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July 2013



## Baseline Survey:

**Support to access to information and strengthening small businesses through data collection**

**“Transforming e-waste into job and business opportunities”**

**SAP ID: 120011**



**SAMSUNG**



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## **LIST OF ACRONYMS**

3R: Reduce, Reuse and Recycle  
BAT: Best Available Technology  
BC: Basel Convention  
CEA: Cambodia Environmental Association  
CFC: Chlorofluorocarbon  
CRT: Cathode Ray Tube  
CSIC: Cambodia Standard Industrial Classification  
DTIE: Division of Technology, Industry and Economics  
EEE: Electrical and Electronic Equipment (or e-products)  
EIA: Environmental Impact Assessment  
EPA: (US) Environmental Protection Agency  
EPR: Extended Producer Responsibility  
H & S: Health and Safety  
HH: household  
ICT: Information and Communication Technology  
IETC: International Environmental Technology Center  
ILO: International Labour Organization  
ISIC: International Standard Industrial Classification  
KHR: Khmer Riel (4,000 KHR = 1 USD)  
KOICA: Korea International Cooperation Agency  
MAFF: Ministry of Agriculture, Forestry and Fisheries  
MFI: Micro Finance Institution  
MIME: Ministry of Industry, Mines and Energy  
MoE: Ministry of Environment  
MoEF: Ministry of Economy and Finance  
MoFA: Ministry of Foreign Affairs and International Cooperation  
MoH: Ministry of Health  
Mol: Ministry of Interior  
MoLVT: Ministry of Labour and Vocational Training  
MoP: Ministry of Planning  
MoWA: Ministry of Women's Affairs  
MPWT: Ministry of Public Works and Transport  
n.e.c.: not elsewhere classified  
NGO: Non-Governmental Organization  
NTTI: National Technical Training Institute  
OECD: Organization for Economic Cooperation and Development  
POP: Persistent Organic Pollutants  
PPM: Phnom Penh Municipality  
RUPP: Royal University of Phnom Penh  
SBC: Secretariat of Basel Convention  
sd: standard deviation  
UEEE: Used EEE  
ULAB: Used Lead Acid Battery

UNEP: United Nations Environment Programme

UNIDO: United Nations Industrial Development Organization

USD: United States Dollar

WEEE: Waste EEE (or e-waste)



## EXECUTIVE SUMMARY

This report outlines the results of the baseline survey conducted for the “Transforming e-waste into jobs and business opportunities” project. This project is a collaboration between the United Nations Industrial Development Organization (UNIDO), the Cambodian Ministry of the Environment (MoE), and the National Technical Training Institute (NTTI) of the Ministry of Labor and Vocational Training (MoLVT). The baseline survey was conducted from May to July 2013, with the objective of understanding the e-product and e-waste management system in Cambodia through an overview of related business profiles, to assess the e-product flows between the different sectors, and to formulate strategic recommendations for entrepreneurs and businesses based on the results of the survey.

Small businesses in the electrical and electronic equipment (EEE) sector were interviewed in the five provinces of the project: Banteay Meanchey, Battambang, Kampong Cham, Phnom Penh and Siem Reap. Focus was on four kinds of activities and their related EEE: retail sale of new and second-hand items, repair businesses for used EEE (UEEE), collection and dismantling businesses for e-waste. Additional information was gathered from spare parts businesses in Cambodia. This project focuses on six kinds of EEE, classified into three categories: large household appliances (washing machines, refrigerators, air conditioners); information and communication technology (mobile phones and computers); and consumer equipment (televisions).

1,360 businesses have been interviewed, including 76 e-waste collectors, 329 repairers, 49 dismantlers, 890 retail sellers and 16 businesses specializing in spare parts.

The EEE flows (in kilograms) detailed in this report consider two possible values: the mean value, which is strongly influenced by the heavy weight of large appliances; and the median value, which considering that the high standard deviation, is representative of more e-products, but does not take into account the heavier weights of larger items.

## SURVEY FINDINGS

The survey revealed that Phnom Penh and Battambang have the largest proportions of repair and dismantling businesses, whereas Kampong Cham and Siem Reap have more retail sellers. Banteay Meanchey has an intermediate profile.

Most of the EEE businesses surveyed started in the last few years, which highlights the recent expansion in availability of e-products and the EEE market in Cambodia.

***Retail businesses:*** New EEE represent two-thirds of all EEE retail sales. Mobile phones is the most sold category of both new EEE and UEEE. While new products come mainly from wholesalers (97.4% of retail businesses), UEEE are mostly supplied by households, which are also the main customers for both new EEE and UEEE.

Repair businesses: Most of the staff at repair businesses are males (86.3% of the average number of staff). Households are the main customers for repair services (88.2% of the customers) and mobile phones and televisions are the most commonly repaired items. Repair businesses generate an average of 25.9kg of e-waste monthly (median: 1kg monthly), which is either sold, disposed of in municipal dumpsites (32.2% of the businesses choose this way), or burned (16.8% of the businesses). Businesses in the EEE repair sector observed an increase in their activity (42.9% of the respondents) and expect their work to increase even more in the future (49.5%), which shows the recent popularity of EEE repair services in Cambodia.

Collection businesses: Waste-pickers constitute the primary and most informal part of the e-waste collection system in Cambodia. 95% of them never received any training. They collect all kinds of e-waste (televisions being the most collected among the six project items category), mainly from households (84.5% of the e-waste collected), and sell to dismantlers (81.6% of the e-waste is sold to scrap yards). They have observed a decrease in the amount of e-waste being collected monthly, primarily because of increased competition.

Dismantling businesses: Dismantlers get e-waste primarily from collectors (68.7% of their supplies) and re-sell the recyclable parts to larger scrap yards (78.2% of the dismantled parts), which export them abroad. Dismantling generates e-waste residue, which is primarily disposed of in municipal dumpsites (89%) or burned. In correlation with the decreasing e-waste volumes observed by waste-pickers, dismantlers also observe a decrease in their activities.

Focus on spare parts: Because of the popularity of repair businesses, demand has increased for spare parts supplies. Small businesses who deal in spare parts (retail sellers, repairers, etc.) are mainly supplied by wholesalers. When they sell spare parts, their main customers are households.

Data management: 89.9% of the businesses do not record any data. When data is recorded among the other 10.1%, it mostly concerns the flows of EEE (stock and sales) and the finances (8.5% of 1,359 businesses record data for both of these components).

Level of awareness: 70.7% of EEE business owners surveyed said that they have never heard of any laws regarding their business. Among the other owners, the law which is the most often mentioned is the Commercial Law. 65.5% of the respondents do not know the potential impacts of e-products and e-waste management on their health and environment, but 32.9% of the respondents have already observed health or environment issues related to their activity, such as eye, nose and ear irritation, respiratory troubles, and electrical shocks.

## RECOMMENDATIONS

Angkor Research asked respondents to propose some recommendations to encourage new entrepreneurs and to improve their own businesses. In compliance with the common technical problems that 51.6% of the businesses met, the main recommendations concerned

training about processes (for selling, repairing, dismantling, etc.), government incentives, and improved access to credit for business investments.

Angkor Research has realized that most projects about e-waste management concern recycling and environmental components; because there are very few dismantling and collection businesses currently in Cambodia, the government focused on this sector. However, based on the survey results, we decided to also focus on the economic components of the sector. Indeed, most respondents are not concerned about the environmental and health issues of their businesses. And although we need to raise their awareness on such subjects, we also need to take into account the e-waste upstream segments, where repair and retail sale businesses are far more numerous and help is also desperately needed.

*Short-term recommendations:* In the short term, Angkor Research proposes two kinds of training courses: “Sound and Safe Practices for Environment and Health” and “Management and Processing Techniques”. These training courses would be open to current EEE workers and business owners, students, potential future entrepreneurs and related stakeholders.

The first training would deal with standards and respectful practices that can be rapidly implemented to improve health and environmental protection. It could be accompanied by an illustrated guidebook, where good practices for risk prevention would be detailed.

The second training deals more with economic matters and would help teach the participants how to manage their business correctly and sustainably (data keeping, marketing, etc.) and would also help them to get specialized training in their activities and e-products (televisions, mobile phones, large appliances, etc.). This training would contain an open communication sessions, where participants could interact with each other and begin to collaborate, instead of competing. The exchange of information would enrich everybody's experience.

The short-term benefits from these two trainings would be: improved and safer working conditions; increased work efficiency, generating increased revenues; improved business situation, due to improved data recording and management techniques. These courses could also be a place for business owners to find and hire well trained and specialized staff, ensuring better work efficiency and possibly higher salaries and job security for trained, specialized workers.

*Long-term recommendations:* These recommendations can only be considered in the long term because of the significant commitments required. They concern the development and improvement of infrastructure (for collection/transportation, recycling centers, equipment, spare parts supply, etc.), evaluation of the quantity, quality and nature of available e-waste (through regular national inventories), design of a specific regulatory framework, and the establishment of support and assistance institutions (inter-professional associations for technical assistance and quality insurance; easier access to credit in the private sector). In addition, government incentives can also be promoted for: lower taxes for EEE-related businesses, e-product and e-waste price regulation, extended producer responsibility.

## **INTRODUCTION**

Electrical and electronic waste (WEEE; e-waste) is a growing concern, especially in developing countries where the lack of infrastructure, know-how and regulatory frameworks do not permit their efficient and sustainable management. With an increasing number of mobile phones, and easier access to ITC, televisions and other electronic goods, which will all eventually become obsolete, Cambodia presents a high potential for the development of small businesses and the creation of a new sector of employment in the field of e-waste management. Such employment would contribute to poverty alleviation, the priority of the Cambodian government. Improvement in this field would also help protect natural resources, as the recycling and reuse of e-products puts less pressure on the environment than the production, sale and disposal of a new product.

This report presents the results from the baseline survey for the “Transforming e-waste into job and business opportunities” project. The report is divided into five sections: 1) a brief desk review about the situation of e-products and e-waste management in Cambodia, the related regulatory framework and the existing initiatives, based on the available literature and reports; 2) the field survey methodology; 3) the presentation of the survey results: sample structure, business profile, flows of EEE and by-products for each kind of activity, their habits in terms of data management and finally the level of awareness and the potential issues encountered within the overall sector; 4) a conclusion summarizing the major findings; 5) recommendations from the respondents and Angkor Research, based on the findings of the survey.

## **PART A: BACKGROUND**

This section presents a brief literature review about e-waste, in order to introduce the reader to this complex issue, with a focus on the situation in Cambodia. The term “e-product” or EEE will be used to talk about electrical and electronic equipment in general (including new EEE, UEEE and e-waste).

### **DEFINITION OF E-WASTE**

The most widely accepted e-waste definition is the one given by the European Commission Directive 2002/96/EC:<sup>1</sup>“waste electrical and electronic equipment’ or ‘WEEE’ means electrical or electronic equipment which is waste within the meaning of Article 1(a) of Directive 75/442/EEC, including all components, subassemblies and consumables which are part of the product at the time of discarding”. This definition has been confirmed in the last European Union Directive 2012/79/EU.<sup>2</sup>

UNIDO agrees with this definition, and thus all of the processes and equipment denominations given in this report will comply with those given by the Directive 2012/79/EU. The different categories of EEE covered by this directive are:

- Large household appliances
- Small household appliances
- IT and telecommunications equipment
- Consumer equipment and photovoltaic panels
- Lighting equipment
- Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
- Toys, leisure and sports equipment
- Medical devices (with the exception of all implanted and infected products)
- Monitoring and control instruments
- Automatic dispensers

According to Lundgren (2012), large HH appliances are generally considered to represent 50% of e-waste production, IT and telecommunications equipment (30%), and consumer equipment (10%). The remaining 10% are represented by the other seven categories. She also states that iron and steel constitute around 50% of e-waste, followed by plastics (21%) and non-ferrous metals (13%).

The main problem with e-waste is related to the fact that it can contain hazardous substances such as heavy metals (lead, mercury, etc.) and persistent organic pollutants (POPs) which have negative impacts on health and environment. Other issues concern the

<sup>1</sup>DIRECTIVE 2002/96/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on waste electrical and electronic equipment (WEEE)

<sup>2</sup>DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012 on waste electrical and electronic equipment (WEEE)

ever-increasing volumes of e-waste produced (as EEE becomes more affordable and rapidly obsolete), its poor design and complexity (mix of many different components, making the treatment difficult and requiring a certain level of technology), the labor issues associated with e-waste management (thousands of people around the world working in conditions where little attention is given to the environment, health and safety), the low financial incentives (e-waste value is generally lower than its management cost, which does not encourage entrepreneurs to invest in this sector), and finally the lack of regulation (no regulation to correctly manage e-waste yet, or difficulty in the enforcement of already existing rules).

