	Work holders
	8466.30.00	Dividing heads and other special attachments for machine-tools
	8466.91.00	Other: For machines of heading84.64
	8466.92.00	For machines of heading84.65
	8466.93.00	For machines of headings 84.56 to 84.61
	8466.94.00	For machines of heading 84.62 or 84.63
	8467.21.00	With self-contained electric motor: Drills of all kinds
	8467.22.00	With self-contained electric motor:Saws
	8467.29.00	Other
	8467.81.00	Other tools: Chain saws
	8467.91.00	Parts: Of chain saws
	8467.99.00	Other
	8468.10.00	Hand-held blow pipes

	8468.80.00	Other machinery and apparatus
	8468.90.00	Parts

Category	HS Code	Description
7. Toys, leisure and sports equipment	8903.99.00	Other
	9504.10.00	Video games of a kind used with a television receiver
	9504.30.00	Other games, operated by coins, banknotes, bank cards, tokens or by other means of payment, other than bowling alley equipment

Category	HS Code	Description
8. Medical devices	9011.10.00	Stereoscopic microscopes
	9011.80.00	Other microscopes, for photomicrography, cinephotomicrography or microprojection
	9011.90.00	Parts and accessories for above
	9012.10.00	Microscopes other than optical microscopes; diffraction apparatus
	9012.90.00	Parts and accessories for diffraction apparatus
	9018.11.00	Electro-diagnostic apparatus (including apparatus for functional exploratory examination or for checking physiological parameters (90.18) - electro-cardiographs
	9018.12.00	Ultrasonic scanning apparatus
	9018.13.00	Magnetic Resonance Imaging apparatus (MRI)
	9018.14.00	Scintigraphic apparatus
	9018.19.00	other electro-diagnostic apparatus[1]
	9018.20.00	Ultra-violet or infra-red ray apparatus
	9022.12.00	Computed tomography apparatus
	9022.13.00	X-ray apparatus for dental use
	9022.14.00	Other x-ray apparatus for medical, surgical or veterinary uses
	9022.21.00	Apparatus based on the use of alpha, beta or gamma radiations, whether or not for medical, surgical, dental or veterinary uses, including radiography or radiotherapy apparatus: For medical, surgical, cental or veterinary uses
	9022.30.00	X-ray tubes
	9022.90.00	Parts & accessories for apparatus based on the use of x-rays or other radiations

Category	HS Code	Description
9. Monitoring and Control Instruments	8531.10.00	Burglar or fire alarms and similar apparatus
	9016.00.00	Balances of a sensitivity of 5cg or better, with or without weights
	9026.10.00	Instruments and apparatus for measuring or checking the flow or level of liquids
	9026.20.00	Instruments and apparatus for measuring or checking pressure
	9026.80.00	Other instruments and apparatus for measuring or checking variables of liquids or gases
	9026.90.00	Parts of ins & app for measuring or checking variables of liquids or gases
	9030.10.00	Instruments & apparatus for measuring or detecting ionising radiations
	9030.20.00	Cathode-ray oscilloscopes and oscillographs
	9030.31.00	Multimeters
	9030.32.00	Multimeters with recording device
	9030.33.00	Instruments & app for measuring or checking voltage, current
	9030.39.00	Instruments & app for measuring or checking voltage, current etc (w/o recording device)
	9030.82.00	Instruments for measuring or checking semiconductor wafers or devices
	9030.83.00	Recording electrical measurement instruments
	9030.84.00	Instruments and appliances for measuring or checking electrical quantities
	9030.89.00	Instruments and apparatus for measuring or checking electrical quantities
	9030.90.00	Parts and accessories for instruments and apparatus for measuring or checking electrical quantities
	9031.10.00	Machines for balancing mechanical parts
	9031.20.00	Test benches
	9031.30.00	Profile projectors
	9031.40.00	Optical instruments for checking semiconductor wafers
	9031.49.00	Other optical instruments for measuring or checking
	9031.80.00	Other measuring or checking instruments, appliances and machines
	9031.90.00	Parts and accessories for measuring or checking instruments
	9032.10.00	Automatic regulating or controlling instruments and apparatus (90.32) - thermostats
	9032.20.00	Manostats
	9032.81.00	Hydraulic or pneumatic automatic regulating or controlling instruments & appliances
	9032.89.00	Automatic regulating or controlling instruments and apparatus (90.32)
	9032.90.00	Parts for above
	9033.00.00	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof