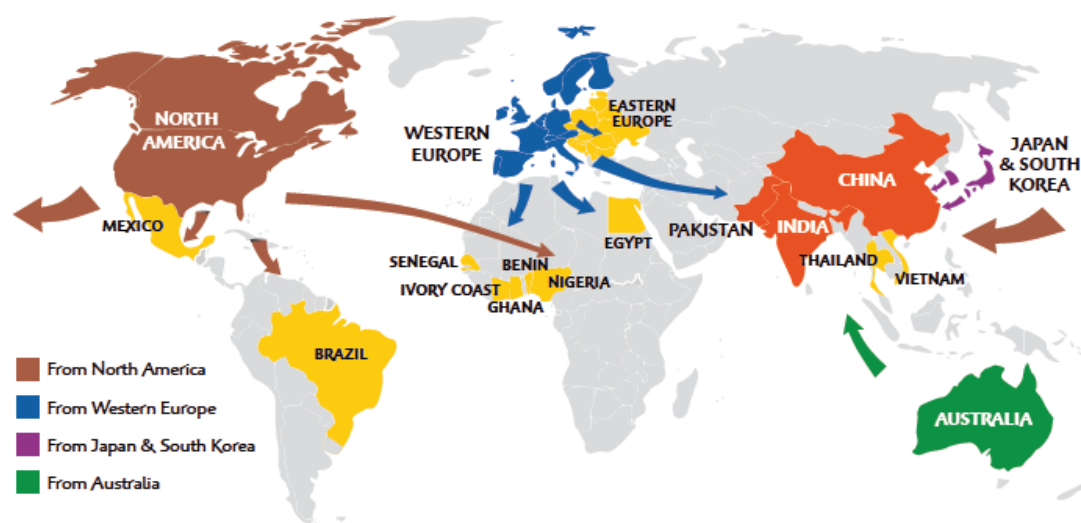
## GLOBAL E-WASTE FLOWS

E-waste is currently the largest growing waste stream in the world (Lundgren, 2012), with 4% growth per year. About 40 million tons are being produced each year. This is mainly due to the easier penetration of EEE in developing countries, where improving living standards combined with cheaper technologies give greater access to EEE for the population. EEE's fast obsolescence rate and the consumption and replacement culture in developed countries are two more causes that explain the exponential increase in e-waste observed for the past two decades.

Yet the high level of technology, the development of adequate logistics and the important related costs required for the management of e-waste has led to wide cross-border movements (Figure 1): often illegally, developed countries would prefer to send their e-waste for recycling to developing countries at much lower costs than if this treatment was undertaken on their soil. In the USA, the Environmental Protection Agency (EPA) stated that it is ten times cheaper to export e-waste to Asia than it is to process it in America. As a result, it is estimated that 80% of the e-waste collected for recycling eventually ends up in developing countries, mainly in Africa and Asia. For example, a common e-waste trade system includes shipments sent to China, rebuilt or refurbished and then re-exported to other countries, mainly in Southeast Asia, including Cambodia.

It is estimated that China receives around 70% of the global e-waste exports. Guiyu, in the province of Guangdong, is famous for being one of the largest e-waste sites on earth. This city counted, in 2010, 100,000 e-waste workers among a population of around 125,000 people, and has focused the world's media attention on the e-waste management issue. The expansion of such a city has been permitted not only by the lack of laws and regulations, but also more especially by weak and inefficient law enforcement.

China thus decided to design stricter environmental policies and ensure stronger enforcement by governmental institutions. As a result, part of the e-waste related activities may be diverted from China to other Southeast Asia countries, such as Cambodia.



**Figure 1. International e-waste exports.**

*The primary destination countries for e-waste are in orange; the secondary destinations are in yellow (Lewis 2010).*

## THE E-WASTE ISSUE IN CAMBODIA

The Cambodian economy is now growing fast, and even if the country remains one of the poorest in the world (30.1% of the total population assumed to live below the poverty line in 2007, with less than USD 1.25 per day, mostly in rural areas<sup>3</sup>), its living conditions are improving and access to EEE is now easier for the Cambodian population.

Yet the country still does not have the technology, the capability and the capacity to produce its own EEE. Therefore, the only way to respond to the EEE demand is to import. In 2007, the Technical Report on National Inventory of UEEE in Cambodia<sup>4</sup> stated that most of the EEE being used in the country are second-hand items, imported from various countries in Asia (Japan, South Korea, etc.). The major problem with importation is the low quality of second-hand products: 10 to 20% of the imported second-hand EE items are not considered suitable for consumption, and thus are disposed of directly on arrival.

The increasing amount of e-waste generated by both the importation of low quality second-hand products and higher EEE consumption convinced the government of Cambodia to conduct research and take action to improve national e-waste management.

<sup>3</sup>The World Bank. *World Development Indicators, World DataBank* (<http://databank.worldbank.org>). Accessed in June 2013.

<sup>4</sup>CEA May 2007. *Technical Report on National Inventory of used of EEE in Cambodia* – Phnom Penh, Cambodia.



**Figure 2. Televisions (CRT) dismantling and reassembling in Banteay Meanchey (personal picture).**

**a) Current e-waste management practices in Cambodia**

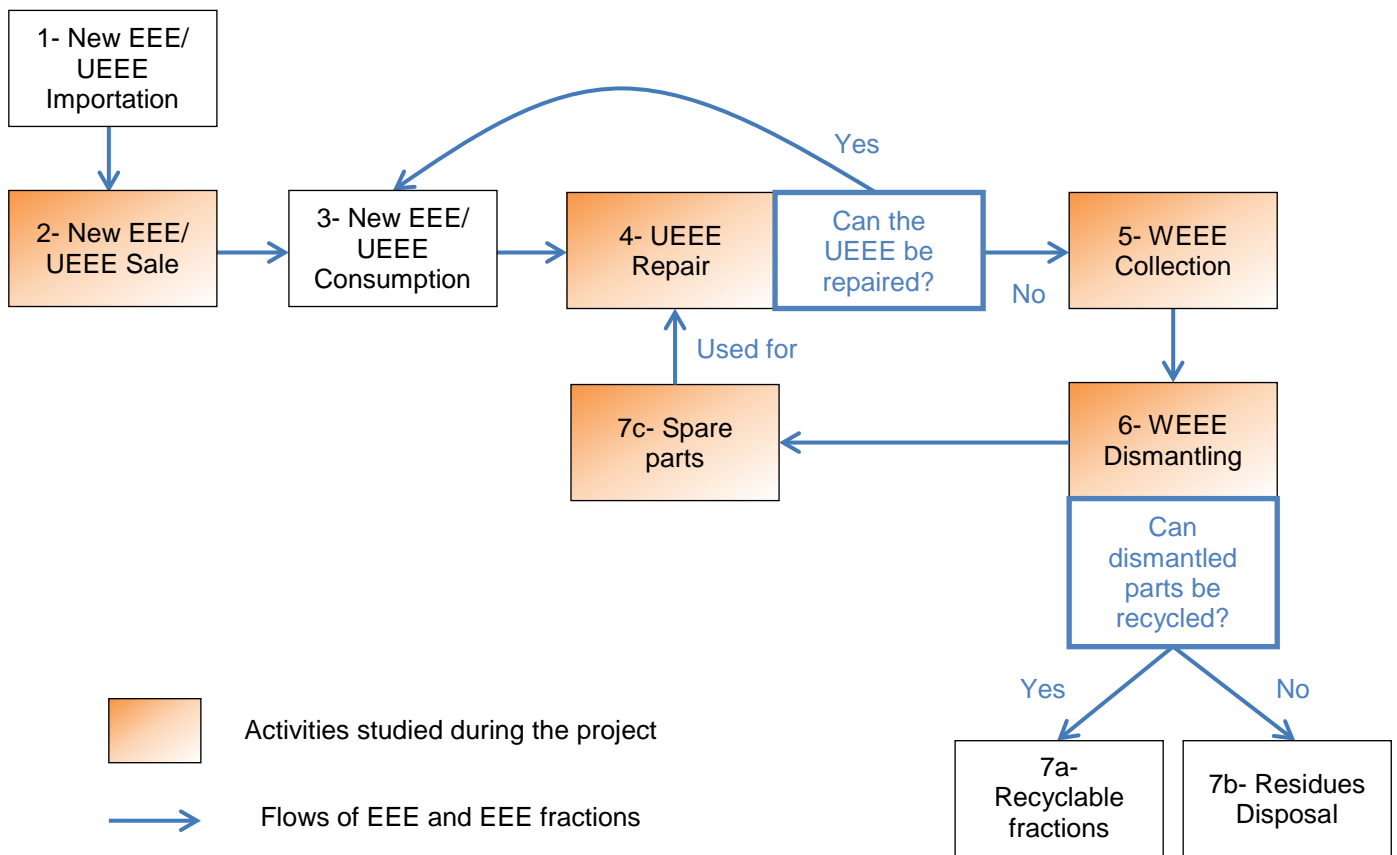
The life cycle of an Electrical and Electronic Equipment consists in a series of interconnected phases and processes where the EEE takes different names. The general pattern in Cambodia, based on the various reports from related projects (see Part A.3.c), is as presented in figure 3.

- 1- New EEE and UEEE (2<sup>nd</sup> hand EEE) are imported. We can indeed consider that 100% of EEE are imported, because Cambodia does not produce any.
- 2- New EEE and UEEE are then sold by wholesalers and retailers to end consumers.
- 3- New EEE become UEEE during consumption.
- 4- Broken or non-functioning UEEE are bought to repairers who assess whether the problem can be fixed or not. If the UEEE can be repaired, then it returns back to consumers.
- 5- If the UEEE cannot be repaired, then it means that the EEE has reached its end of life and has thus become a WEEE (e-waste). WEEE are collected and brought to the scrap yards.
- 6- In the scrap yards, WEEE are dismantled and sorted.
- 7- The different parts are either sold and exported for recycling, or disposed of in dumpsites. Functioning spare parts (chips, transistors...) can also be used to repair other EEE.

According to the CEA 2007 report, e-waste management is not operated in a safe and sound way in Cambodia. Rather informal, the sector relies on very basic processes and does not present any modern technology all along the EEE value chain. Collection is mainly ensured by waste-pickers with hand-driven carts while repairing activity consists most of the time in simply replacing the broken or non-functioning pieces. Recycling only concerns the pre-processing steps, like dismantling and sorting, which are considered to be very simple or even outdated (the recycling chain starts with pre-processing and ends either with end-



processing or with final disposal of the residue). End processing (for the materials which need a refining or smelting step for example) does not happen in Cambodia.



**Figure 3. Conceptual flow chart for EEE value chain (designed by Angkor Research).**

Workers hardly ever have a technical education, and never receive any instructions from governmental institutions about the correct procedures to apply. Most of the time, the same business undertakes several activities and manages different kinds of EEE: sell new/UEEE and repair; repair UEEE and dismantle WEEE.

During these e-waste treatment processes, little attention is given to safety, and even less to environmental issues; work generally occurs in very basic conditions, without protection (gloves, mask, glasses...) and workers have very limited knowledge about e-waste potential impacts on health and environment.

Cambodian e-waste management system is considered inefficient, mainly because of its low collection/transportation efficiency; with no formal and organized e-waste collection sector, only a little percentage of the WEEE total amount is actually being collected. The different discarded devices are often mixed and transported long distances, which slows down the treatment process and limits the quantity of materials available for recycling. Moreover, the lack of infrastructure (road, access for municipal waste collection vehicles...) makes the collection even more difficult in remote areas.

With EEE consumption increasing every year, numerous new e-waste treatment facilities should be created. This could bring more pressure on Cambodian natural resources and enhance the e-waste toxic footprint. The potential resulting impact of e-waste management on environment and health will mainly depend on the regulatory framework applicable in Cambodia and its good enforcement.

### ***b) Policy and regulation framework***

In order to better understand how e-waste and related issues are being perceived in Cambodia, Angkor Research conducted a review of the different existing texts and policies which can be linked to the EEE items and their management practices.<sup>5</sup>

#### **i. Existing laws**

Article 59 from the 1993 Constitution explains that “the State shall protect the environment and balance of abundant natural resources”.

In 1996, the Law on Environmental Protection and Natural Resource Management was ratified, with the overall objective of protecting the environment and people’s health by assessing and mitigating the potential impact of any project on these two components. More especially, Article 13 proposes the creation of a sub-decree by the Ministry of Environment for the “prevention, reduction and control of ... hazardous substances”. The law recommends conducting an environmental impact assessment (EIA) to avoid and eliminate any act affecting the environment (see related sub-decree in Part A.3.b.ii).

Currently the Ministry of Environment, in cooperation with the Vishnu Law Group of Cambodia and international EIA experts, is designing a Law on Environmental Impact Assessment with the purpose of setting out provisions, principles, standards, procedures and measures for EIA in Cambodia (Lewis & Narim 2012).

Moreover a draft law on Environmental Pollution Management has recently been designed (Sothun 2012), and includes guidelines about solid waste and garbage management, comprising the garbage management in the capital but also in the provinces, the solid waste management from enterprises, the hazardous waste management and the modalities about their importation/exportation.

The Law on the Management of Quality and Safety of Products and Services from 2000 provides general obligations to protect human health from contaminated products and goods. Article 6 particularly plans to request an inspection and an authorization for any products, goods or services that could harm health or safety of consumers. This could refer to some products (discarded CRT TV, refrigerators, etc.) and processes related to e-waste management (repair, dismantling, etc.).

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<sup>5</sup>All of the official texts references mentioned in this paragraph can be found in the “References” section.

The Law on Land Traffic from 2006 has for one of its main purposes to ensure the protection of humans, animals and environment during hazardous cargo road transportation. E-waste collection and transportation can be considered hazardous as they mix all kinds of devices, containing polluting substances, sometimes on long distances.

## ii. Sub-decrees

The 1999 Sub-decree on Solid Waste Management regulates solid waste management and covers all the activities related to disposal, storage, collection, transport, recycling, dumping of garbage, and hazardous waste. It provides the guidelines to prevent any harm for human health and environment, related to the solid waste management. Among the thirty-two categories detailed in this sub-decree, six directly concern e-waste management:

- Category 6: PCB waste from use of PCB contained in discarded air conditioners, TVs and microwaves
- Category 9: Acid waste (acid contained in batteries for example)
- Category 10: Alkali waste
- Category 11: Metal waste and their compounds: Zinc (Zn), Selenium (Se), Tin (Sn), Vanadium (V), Copper (Cu), Arsenic (As), Barium (Ba), Cobalt (Co), Nickel (Ni), Antimony (Sb), Beryllium (Be), Tellurium (Te), Lead (Pb), Titanium (Ti), Uranium (U), and Silver (Ag)
- Category 13: Wastes from used or discarded electricity lamp
- Category 14: Wastes from production or use of battery

Article 20 of this sub-decree states that any exportation of hazardous substances should follow the principles and rules of the Basel Convention, while Article 21 strictly forbids the importation of any hazardous waste in Cambodia.

The Sub-decree on Water Pollution Control from 1999 aims at preventing any kind of pollution of water resources. More precisely, Article 8 stipulates that “the disposal of solid waste or any garbage or hazardous substances into public water areas or into public drainage system shall be strictly prohibited. The storage or disposal of solid waste or any garbage and hazardous substances that lead to the pollution of water of the public water areas shall be strictly prohibited.” In businesses with a dismantling activity, for example, hazardous leakages may occur and contaminate water bodies in the surrounding environment.

A Sub-decree to the Law on Environmental Protection and Natural Resource Management enunciates the procedures to carry out EIA, as well as the size and type of project requiring an EIA. The Sub-decree on Environmental Impact Assessment Process was issued by the Cambodian government in 1999 and applies to “every proposed and ongoing project(s) and activities, either by private, joint-venture or state government, ministry institutions of which are described in the Annex”. Categories V.2 and IX.1 for, respectively, “Battery Industry” and “Waste Processing, Burning”, directly concern e-waste related businesses. However, a recent study showed that only 5% of the businesses which have to conduct an EIA actually do it, suggesting that this sub-decree is ignored by most businesses (LEWIS and NARIM 2012).

The 2000 Sub-decree on Air Pollution Control and Noise Disturbance sets the quality standards for the ambient air and generally aims at limiting and controlling air pollution from pollutants and noise disturbances. Some e-waste related activities can release polluting dusts in the air that could be harmful for health if inhaled.

The 2005 Sub-decree on Ozone Depleting Substances was created to comply with the obligations of the Vienna Convention and the Montréal Protocol. Its objective is to stop using ozone depleting substances and to identify the businesses likely to work with these compounds. For example, the CFCs used as refrigerants in old refrigerators have a heavy ozone depleting effect (and they are also considered as strong greenhouse effect gases).

The Sub-decree on the Facilitation of Trade through Risk Management (2006) finally aims at regulating the importations/exportations procedures, in compliance with national and international laws, regulations, agreements and protocols (Basel Convention, etc.).

### iii. Relevant regulations

In March 2002, the Custom and Excise Department announced the “Ban of importation of old computers and spare parts for occupation purpose, except for self-consumption and/or charity in minor amount”<sup>6</sup>.

The Joint Declaration between Ministry of Interior and Ministry of Environment on Solid wastes and Litter Management in Cambodia, the Environmental Guideline on Solid Waste Management in Cambodia and the Guideline on Plastic Waste Management were developed to provide the responsible authorities, at all level, with the safe and sound ways to effectively manage solid waste and plastics, with regard to human health and environment protection (Sothun 2012).

A draft National 3R Strategy on Wastes Management<sup>7</sup> is being developed since 2008, with for objectives to establish an efficient solid waste management system. This should permit to generate jobs and revenues for the population, but also to reduce the quantity of wastes in dumpsites, improve the solid waste treatment and recycling system in order to protect human health and environmental resources in Cambodia (Laska 2009).

No extended producer responsibility (EPR) has been set up in Cambodia yet. This kind of regulation, which has been adopted by many countries, ensures the product take back by the producer at its end of life. The producer is then “responsible” for the e-waste safe and sound management.

### iv. International Conventions

Cambodia signed the Basel Convention on the 2<sup>nd</sup> of March 2001 (“accession” status, see glossary). It entered into force on the 31<sup>st</sup> of May the same year.<sup>8</sup> The convention regulates

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<sup>6</sup>Ministry of Environment, supported by UNEP-DTIE August 2009. *WEEE/E-waste in Phnom Penh Municipality and Current Management System, Kingdom of Cambodia* – Phnom Penh, Cambodia.

<sup>7</sup>This text is still being drafted and is not publicly available, but the MoE has access to the draft and quotes it in several reports.

<sup>8</sup>Basel Convention Website, consulted on 24/06/2013, available on

the cross-border movement of hazardous waste. Because e-waste contains several of the dangerous components listed by the BC, it can be considered as a hazardous waste.

In Cambodia, the Department of Environmental Pollution Control (Ministry of Environment) is the competent authority in charge with the implementation of the BC principles. Nevertheless, the whole BC working group/steering committee comprises the following institutions: MoE, Mol, MoEF (General Department of Customs and Excises), MoC (CAMCONTROL Cambodia Import/Export Inspection Fraud Repression Directorate General), MoP, MoH, MAFF, MPWT, MoFA, MoWA, MoLVT, PPM and RUPP.

Cambodia signed the Stockholm Convention on the 23<sup>rd</sup> of May 2001 (ratified on the 25<sup>th</sup> of August 2006)<sup>9</sup>. This convention deals with the protection of Health and Environment from the Persistent Organic Pollutants (POPs). These POPs comprise dioxins, furans... highly toxic compounds which can be emitted during e-waste management related processes, especially if e-waste is burnt.

Since the 27<sup>th</sup> of June 2001, Cambodia is also a signatory of both the Montreal Protocol and the Vienna Convention<sup>10</sup> ("accession" status). These two texts aim at protecting the ozone layer and avoiding/forbidding the use of ozone depleting substances (like CFCs for example). Cambodia also signed the four amendments to these texts on the 31<sup>st</sup> of January 2007: London Amendment, Copenhagen Amendment, Montreal Amendment and Beijing Amendment ("accession" status for all of the amendments), after it adopted the 2005 Sub-decree.

## v. Conclusions

E-waste is not specifically mentioned in any of the related national regulations seen here before. Its definition is thus still unclear in Cambodia. Nevertheless, the list of hazardous wastes given by the Sub-decree on Solid Waste Management covers some of the various kinds of e-waste. Even if e-waste is mentioned and defined in the Basel Convention, a clear definition is still needed at the national level.

Cambodia has ratified numerous international conventions in the past fifteen years, which shows the willingness and motivation of the country and its government to care about the waste management issue in general and consequently about Cambodian environment and its natural resources protection.

Moreover a few new laws about Environmental Pollution Management and Environmental Impact Assessment are currently under design and should bring some further regulation about the potential impact of human activities on the environment, including waste management. When these laws will be adopted and enforced, we can expect that any new

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<http://www.basel.int/Countries/Statusofratifications/PartiesSignatories/tabid/1290/language/en-US/Default.aspx>

<sup>9</sup>Stockholm Convention Website, consulted on 25/06/2013, available on <http://chm.pops.int/Countries/StatusofRatifications/tabid/252/Default.aspx>

<sup>10</sup>Montreal Protocol and Vienna Convention, consulted on 25/06/2013, available on [http://ozone.unep.org/new\\_site/en/index.php](http://ozone.unep.org/new_site/en/index.php)

e-waste related business will have to conduct an EIA and find a way to mitigate the impacts of its activities on environment.

The national 3R strategy, still being drafted, should finally bring the detailed guidelines about the waste management processes in Cambodia. Hopefully the text will also cover e-waste and propose a safe, environmentally sound and suitable strategy to transform the low-efficiency and informal sector in a more structured and efficient management system.

### **c) E-waste related initiatives in Cambodia**

The following projects have been conducted under the framework of the Basel Convention and according to the draft 3R strategy seen here above:

In 2003, Cambodia was awarded financial and technical support from the Secretariat of Basel Convention. In 2004, the project named “Environmentally Sound Management of Used Lead Acid Batteries (ULAB)”<sup>11</sup> was launched. Its objectives were to characterize the ULAB sector in Cambodia, from its trade flows to the related regulatory framework and management practices (recycling, disposals...). The project also aimed at identifying the level of awareness about environmental and health ULAB related issues. Recommendations were formulated in order to improve the sector: increase the different actors’ incomes, provide them with an understanding of necessary measures in order to prevent or avoid ULAB potential impacts on their health and on their surrounding environment.

In 2005, the Asia-Pacific Regional Center for Hazardous Waste Management Training and Technology Transfer (part of the Basel Convention Regional Centre in China, BCRC China) conducted a study, with supervision from SBC. This project was funded by BC and Environment Canada. Entitled “Survey of the import and the environmentally sound management of electronic wastes in Asia-Pacific Region<sup>12</sup>”, the study gave a first approach about the e-waste management system in Cambodia, with support from the MoE and its Environmental Pollution Research and Technology Management Office.

In 2007, the MoE got support from the SBC and from the Japanese Ministry of Environment to characterize the e-waste management system in Cambodia. The project entitled “Environmentally Sound Management of Electrical and Electronic Waste in Cambodia” had the objective of identifying the processes gaps and requirements, to propose recommendations and adequate actions in order to make the management system more efficient and to limit the potential impacts on environment. The Cambodian Environment Agency, in cooperation with EX Corporation, designed the “Technical Report on National Inventory of Used of EEE in Cambodia<sup>13</sup>” as an outcome of this project.

From February to July 2008, the MoE through its Department of Pollution Control, with support from SBC, provided some “Training Courses on Environmentally Sound

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<sup>11</sup>Ministry of Environment, Department of Environmental Pollution Control, supported by UNEP and SBC, 2004. *Technical Report: Status of Used Lead Acid Battery Management in Kingdom of Cambodia* – Phnom Penh, Cambodia.

<sup>12</sup>Asia-Pacific Regional Center for HWM Training and Technology Transfer (BCRC China), December 2005. *Survey of the import and the environmentally sound management of electronic wastes in Asia-Pacific Region* – Beijing, China.

<sup>13</sup>CEA May 2007. *Technical Report on National Inventory of used of EEE in Cambodia* – Phnom Penh, Cambodia.

Management of Electrical and Electronic Wastes in Cambodia<sup>14</sup>” to various actors of the e-waste related sector: government officials, customs and police, businesses, etc. The project was funded by the Japanese Ministry of Environment through BC and aimed at raising the participants’ awareness about e-waste related issues and cross-border exchange of WEEE. During the training, people were also asked to formulate recommendations to improve Cambodian e-waste management.