Category	HS Code	Description
10. Automatic dispensers	8472.90.00	Other
	8476.21.00	Other
	8476.29.00	Other
	8476.81.00	Other machines: incorporating heating or refrigerating devices
	8476.89.00	Other
	8476.90.00	Parts

Appendix III

List of Interviewed Stakeholders

1. Distributors

- Peake Technologies Limited
- Peake Home Store
- Illuminat
- Fujitsu
- Next Technology Limited
- PRW Enterprises
- TSTT
- The Music House
- Modern Electrical Supplies Limited
- Trius Medical Sales and Services Limited
- Five Star Vending
- Vending Plus Caribbean
- ECT Solutions
- Solar Power Systems

2. Consumers

- British Gas
- First Citizens Bank Limited (ATM use and disposal)
- First Citizens Bank (IT Department)
- Guardian Life of the Caribbean Limited
- Trinidad and Tobago Insurance Limited (TATIL)
- Sagicor Life Incorporated
- Peake (IT Department)
- North Central Regional Health Authority (NCRHA)-Eric Williams Medical Complex
- St. Augustine Private Hospital
- St. Clair Medical Centre

3. Waste Collectors

- Trinidad and Tobago Solid Waste Management Company Limited (SWMCOL)
- Green Engineering

4. E-Waste Brokers (Recyclers)

- Piranha International
- Caribbean Tech Disposals

Appendix

IV

Sample Questionnaires

BASEL CONVENTION REGIONAL CENTRE

ASSESSMENT ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Questionnaire

CONSUMER (IT & Telecommunications Equipment)

1. What are the main categories of telecommunication and IT equipment used by your company?

2. What are the main brands of telecom and IT equipment used by your company? Any particular reason for the brand choice(s)?

3. Generally when the equipment is replaced is it new or second-hand?

4. On average how often is this equipment replaced? *Please separate based on type of equipment*.

5. Is there a policy that guides how often equipment should be replaced? If yes please indicate the designated timeframe and please differentiate by category of equipment if necessary.

6. What is the general procedure for replacing equipment?

7. What are the annual figures on the **quantities** of new equipment purchased**?** *Please separate based on type of equipment.*

8. What is the average lifespan of the equipment used? *Please separate based on type of equipment.*

9. What do you think is the average turnover rate of your equipment used? *Please separate based on type of equipment*.

10. Do you have any arrangements for take-back of products with **suppliers**?
    - If yes, what are the quantities returned per annum?

11. What is the definition used for the End of Life (EoL) of equipment within the company?

12. What is the general procedure for EoL equipment: stored, dumped, sold, returned to originator, repaired, donated, refurbished, recycled?

*Questions 13-15 are relevant if you selected **stored** above*

13. What are the main factors behind retention of non-functional unwanted EEEs, (select as applicable) :
    - internal parts can be used

- belief that the e-waste is repairable and therefore functional in the future,
- bought at a high price so that they were storing or returning back to head offices waiting for collectors to buy from them rather than having to pay for collection
- Company policy: unsure of main reasons
- Difficulty in writing off from the books
- Other: *please indicate*

14. Where is this non-functional equipment stored?
    - Internally
    - Externally: e.g. warehouse
    - Other: *please indicate*

15. What are the quantities of equipment stored?

16. Can you describe the data management system for records of stored, replaced and discarded equipment?
    - Data storage mechanism: manual entries, computerized etc.
    - Procedure
    - None

17. Can you describe what kinds of information are recorded in your data management system?
    - E.g. Incoming and outgoing stock quantities? or values?

18. Would you be ready to pay for your electrical equipment to be collected and recycled? y/n
    - If yes, at what conditions? (e.g. pick-up service, guarantee of proper disposal, etc.)