From February 2009 to 2010, a study based on the 2007 CEA report was conducted by the Ministry of Environment and got support from UNEP-DTIE-IETC. The project entitled “E-waste Management in the Phnom Penh Municipality” had the objective to “formulate, design and implement an integrated E-waste management pilot project in Phnom Penh Municipality”. A major outcome for this project was to provide capacity building for national and local government staff, small businesses and private sector actors.

This project was divided in two “volumes”. The first volume<sup>15</sup> concerned the EEE flows and more especially the e-waste inventory: it provided the methodologies and the techniques to conduct an inventory and detailed the current situation of the e-waste management system in PPM. The second volume<sup>16</sup> formulated recommendations, reviewed the Best Available Technologies (BAT) and proposed an e-waste management plan based on the findings of the first volume.

Since it signed or ratified several international protocols and conventions in 2001 (see Part B), Cambodia, through its Ministry of Environment, has become more aware about e-waste related issues and has engaged several projects on this matter since 2003. The MoE benefits from international forums, where experience and knowledge are shared with ministries from other developing and developed countries. It can thus now identify the best practices for e-waste management and design a Cambodian e-waste policy, basing itself on other countries successes and failures.

We can also observe that the succession of the different e-waste projects follow some logic. Indeed, after first understanding the main issues related to e-waste, Cambodia secondly focused on establishing an inventory of its e-waste flows, and then on designing the general guidelines to be followed for an environmentally sound e-waste management. Several campaigns of training were finally organized to raise awareness among the different actors of the sector.

The impending development of the e-waste management system and the awareness raising among its different actors is likely to bring new employment opportunities for the Cambodian population. In order to conduct the various activities of this expanding sector in a safe and sound manner for health and environment, it is necessary to understand the Cambodian e-

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<sup>14</sup>Ministry of Environment, Department of Pollution Control, August 2008. *Training Courses on the Environmentally Sound Management of Electrical and Electronic Wastes in Cambodia* (Final Report) – Phnom Penh, Cambodia.

<sup>15</sup>Ministry of Environment, supported by UNEP-DTIE August 2009. *WEEE/E-waste in Phnom Penh Municipality and Current Management System, Kingdom of Cambodia* – Phnom Penh, Cambodia.

<sup>16</sup>Ministry of Environment, supported by UNEP-DTIE, October 2009. *WEEE/E-waste Management Report, Phnom Penh Municipality, Kingdom of Cambodia* – Phnom Penh, Cambodia.

products market, the issues it faces and its needs. Therefore, the following project was required and has been implemented.

## THE UNIDO “TRANSFORMING E-WASTE INTO JOB AND BUSINESS OPPORTUNITIES” PROJECT

As part of the inception phase of the e-waste project of the United Nations Industrial Development Organization (UNIDO), in close collaboration with the National Technical Training Institute (NTTI) of the Ministry of Labor and Vocational Training (MoLVT) and MoE, Angkor Research and Consulting undertook a baseline survey among e-waste related businesses in the target project areas.

### **a) Project Objectives**

This data collection is of capital importance to, first, better understand the e-product market and its demands for services, and secondly to formulate recommendations for job creation and the improvement of existing businesses. This project is thus in compliance with one of the Cambodian government’s most important general objectives, which is poverty alleviation.

These objectives are fulfilled through the following specific objectives, as per the Terms of References:

- Undertake data collection on profile, number of operators and market for e-products repair services and other existing e-waste related business in 5 baseline areas (operators, client/market);
- Obtain information on initiatives and e-waste related businesses in baseline areas for potential interventions (support to clusters of operators for example);
- Identify and assess issues and provide strategic recommendations for small businesses and potential entrepreneurs.

### **b) Identification of the e-product related businesses**

This project concerns e-product related small businesses in Cambodia. In order to ease their identification for the field team, prior study was conducted to recognize the concerned activities, as classified by the United Nations 4<sup>th</sup> revision of the ISIC (2008).<sup>17</sup> Based on this version of the ISIC, Cambodia published its own classification in 2012, with five-digit codes to improve the overall precision of the document.<sup>18</sup> The cross-analysis of this Cambodian classification with the 2009 Cambodian Establishment Listing<sup>19</sup> gives a first idea of the total number of e-product related businesses in the Kingdom. Table 1 summarizes the main e-product related businesses in Cambodia (not taking into account activities represented by less than 50 establishments).

<sup>17</sup> United Nations, Department of Economic and Social Affairs, Statistic Division, 2008. *International Standard Industrial Classification of All Economic Activities, Revision 4* – New York, USA.

<sup>18</sup> Ministry of Planning, National Institute of Statistics, October 2012. *Cambodia Standard Industrial Classification CSIC, Version 1.0* – Phnom Penh, Cambodia.

<sup>19</sup> Ministry of Planning, National Institute of Statistics, December 2009. *Nation-wide Establishment Listing of Cambodia 2009 – National Report on Final Results* – Phnom Penh, Cambodia.



The detail of some CSIC activities was not available yet for the 2009 listing, and thus some ISIC categories contain activities not related to EEE products (especially 4759, 4774 and 4789).

Repair and retail sale activities are very common in the country, with at least 9,475 establishments (15,053 if we take into account the categories containing non-EEE related activities). Repair and retail sale activities together represent 2.5% (4% with non-EEE activities) of the total number of establishments in Cambodia (376,761 in 2009).

We can notice that the 2009 listing does not record any establishment undertaking hazardous waste treatment, which would include e-waste recycling pre-processes (dismantling, sorting, etc.). However this activity is listed in the 2012 CSIC. Three reasons could explain why hazardous waste treatment is not recorded in the 2009 listing:

- 1) no businesses undertook this kind of activity in 2009 (very unlikely, as e-waste dismantling/sorting activity has been reported since 2005 at least);<sup>20</sup>
- 2) e-waste treatment was not considered hazardous waste treatment (unlikely once again, as e-waste is considered as hazardous waste by the Basel Convention, signed by Cambodia in 2001);
- 3) most of the time, e-product-related businesses in Cambodia have several activities.

Now ISIC/CSIC identifies the principal activity (the one with the most important share of added value), which means that even if hazardous waste treatment does exist in the country, it can never be the main activity of any concerned establishment. We can thus conclude that in 2009, no establishment had e-waste treatment as a unique or principal activity, but as auxiliary activity at best.

Similarly, hazardous waste collection (and thus e-waste collection) is not recorded in the 2009 listing. This activity in Cambodia is mostly undertaken by waste-pickers, who collect a mix of different kinds of waste, and never exclusively e-waste. Therefore the best reason why the hazardous waste collection activity is not listed is that the non-hazardous waste collection activity has a bigger share of added value for waste-pickers (682 establishments recorded for “non-hazardous waste collection” in the 2009 listing). In 2009, no establishment reported e-waste collection as a unique or principal activity, but some businesses reported it as an auxiliary activity.

As stated before in this report, Cambodia is not considered an EEE producing country, with only 387 registered establishments (around 0.1% of Cambodian establishments). Therefore to feed the needs of its population, Cambodia has to import its e-products.

E-waste management in Cambodia generally aims at recycling discarded products. This lowers the demand for new materials and thus decreases the pressure on natural resources. Moreover, e-waste contains valuable components which can be recovered, such as lead, copper, gold, silver, iron, platinum or aluminum. For several years, and mainly for environmental purposes, stress has thus been on developing and improving the recycling sector.

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<sup>20</sup>Asia-Pacific Regional Center for HWM Training and Technology Transfer (BCRC China), December 2005. *Survey of the import and the environmentally sound management of electronic wastes in Asia-Pacific Region* – Beijing, China.

**However, a closer look at EEE-related activities and businesses in Cambodia shows that retail sale and repair activities are much more widespread than e-waste dismantling/sorting and collection activities. It seems relevant to consider that stronger support is needed at each step of the EEE value chain, from retail sale to repair, collection and eventually recycling.**

Consequently, the baseline survey of the UNIDO “Transforming e-waste into job and business opportunities” project was conducted among small businesses undertaking retail sales and repair, as these activities are the most represented. In addition, businesses that dismantle/sort and collect e-waste were also targeted, even if these are not their principal activities.

This project should help to recognize the needs and formulate recommendations to improve the overall EEE and e-waste sector in Cambodia.

**Table 1. E-product related activities classification and businesses inventory in Cambodia.**<sup>21, 22, 23</sup>

Kind of Activity (ISIC)	ISIC code	Kind of Activity (CSIC)	CSIC code	Number of establishments in Cambodia in 2009
Section C: Manufacturing				
Manufacture of domestic appliances	2750	Manufacture of domestic electric appliances	27510	387
		Manufacture of domestic electrothermic appliances	27520	
Repair of electronic and optical equipment	3313	Repair of electronic and optical equipment	33130	229
Repair of electrical equipment	3314	Repair of electrical equipment	33140	137
Section G: Wholesale and retail trade; repair of motor vehicles and motorcycles				
Wholesale on a fee or contract basis	4610	Wholesale on a fee or contract basis	46100	614
Wholesale of electronic and telecommunications equipment and parts	4652	Wholesale of telephone and communications equipment, including cell phones...	46521	150
		Wholesale of blank audio and video tapes and diskettes, magnetic and optical disks (CDs, DVDs)	46522	
		Wholesale of other electronic equipment	46529	
Retail sale of computers, peripheral units, software and telecommunications equipment in specialized stores	4741	Retail sale of computer and peripheral equipment	47411	4,083
		Retail sale of video game consoles	47412	
		Retail sale of non-customized software, including video games	47413	
		Retail sale of mobile phones & other telecommunication equipment	47414	
Retail sale of audio and video equipment in specialized stores	4742	Retail sale of radio and television equipment	47421	1,129
		Retail sale of CD and DVD players and recorders and speakers & sound equipment	47422	
Retail sale of electrical household appliances, furniture, lighting equipment and other household articles in specialized stores	4759	Retail sale of articles for lighting	47592	4,049
		Retail sale of household appliances	47594	
		Retail sale of musical instruments and scores	47595	
		+ non-EEE...	47591, 47593, 47596 & 47599	
Retail sale of music and video recordings in specialized stores	4672	Retail sale of music and video recordings on compact discs, VCDs and DVDs	47620	592
Retail sale of second-hand goods	4774	Retail sale of second-hand electrical and electronic goods	47742	789
		+ non-EEE...	47741, 47743 & 47749	
Retail sale via stalls and markets of other goods	4789	Retail sale of household appliances and consumer electronics via stalls or markets	47894	126
		+ non-EEE...	47891, 47892, 47893 & 47895	
Section S: Other Service Activities				
Repair and maintenance of communication equipment	9512	Repair and maintenance of cellular phones	95121	540
		Repair and maintenance of communication equipment, n.e.c.	95129	
Repair of consumer electronics	9521	Repair and maintenance of video and audio equipment	95211	2,475
		Repair and maintenance of other consumer electronics	95219	

<sup>21</sup> United Nations, Department of Economic and Social Affairs, Statistic Division, 2008. *International Standard Industrial Classification of All Economic Activities, Revision 4* – New York, USA.

<sup>22</sup> Ministry of Planning, National Institute of Statistics, October 2012. *Cambodia Standard Industrial Classification CSIC, Version 1.0* – Phnom Penh, Cambodia.

<sup>23</sup> Ministry of Planning, National Institute of Statistics, December 2009. *Nation-wide Establishment Listing of Cambodia 2009 – National Report on Final Results* – Phnom Penh, Cambodia.

Repair of household appliances and home and garden equipment	9522	Repair and servicing of household appliances, including garden equipment	95220	140
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## **PART B: PROJECT METHODOLOGY**

In this section, the research methodology, as approved and agreed with UNIDO for this small businesses survey, include sampling, instruments, data processing and analysis, and any methodological limitations of the results.

Data from secondary sources (reports, presentations...) was used to inform all sections of this report, and more especially the introduction and background (Part A).

Primary research was conducted through a field survey among small businesses undertaking the following EEE product related activities: new EEE/UEEE retail sale, UEEE repair, WEEE dismantling/sorting and WEEE collection. Face-to-face interviews were carried out with the business owners in the e-product related sectors. This provided valuable information about the number of operators and the way they work.

After evaluation of the Terms of Reference, Angkor Research proposed to adopt the following tested and proven successful methodology to conduct the target survey activities. This methodology consists of phases tightly integrated to achieve the targeted outcomes envisaged for this survey, and in the timeframe outlined in the work plan (Table 3).

### **SAMPLE SELECTION AND DESIGN**

Angkor Research collected data in five targeted provinces: Banteay Meanchey, Battambang, Kampong Cham, Phnom Penh and Siem Reap. Interviews were conducted in urban areas, in the five provincial capital cities,<sup>24</sup> where it was more likely to find e-product related businesses. Indeed, population is concentrated in these areas, as are corporations, NGOs and governmental institutions. The demands and the needs for domestic household electrical appliances, communication devices, and consumer electronics are thus much higher in urban areas.

The 2009 listing,<sup>25</sup> as seen before, gives the total number of establishments for each category of activity. Nevertheless, this number concerns the whole country and no detailed data is available yet about the number of establishments for each kind of activity and for each province (the Economic Census 2011 of Cambodia, which could contain this information, is not yet publicly available). Therefore, Angkor Research was not able to determine the sample size at this stage.

It was thus decided to divide the fieldwork time as follows: two weeks for Phnom Penh and one week for each of the four other provinces. Angkor Research assumed that most of the

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<sup>24</sup>For Banteay Meanchey, Angkor Research decided to survey Sisophon city instead of Poipet because this last, though more populated, has the unusual status of being situated on the Thai border, and thus shows an economic situation strongly influenced by the proximity of Thailand, which could bias the survey results.

<sup>25</sup>Ministry of Planning, National Institute of Statistics, December 2009. *Nation-wide Establishment Listing of Cambodia 2009 – National Report on Final Results* – Phnom Penh, Cambodia.

concerned businesses could be found around market areas, which were then prioritized for the survey. For the provinces of Banteay Meanchey, Battambang, Kampong Cham and Siem Reap, time was divided among the different market areas of each capital city. But for Phnom Penh, time was firstly equally divided among the different *khans* (districts) of the city, and secondly among the different market areas of each *khan*. In this allocated time for each market area, the research team had to interview as many e-product related businesses as possible.

This methodology turned out to be very successful, and allowed the field teams to conduct a census of e-product businesses in Kampong Cham and Sisophon (Banteay Meanchey) cities. A census was nearly achieved in Siem Reap and Battambang, but the time limit did not make it possible to interview all of the e-product related businesses in these larger cities.

Finally, more than 500 businesses were approached in Phnom Penh. Among all of the surveyed *khans*, many e-product related businesses were found in Meanchey, Chamkarmon and Tuol Kork districts, as stated in the 2009 first volume of the “E-waste Management in the Phnom Penh Municipality”, but also in areas such as Kakab *sangkat*(commune), around Pochentong Airport and Pochentong Market, where new residential areas are rapidly expanding.

Table 2 shows the size of the final sample. Out of the 1,401 businesses approached, 1,360 accepted to answer all of our questions (completed questionnaires), which gives the satisfactory completion rate of 97%.

**Table 2. Sample size and interviews results by province.**

Province	Banteay Meanchey	Battambang	Kampong Cham	Phnom Penh	Siem Reap	Total
Result						
Completed	179	238	140	513	290	<b>1,360</b>
Incomplete: respondent termination	1	0	1	1	0	3
Respondent refusal	7	4	3	17	5	36
3 <sup>rd</sup> party refusal	0	0	0	1	0	1
Respondent absent at least appointment	1	0	0	0	0	1
Total	188	242	144	532	295	<b>1,401</b>

For the “Environmentally Sound Management of Electrical and Electronic Waste in Cambodia” project in 2007 (CEA), 150 businesses were interviewed in Phnom Penh and 50 in each of the other targeted provinces (for a total of 400 businesses, called “recyclers” in the report),<sup>26</sup> while for the “E-waste Management in the Phnom Penh Municipality” project, 88 businesses were surveyed in the capital city.<sup>27</sup> The sample size of 1,360 interviewed businesses for this baseline survey seems therefore rather adequate and representative.

<sup>26</sup>CEA May 2007. *Technical Report on National Inventory of used of EEE in Cambodia* (table 2 p13) – Phnom Penh, Cambodia.

<sup>27</sup>Ministry of Environment, supported by UNEP-DTIE August 2009. *WEEE/E-waste in Phnom Penh Municipality and Current Management System, Kingdom of Cambodia* (appendix 7)– Phnom Penh, Cambodia.

However, the two projects mentioned did not have the same objectives as ours, and it may be risky to compare survey methodologies and sample sizes.

## INSTRUMENT

The instrument of the small businesses survey for this project consists of seven sections:

- Business profile;
- Business activities: e-waste collection;
- Business activities: UEEE repair/refurbishment;
- Business activities: e-waste dismantling/sorting;
- Business activities: new/UEEE retail sale;
- Business activities: purchase/sale of spare parts;
- Data collection, record keeping;
- Level of awareness, issues encountered and recommendations.

In compliance with UNIDO and MoE priorities, Angkor Research designed this questionnaire with a focus on three main categories (as defined by Directive 2012/79/EU), concerning six kinds of e-products:

- Large household appliances: air conditioner, refrigerator and washing machine;
- Information and communication technologies: computer (desktop or laptop) and phones (mobile phone or land line telephone);
- Consumer equipment: television.

Although these six kinds of devices are the most common among e-product related businesses, the research team also recorded the information from businesses dealing with other kinds of EEE (fan, rice cooker, video recorder, radio...).

The sections and questions in the instrument were designed to gather data about the following topics: business profile (number/gender of staff, salary, education...); characterization of each kind of activity (kind of device, supplier, customers...); flows of e-products; trends (in the past years and estimation for the years to come...); data collection and recording practices; issues encountered (technical, environmental and H & S); and finally recommendations for sector improvement.

The questionnaire underwent two field tests in Kandal and Kampong Speu provinces (not among the project target areas), to ensure that it was: 1) easily understandable for all respondents; 2) non-offensive and non-threatening (and therefore more likely to elicit true responses); 3) simple for interviewers to record; and, 4) not eliciting random data. Angkor Research has developed a very successful questionnaire format which was adapted for this survey. Questionnaires were pre-coded for ease of ID tracking, and included detailed interviewer instructions and skipping options where necessary.

**Table 3. Work plan for UNIDO "Transforming e-waste into job and business opportunities" project.**

Work	May			June				July			
	13/05	20/05	27/05	03/06	10/06	17/06	24/06	01/07	08/07	15/07	22/07
<b>UNIDO "Transforming e-waste into job and business opportunities"</b>											
<b>Preparatory Phase</b>											
Work plan and methodology formulation											
Review of available qualitative and quantitative information											
Sampling + Instrument design/translation/adaptation											
Field Team Recruitment : begin on 20/05											
Instrument field 1 <sup>st</sup> pre-testing: 29/05											
Field Team Training: 03/06 to 06/06											
Data entry program design											
<b>Data Collection</b>											
Pilot Field Test: 05/06											
Field Work: 10/06 to 23/06											
<b>Data Analysis</b>											
Data entry (First and second)											
Data Cleaning (Clean Dataset)											
Final Database and Data Analysis											
<b>Baseline Report</b>											
Presentation of the Preliminary Results: 05/07											
Draft Report											
Final Report											



## FIELD STAFF TRAINING AND DATA COLLECTION

The first instrument field test was conducted on the 29<sup>th</sup> of May 2013 in Kandal province with the field teams' editors and supervisors only, to ensure that they understand the objectives of the project, the objectives of the data collection, and to take into account their recommendations in order to improve the instrument.

Training for the field staff was conducted over four days, from the 3<sup>rd</sup> to the 6<sup>th</sup> of June 2013, in Angkor Research's Phnom Penh offices. Staff were trained in appropriate interview techniques, e-product related business identification/sampling procedures, and data collection methods, as well as ethical issues (1<sup>st</sup> and 2<sup>nd</sup> days of the training). Extensive practice with the actual instrument was included in the training, to ensure that all field staff were familiar with its use.

Pilot testing of the instrument by all field staff took place on the 5<sup>th</sup> of June 2013 (3<sup>rd</sup> day of training), in Kampong Speu province. The pilot field test ensured that all questions were comprehensible and appropriate, and assessed the functionality of the questionnaire including skipping patterns, open-ended and "other" responses. Feedback supplied by the staff and any findings noted by the supervisors during training and pilot testing were once again incorporated into the final version of the questionnaire (debriefing session on the 4<sup>th</sup> day of training).

Three teams of field staff conducted data collection activities for two weeks in June 2013. One team was assigned to Kampong Cham and Siem Reap provinces, the second team to Banteay Meanchey and Battambang, and the third team stayed in Phnom Penh. Each team contained a dedicated Field Supervisor and an Editor, as well as four Interviewers. Therefore each team had six staff, giving a total number of eighteen field staff for this project. Fieldwork was overseen by the Fieldwork Director, who was also a Supervisor, and in touch with the field teams every day, as well as the Project Director.

Supervisors and Field Editors used field reporting forms to manage data collection. In the field, Supervisors conducted spot checks and/or direct observation of 20% of all interviews to ensure data quality. The Field Editors in each team checked all questionnaires before leaving each market area. Each supervisor reported in from the field at the end of each day with totals of completed interviews and any non-responses. These figures were tabulated and sent back out to all field staff, the Research Director and other relevant staff the next morning via SMS, with both the previous day's fieldwork results and a running total for each team.

Data was collated in the field by the Supervisors, and sent back to Angkor Research's Phnom Penh office when possible (every day for Phnom Penh, and after one week for Kampong Cham and Banteay Meanchey provinces). Data was delivered to the Research Director with a summary sheet for each cluster, the completed questionnaires, the records of field checks, and any refusals or incomplete questionnaires. The Research Director checked and collated this information, and prepared it for data entry and analysis.

Angkor Research's Data Manager designed the data entry program, using the final questionnaire and feedback from the two pretests.



Figure 4. Field data collection in Phnom Penh (personal picture).

## DATA ENTRY, CLEANING AND ANALYSIS

All collected data was entered into the database designed by the Data Manager using CSPro (Census and Survey Processing System) software by three trained Data Encoders. All questionnaires were entered into two separate databases by different staff members (double data entry). The two databases were then reconciled, and all entries checked for inconsistencies between the first and second data entry. We verified and corrected all inconsistencies by comparing data with the completed paper questionnaires. Checks and error messages for legal values, validation rules and queries for internal consistency checks were also performed. Simple cross tabulations allowed us to check and either explain, correct, disregard or delete outlying values.

All quantitative data was analyzed using Stata statistical analysis software. The analysis was conducted to examine both the statistical confidence of the data, as well as the relevance to the overall project objectives.

Primary data was analyzed alongside complementary data from secondary sources (desk review), to provide a clear picture of the various aspects of the e-product and e-waste management sector in Cambodia.

## CONFIDENTIALITY OF DATA

All data for this survey is kept confidential. Full names and personal addresses of respondents are not recorded on the questionnaires; only businesses names, mobile phone numbers and addresses are reported, to be able to identify and refer to these different businesses. Personal information is not provided in the report or appendixes.

## LIMITATIONS OF THE PROJECT

A detailed directory of e-product related businesses by province is not available, and thus Angkor Research was not able to design a more suitable sampling methodology. However, as mentioned before, the census realized in Kampong Cham and Banteay Meanchey, and almost realized in Siem Reap and Battambang, and the more than 500 businesses interviewed in Phnom Penh provide a strong overview of the e-product and e-waste management sector in Cambodia.

The informal nature of some activities such as e-waste collection and dismantling may have caused some difficulties in the field, especially concerning the identification and the localization of the related businesses. Maybe the “Economic Census 2011 of Cambodia”, which lists all of these businesses in the country, can be of help for future projects if it becomes publicly available.

During interviews, respondents were asked to assess different percentages (for the different kinds of devices being sold/repaired/collected/dismantled, different suppliers/customers...) and different quantities (kilograms of e-products being processed every month...). The answers given are estimations and could not be measured for verification. It is nevertheless assumed that most respondents have a good knowledge about the questions related to their own activity processes. The answers were thus analyzed and are presented in the next section.

## PART C: PRESENTATION OF THE SURVEY RESULTS

In this section, we will present and describe the results obtained from the data collection and analysis processes. These different findings will be organized by type of business activity, and will follow the logic proposed in the conceptual flow chart for the EEE value chain (Figure 3).

Therefore, after a brief examination of the structure of the surveyed businesses, we will successively describe their activities: the general business profile, the flows of e-products, the current trends, expectations for the future, and the data recording habits will be described. The last section will describe the potential issues encountered by EEE businesses, and the respondents' level of awareness about these issues.

In the instrument and this report, we use the term “business”. Angkor Research considers that in this report, “business” has the same definition as “establishment”, the term used by the UN and the Cambodian Ministry of Planning in the ISIC and CSIC. The definition of “establishment” can be found in the glossary.

Angkor Research adopted the common conversion rate of KHR 4,000 = USD 1.00.