19. Does your company have any environmental certifications?

20. Does your company have an e-waste policy?

21. What knowledge do you have on the outcome of WEEE locally?

22. What knowledge do you have on treating WEEE?

23. Do you have any knowledge of the dangers of WEEE?

24. Where do you think the primary responsibility lies for dealing with WEEE?

BASEL CONVENTION REGIONAL CENTRE

ASSESSMENT ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Questionnaire

DISTRIBUTOR (General)

1. What types of products do you distribute?
2. What are the main models (brands) of products distributed?
3. On average, what is the fastest selling product?
4. What is the fastest selling model/brand?
5. Who are your major clients?
6. What is the average lifespan of the products you distribute?
7. Does the lifespan vary based on the model (brand)?
8. What are the annual figures on the **quantity** and **weights** of these products imported?
9. What are the annual figures on the **quantity** and **weights** of these products sold?
10. Is there a particular time period when sales are the highest?
    - **a.** If yes, does the time frame correlate with particular types of products?
11. Do you use a particular set of criteria when selecting which models you distribute?
    - **a.** Customer preference
    - **b.** Designs based on efficiency/quality
    - **c.** Price
    - **d.** Market forces
    - **e.** Long-standing business relationship
    - o Other: please indicate

12. What is the procedure for replenishing your stocks?
    a. Re-order based on demand?
    b. Re-order in bulk based on pre-defined time period?
    o Other: please indicate
13. How often do you need to replenish your stocks of products?
14. Who is responsible for keeping stock inventories and how is the data stored?
15. What type of information is stored?
16. What is the procedure for dealing with unsold products?
17. Do you have any arrangements for take-back of any products with **suppliers** and/or **customers**?
18. Are there any additional services your company provides to customers with regard to maintenance and care of the product (s)? If yes, please expand.
    If refurbishment/repair:
    -Where are parts sourced from?
    -What happens to unwanted parts?
    -What happens to irreparable products?
19. Does your company have any environmental certifications?
20. Does your company have a policy for the management of e-waste?
    - If not, does your company plan to adopt a policy of e-waste management?
21. What knowledge do you have on the outcome of WEEE locally?
22. What knowledge do you have on treating WEEE?
23. Do you have any knowledge of the dangers of improper disposal of electronic equipment?
24. Where do you think the primary responsibility lies for dealing with WEEE?

BASEL CONVENTION REGIONAL CENTRE

ASSESSMENT ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT

Questionnaire

RECYCLER

1. What's the general background of the company?
    - Types of waste material?
    - Why this specific waste stream chosen?
    - Quantities of waste received annually?
    - Treatment procedure?
    - Is there a system for determining or defining End of Life (EoL) for waste?

2. Who are your major clients?

3. What is the general trend of WEEE received?
    - Any reasons that may account for this?

4. Can you describe the data collection procedure, in terms of:
    - What general type of information is collected?
    - How often is data collected?
    - Who holds the responsibility for collection?

5. Can you describe the data management system, in terms of:
    - Storage mechanism
    - Procedure
    - Type of system employed: standard/international/ in-house

6. Can you describe the end of life activity for WEEE in terms of:
    - Volumes shipped?
    - Final market?
    - Do you have any knowledge of the WEEE after shipment?

7. What is the staff size?

8. What general qualifications are required for employment?

9. Are there training sessions during the employment term? More specifically for :
    - Dealing with current waste stream?
    - Dealing with shifts in the waste stream?
    - How frequently are these training sessions carried out?

10. **What** are the service charges for WEEE generators and **how** are they determined?

11. What method is used to attract clients:
    - Advertising/marketing campaign
    - Networking
    - None: companies take their own initiative
    - Other

12. What are the main challenges your company experiences w.r.t. waste collection and treatment?
    - Costs
    - Lack of public awareness
    - Infrastructure
    - Government
    - Technical capacity: company size/ limited qualifications etc.
    - Other

13. Does your company have any relevant local or global certifications?

14. If yes, are there any challenges related to gaining certification: E-Steward, MAR?
    a. For e.g. requirements, timeframe

15. Does your company have a WEE policy?

16. Can you expand on the manifest system: is there genuine interest from clients in the EoL activity of WEEE?

17. Why was Trinidad and Tobago selected as a location site for the company:
    a. High WEEE generation rates?
    b. Strategic location: hub-point?
    c. Government incentives?
    d. Local impetus?

18. Do you believe there is potential for expansion of the WEEE treatment market locally (esp. w.r.t volume generation rates) or is it still a niche sector?

19. Where do you think the primary responsibility lies for dealing with WEEE?

20. What do you think is the general public perception of WEEE?

21. What small-scale activities can be implemented to reduce the WEEE generation locally?

22. What are your thoughts on the future WEEE trend locally and globally?

23. Do you have knowledge of alternative data sources of WEEE generation rates for T&T?

24. What policies or systems do you believe should be implemented to improve the existing WEEE management system?