“n” represents the total number of respondents for the related indicator.

### SURVEYED SAMPLE STRUCTURE

We use the terms “principal”, “primary” and “main” to identify the activity with the biggest share of added value in the business. “Secondary” and “auxiliary” apply to activities with a smaller share of added value. The decision of whether an activity is a principal or secondary activity is determined by the respondent at the time of the survey.

#### a) Main activities

Figure 5 shows that retail sales are the main activity for 65.4% of the 1,360 surveyed businesses, while repair activities are the primary activity for 24.2% of businesses.

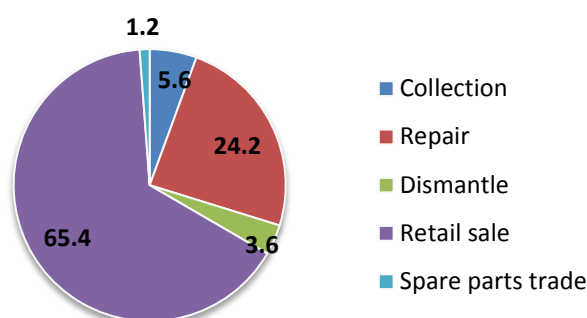
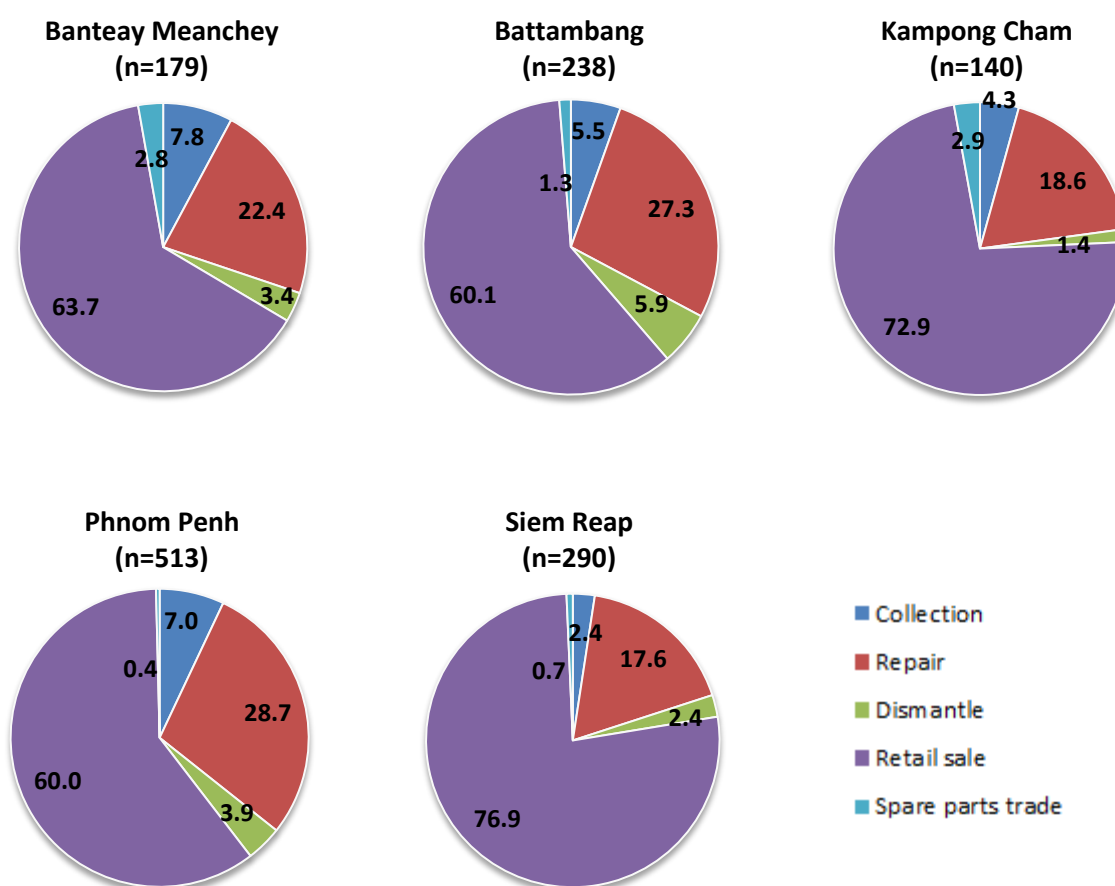


Figure 5. All business respondents, by main activity (in %; n=1,360).

We saw previously in Table 1 that e-waste dismantling activities were not reported in the 2009 listing, probably because they were not considered a principal activity in that year. However, during our survey 3.6% of the interviewed business owners affirmed that e-waste dismantling is their main activity. Although this rate is very low compared to retail sales and repair activities, this could mean that since 2009, some specialized dismantlers have appeared (“specialized” referring to the fact that dismantling is their sole or primary activity).

5.6% of the respondents collect e-waste, most of them being waste-pickers, while businesses that trade in spare EEE parts represent 1.2% of the interviewed businesses in the Cambodian e-product sector.



**Figure 6. EEE business respondents in each province, by main activity (in %; ).**

Figure 6 gives the detail of businesses by primary activity and province. It shows that Battambang and Phnom Penh present the lowest proportion of retail sale activity (around 60%) and highest proportion of repair and dismantling activities (together around 33%). We can assume that Phnom Penh and Battambang provinces have a more developed network for UEEE repair and e-waste dismantling than the three other provinces.

Siem Reap and Kampong Cham have much higher proportions of retail sale activity (around 77% and 73%, respectively), and consequently much lower percentages of repair activity

(respectively around 18% and 19%). They also show the lowest rates of dismantling businesses (around 2% and 1%, respectively). Around 13% less businesses that engage in UEEE repair and e-waste dismantling as primary activities have been found in Siem Reap and Kampong Cham.

Banteay Meanchey province seems to have an intermediate profile, with proportions for retail sale, repair and dismantling activities situated between the two groups of provinces here mentioned. We can also notice that a high proportion of waste-pickers have been surveyed in this province (around 8% of the provincial sample).

### **b) Secondary activities**

The survey also confirmed that most businesses have several activities; 67% of all surveyed businesses undertake at least two activities. Table 4 shows which auxiliary activities are the most popular (for each category of auxiliary activity, businesses who consider it as their main activity are not included):

**Table 4. Percentages of businesses undertaking each kind of auxiliary activities (n=909).**

<b>Auxiliary Activity</b>	<b>% of businesses</b>
Spare parts trade	91.8
Repair	39.3
Retail sale	23.2
Dismantling	0.7
Collection	0.1

We can see that around 92% of the businesses with secondary activities trade spare parts as an auxiliary activity. This highlights the fact that spare parts are important for numerous businesses in the EEE sector, independent of their main activity.

Repair and retail sale activities are the next most important auxiliary activities, respectively. Among the multi-activity businesses, 39% repair e-products as an auxiliary activity. Similarly, businesses who do not conduct retail sales as a main activity sell e-products as an auxiliary activity in 23% of the cases. This gives even more importance to these two kinds of activities in the e-product sector.

Dismantling and collection of e-waste are rarely reported as secondary activities, and considering their low rates as main activities too, we can affirm that e-waste collection and dismantling activities are not widespread in Cambodia.

## RETAIL SALE ACTIVITY

This activity concerns the retail sales of new and used EEE.



Figure 7. Retail mobile phone sellers in Battambang (personal picture).

### a) Business profile

We consider here the businesses who reported that their main activity is retail sale (n=890).

#### i. Starting year

Among the retail businesses surveyed, the oldest one opened in 1980 and the most recent one in 2013. As the standard deviation for these values is high (s.d.; Table 5), we can use the median value to represent the opening year of most retail sale businesses in the e-product sector, which is more representative of the reality.

Table 5. Opening year for retail sale businesses.

	mean	sd	min	p50	max	N
Retail sale	2008	5.1	1980	2009	2013	888*

\*2 businesses did not answer this question

The starting year median value among these 888 businesses is 2009. Indeed most of the population has acquired easier access to EEE (e.g. mobile phones, computers, household appliances, etc.) rather recently, only in the last few years.

#### ii. Staff composition

82% of the retail sale businesses employ males and 73% employ females. Women are responsible for retail sale businesses almost as often as men: the gender balance is rather good for this kind of business (Table 6).

**Table 6. Gender and paid staff balances among the retail sale businesses (n = 890).**

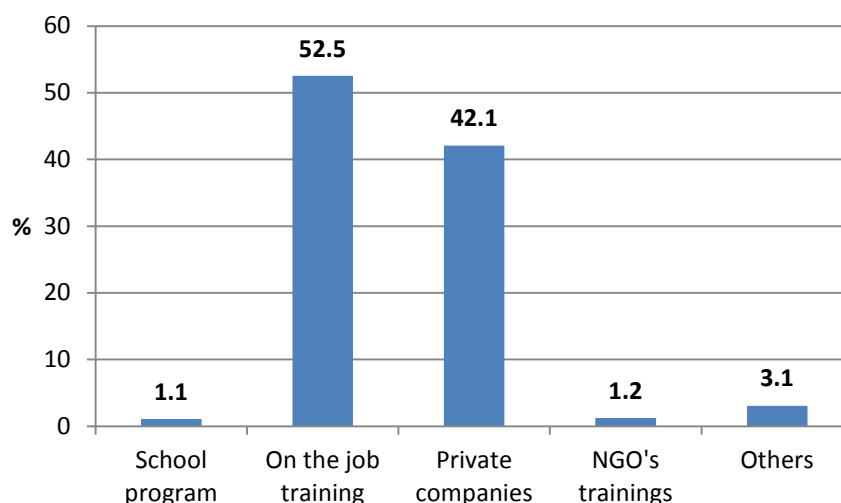
Business Main Activity	Average number of staff	% Male staff	% Female staff	% Paid staff
Retail Sale	2.2	55.0	45.1	13.5

Retail sale businesses, in the EEE sector, count on average 2.2 staff. As stated above the ratio of men and women is rather balanced. However, only 13.5% of the staff are paid. This could mean that in most cases, either the owner or their spouse is in charge of the business, and thus does not receive a salary.

When paid, male staff earn on average KHR 12,900 per day (around USD 3.20) and female staff earn KHR 9,200 (around USD 2.30) although they all work around 11 hours per day, 7 days per week.

### iii. Training

50% of the businesses have staff who received training for this activity. Most staff learned on-the-job and from private companies (e.g., private training centers, etc.).

**Figure 8. Types of training received by staff in retail sale businesses (n=445).**

*"Others" refers to training in other shops or abroad.*

### b) New EEE and UEEE flows

We consider here the overall retail sale activity, for both the primary and secondary business activities (n=1,096 businesses).

92.8% of the retail sale businesses sell new products, whereas 68.8% sell UEEE. In terms of proportions within the whole retail sale sector, 65.9% of the products sold are new, and consequently 34.1% are second-hand EEE. Although we stated earlier in this report that Cambodia imports considerable amounts of second-hand items, we can see here that two-thirds of the EEE products are actually sold new.

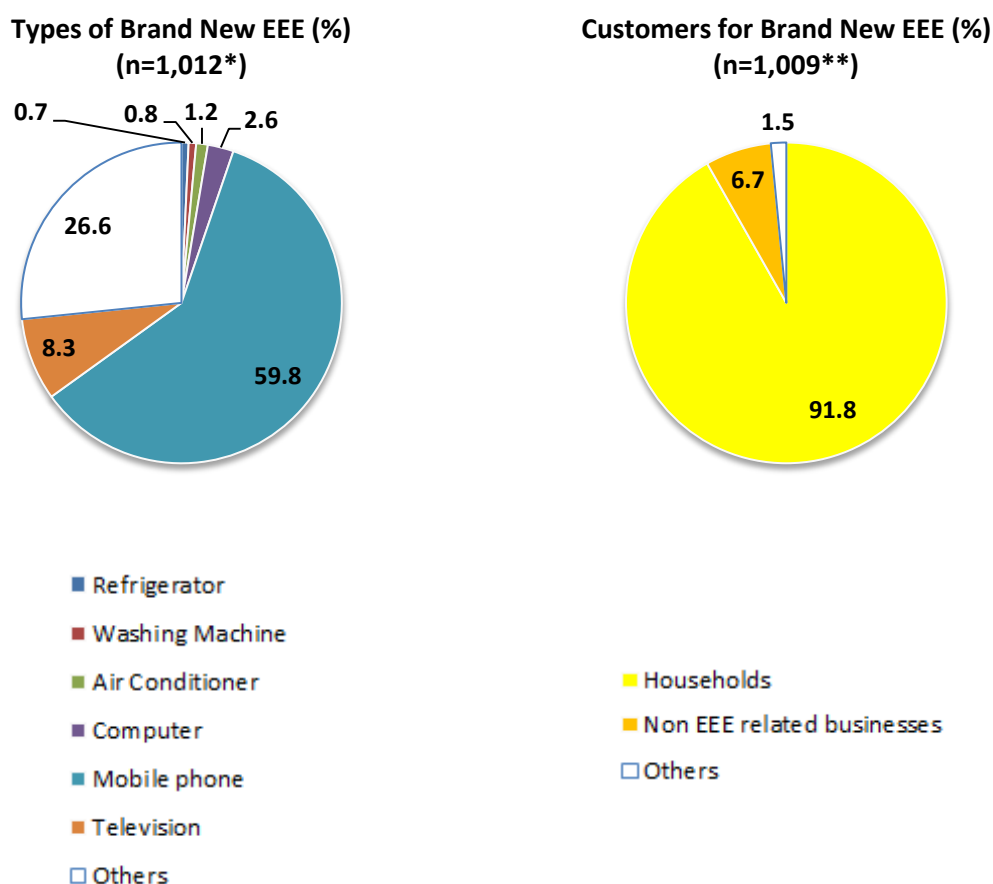


**i. New EEE**

Figure 9 shows that almost 60% of the new EEE sold are mobile phones. New televisions represent 8.3% of the new products market, whereas large household appliances together account for only 2.7%. Computers are not very well represented, with a market share of only 2.6%. “Other” EEE are, in order of importance: fans, DVD players, speakers, radios, kitchen appliances such as rice cookers, lamps.

Businesses which sell new EEE buy them initially from local wholesalers (97.4%; n=1,011 businesses, with four excluded because they gave incorrect proportions (total different from 100%)). Only 2.4% of the respondents say that they directly import their products.

Customers of new EEE products are almost exclusively households and individuals (91.8%). 6.7% of the new EEE are, however, bought by corporations, institutions, etc.



**Figure 9. New EEE flows through retail sale activity.**

*\*3/\*\*6 businesses excluded because they did not give correct proportions (total different from 100%)*

Table 7 shows a high standard deviation in the amount of new EEE sold monthly, probably caused by the sale of large household appliances much heavier than mobile phones. If we want to take into account all kinds of new EEE products sold, then we will choose the mean value of 70.6kg. But as we saw previously, most new EEE products sold are mobile phones, and thus the median value of 7kg of new EEE sold monthly is more representative of the reality.

**Table 7. Amount of new EEE sold monthly (kg).**

mean	sd	min	p50	max	sum	N
70.6	314.83	0	7	6500	71402.5	1011*

\*4 businesses did not answer this question.



**Figure 10. Mobile phone retail seller in Phnom Penh (personal picture).**

## ii. UEEE

76.5% of the UEEE sold by retail sale businesses are mobile phones. Televisions and computers account for 8.6% and 3.2% of the UEEE products sold, respectively. Large appliances together represent 4.8% (Figure 12). “Others” refers to DVD and videotape readers, amplifiers, walkie-talkies, etc.

UEEE are bought from households and individuals (71.8%), and from UEEE wholesalers (19.1%). 4.7% buy items such as computers from corporations and 2.4% directly import UEEE.

The main customers are individuals and households (91.9%), and some corporations (6.6%) which prefer to buy UEEE, as they are cheaper than new equipment (Figure 12).

For the same reasons as new EEE, the standard deviation for average UEEE is high. We can use the mean value, 42.4kg UEEE sold monthly, if we want to take all kinds of UEEE items into account, or the median value if we want to have the most commonly given value, 6kg (Table 8).

**Table 8. Amount of UEEE sold monthly (kg).**

mean	sd	min	p50	max	sum	N
42.4	130.75	0	6	1500	31655	746*

\*8 businesses did not answer this question



Figure 11. Large households' appliances and consumer equipment retail sale in Phnom Penh (personal picture).

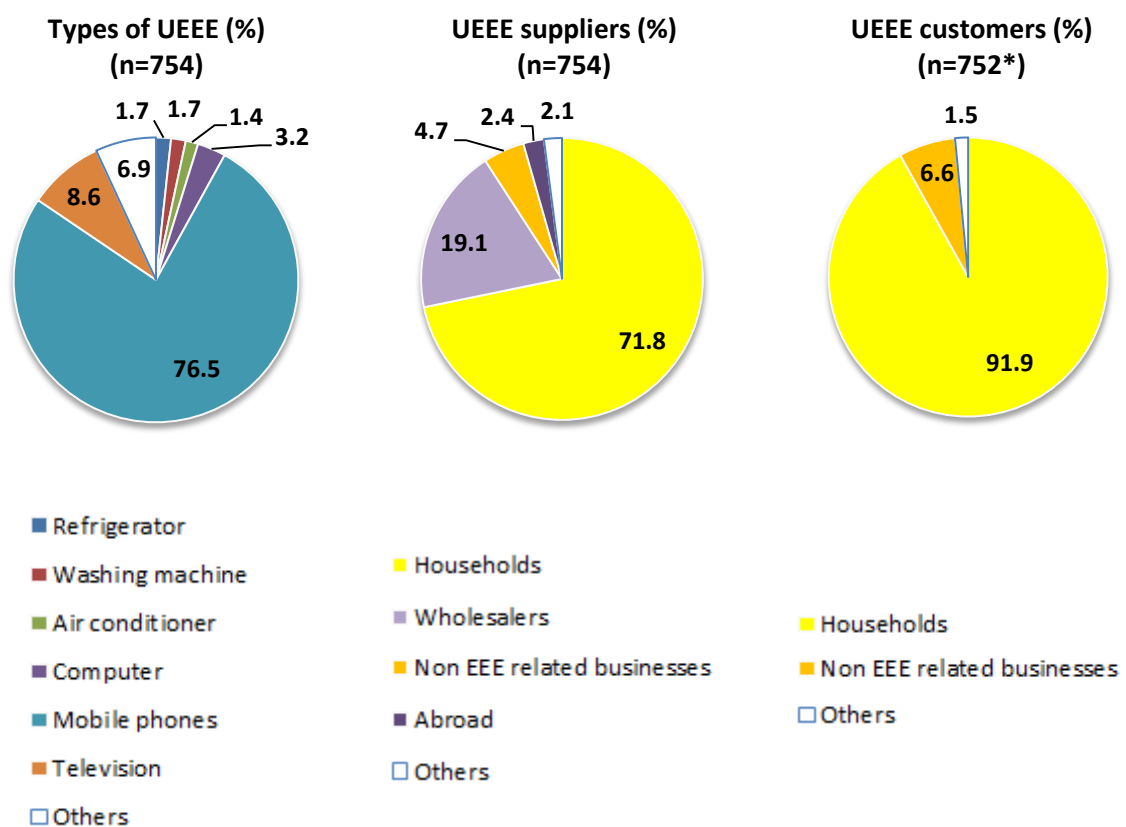


Figure 12. UEEE flows through retail sale activity.

\*2 businesses excluded because they did not give correct proportions (total different from 100%)

**c) Variations over time**

73.7% and 75.5% of the respondents observed a variation for the sales of new EEE and UEEE, respectively.

Figure 13 shows that respondents who noticed a variation generally observed a decrease in the amount of new EEE sales (41.9%) and an increase in the amount of UEEE sales (45.2%). Even though two-thirds of the EEE products sold are new, the current trend is that UEEE sales are rising.

When asked about their expectations for the future, 48.8% of the respondents think that the UEEE sales will increase, because UEEE are less expensive (61.4% of the reasons given) and because Cambodian society consumes more (30.7%).

28.4% of the respondents who think that they will sell less UEEE in the future explain it by the fact that new EEE are now more affordable (40.7% of the reasons given), there is too much competition in the second-hand retail sector (36.9%), and that UEEE have a low quality compared to new EEE (13.1%).

As far as new EEE sales are concerned, 43.7% of the respondents think they will sell more new EEE in the future, because of higher consumption (78% of the reasons given), new EEE are now more affordable (9.9%), and peoples' socio-economic situations have improved (they have more money; 6.7%).

On the contrary, 31% think that they will sell less new EEE, because there are too many competitors (63.1%), and new EEE products are still too expensive (7.6%). Some respondents also think that people go to Thailand when they want to buy new EEE.

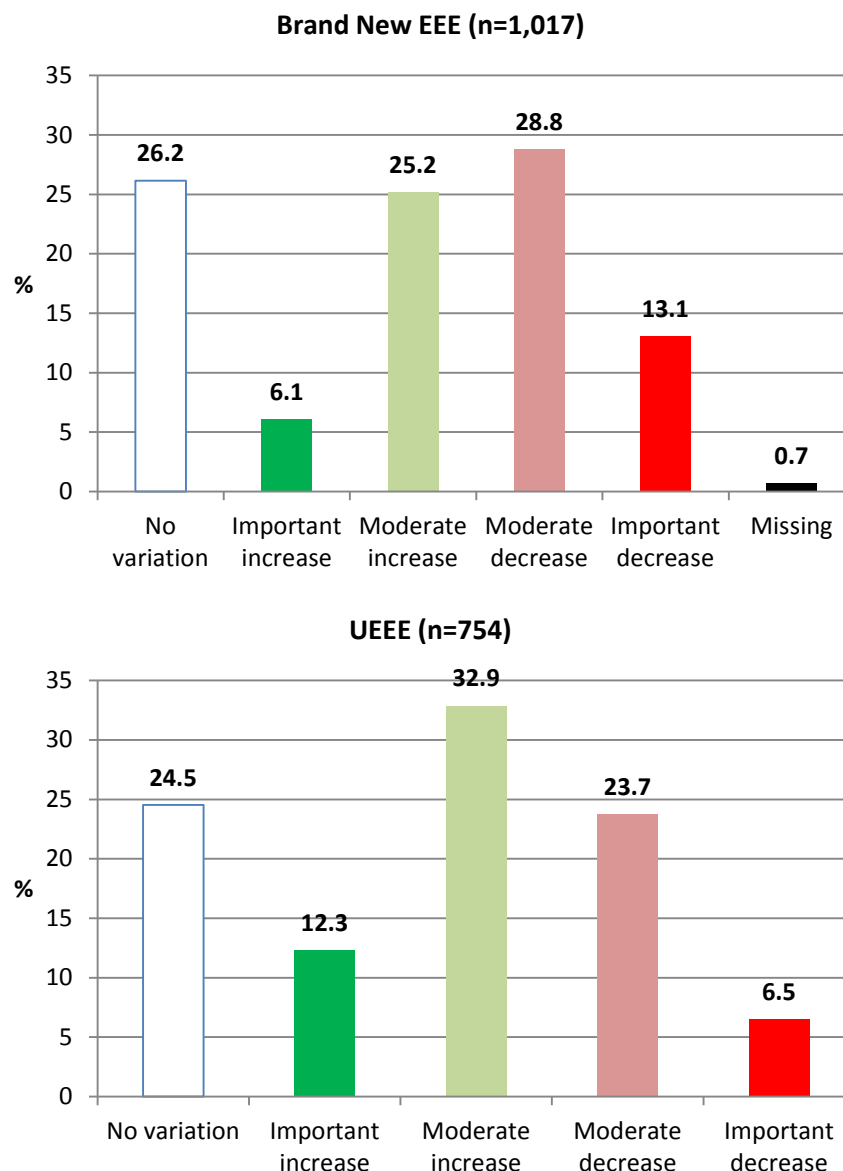


Figure 13. Variations observed since retail sale activity started.

## REPAIR ACTIVITY

Repair activity concerns UEEE. However, this activity also generates e-waste from the non-functioning parts from the repaired devices, and the UEEE which cannot be repaired.

### a) Business profile

We consider here the businesses whose main activity is repairing EEE (n=329).

#### i. Starting year

The oldest repair business started in 1979 and the most recent in 2013. We consider the median value for the same reason seen previously (high standard deviation).



Figure 14. Mobile phone manual repair technician in Banteay Meanchey (personal picture).

Table 9. Opening year for repair businesses.

	mean	sd	min	p50	max	N
Repair	2006	7.0	1979	2008	2013	329

The large quantities of second-hand products imported over the past few years (more affordable than new EEE, but of lower quality) and the fact that repairing is often cheaper than buying new or second-hand equipment could explain why most repair services for e-products appeared in Cambodia almost at the same time as retail sale businesses (2008); people had easier access to UEEE mainly, and thus needed more repair services.

#### ii. Staff composition

All of the repair businesses employ males and only 28% employ females. Repair businesses are thus more likely to employ men.

Repair businesses, in the EEE sector, have on average 2.2 staff. As stated above the ratio of men and women is very unbalanced (on average 86.3% of these 2.2 staff are men). Only 16.2% of the staff are paid: this could mean that in most cases, either the owner or their spouse, is in charge of the business and thus does not get a salary.

Table 10. Gender and paid staff balances among the repair businesses.

Business Main Activity	Average number of staff	% Male staff	% Female staff	% Paid staff
Repair	2.2	86.3	13.7	16.2

When paid, male staff get on average KHR 13,900 per day (around USD 3.50) and female staff get KHR 8,300 (around USD 2.10) although they all work around 10 hours per day, 7 days per week.

### iii. Training

99% of the businesses have staff who received training for repairing EEE. Most staff learned from private companies (e.g. private training center...) and on-the-job training. ("Others" refers to training in other shops or abroad)

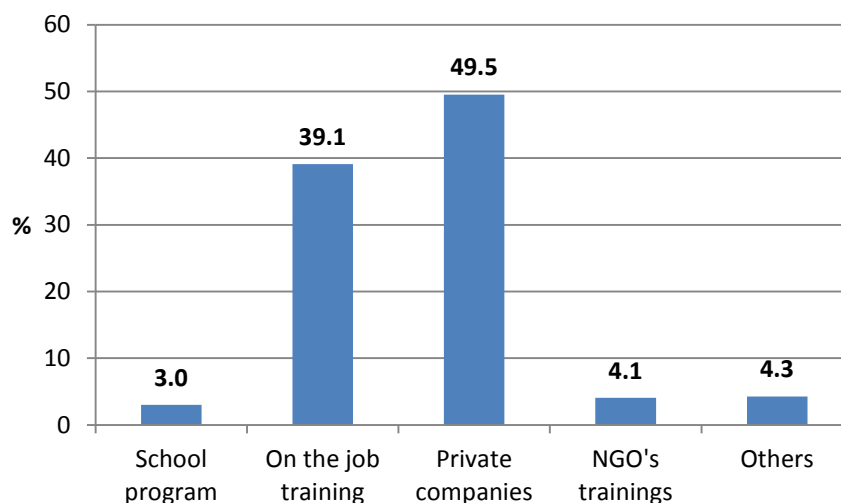


Figure 15. Kinds of training received by staff in repair businesses (n=327).

### b) UEEE flow

We consider here the overall repair activity, for both the primary and secondary business activities (n=685 businesses concerned).

According to Figure 17, 59.3% of the UEEE products repaired are mobile phones, and 13.6% are televisions (Figure 16). We can see that large appliances represent only 5.9% of the repaired items (Figure 18), more than the 4.9% represented by computers. "Others" refers to fans, DVD readers, videotape recorders, speakers and amplifiers.



Figure 16. Television repair process in Banteay Meanchey (personal picture).

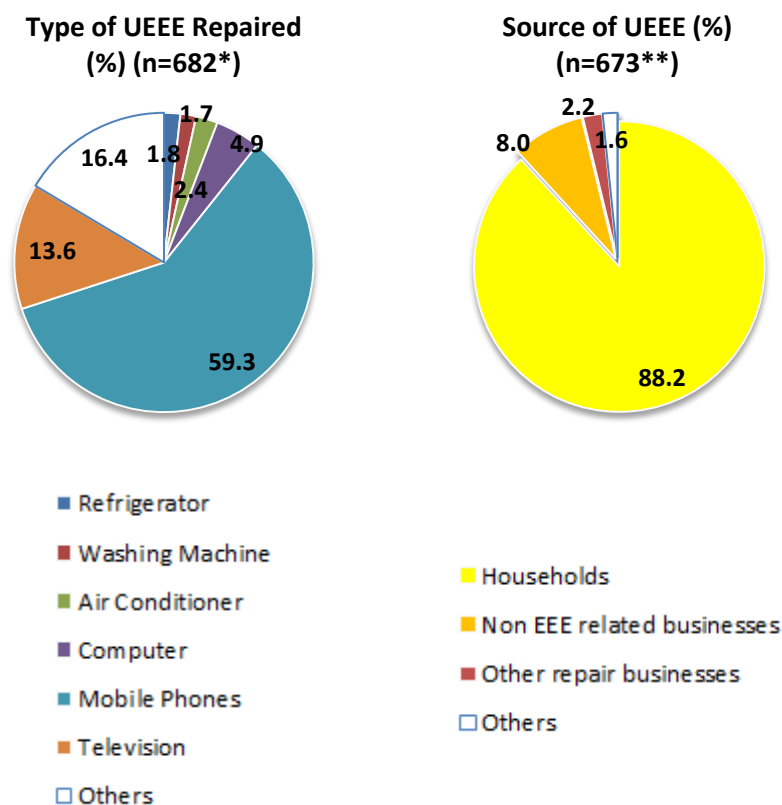
Repair services are mostly used by households (88.2%). 8% of the customers are non-EEE related businesses, such as corporations, institutions, offices, etc. 2.2% are other repair businesses who cannot repair the item themselves (no time, lack of specific skills and equipment,...), so they send it to another repair business. "Others" refers to retail sale businesses and wholesalers.

**Table 11. Amount of UEEE repaired monthly (kg).**

mean	sd	min	p50	max	sum	N
174.1	463.64	0.5	18	5400	118942.8	683*

\*2 businesses did not answer this question.

The high standard deviation in the monthly amounts (Table 11) shows the influence of extreme values on the mean. Indeed, most of the UEEE repaired are mobile phones and televisions, and only 5.9% are large appliances. However, these large appliances weigh much more than phones and televisions, and thus influence the mean value considerably. If we want to take all items into account, we should consider the mean value of around 174kg. But if we want an indicator not influenced by extreme values, we should choose the median value of 18kg of UEEE repaired monthly.



**Figure 17. UEEE flows through repair activity.**

\*3/\*\*12 businesses excluded because they did not give correct proportions (total different from 100%)





Figure 18. Washing machine repair technician and tools in Phnom Penh (personal picture).

**c) Variations over time**

42.9% of the respondents observed an increase in the amount of UEEE they repaired (35.3% observed a moderate increase). However, 35.1% think that they repair less UEEE than when they started (25.8% observed a moderate decrease). 21.3% did not report any variation.

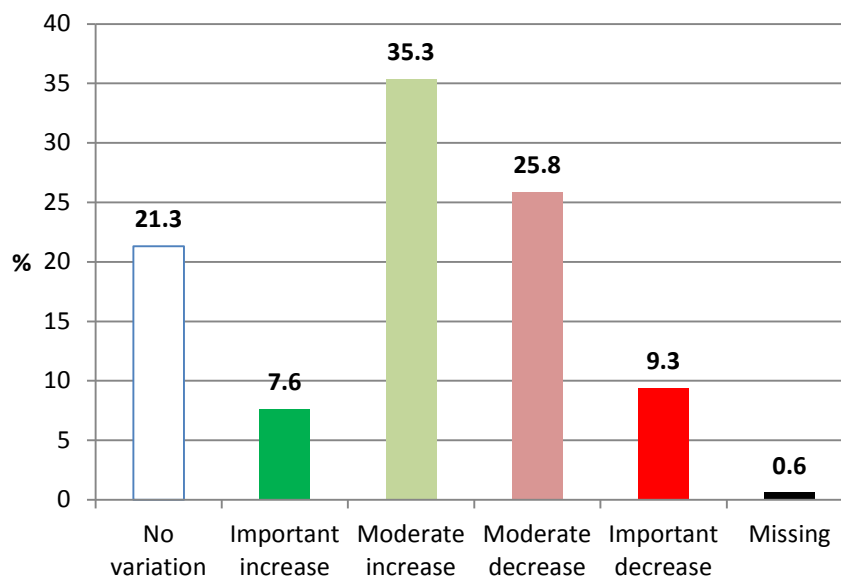


Figure 19. Variations observed since repair activity started (n=685).

When respondents were asked about their business expectations for the future, 19.3% of them do not expect any variation. Half of them (49.5%) expect to repair more UEEE in the next years, mostly because of an increased consumption rate of EEE in the society (according to 63.4% of these respondents).

31.2% of the respondents think they will repair less UEEE because of increased competition between repair businesses (41.6%).

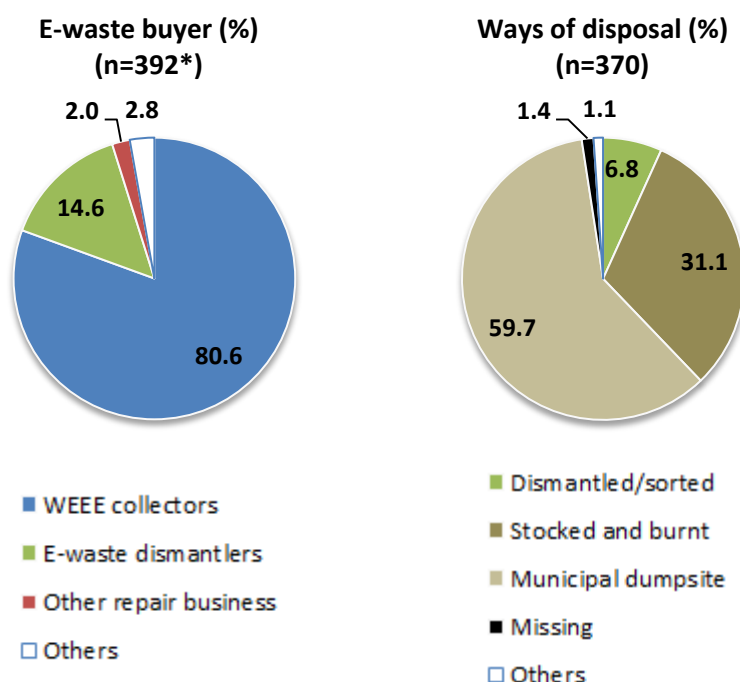
**d) Generation of non-repairable UEEE and non-functioning components**

We then asked the respondents about the way they manage the e-waste potentially generated by their activity, including the non-functioning parts that they remove from the devices they repair, and the UEEE devices they cannot repair. Businesses can generally sell these WEEE and/or find other ways to dispose of them (Figure 20).

57.5% of the businesses which have repair activities sell the e-waste they generate.80.6% of these businesses sell it to waste-pickers and 14.6% directly to dismantling businesses.2% sell WEEE to other repair businesses.

53.9% of the businesses dispose of their e-waste through other ways. 59.7% let the municipal waste collection system take it away to dumpsite, while 31.1% burn it. 6.8% of the repairers dismantle the e-waste themselves (multi-activity).

Some businesses both sell e-waste, and have other ways to dispose of it.



**Figure 20. Becoming of the generated e-waste when sold or disposed of.**

*\*2 businesses excluded because they did not give correct proportions (total different from 100%)*

Table 12 shows that some repair businesses estimate that they do not generate any e-waste, while others say that they can generate up to 6,000kg of e-waste per month. This value, which represents one-third of the total amount of e-waste reported for all repair activity respondents, comes from a business which has five staff and is specialized in television repair/sale. All of the devices they cannot repair are sold, and this amount is assessed to reach 6,000kg. If this high value cannot be ignored (and causes a high standard

deviation), it is not representative of the general situation in our sample and thus we will choose the median value of 1kg of e-waste generated monthly by businesses with repair activity.

**Table 12. Amount of WEEE generated monthly (kg).**

mean	sd	min	p50	max	sum	N
25.9	248.37	0	1	6000	17452	675*

*\*10 businesses did not answer this question*

## COLLECTION ACTIVITY

Angkor Research considers that the collection activity concerns WEEE or e-waste for this project. Waste-pickers can sometimes collect broken UEEE that can still be repaired, and are thus not yet WEEE. But waste-pickers cannot recognize WEEE from these broken UEEE, and therefore sell them as WEEE.

### a) Business profile

We consider here businesses whose main activity is the collection of UEEE and e-waste (n=76).

#### i. Starting year

The waste-pickers who began their activity for the longest time started in 1980; the newest waste-pickers started in 2013. We consider the median starting date of 2007, for the same reason seen previously (high standard deviation).

**Table 13. Opening year for collection businesses.**

	mean	sd	min	p50	max	N
Collection	2005	8.0	1980	2007	2013	76

Most collection businesses started earlier than repair and retail sale businesses. Considering that e-waste collection is reported as their main activity, we can wonder why these establishments were not recorded in the 2009 listing. A possible explanation is that these waste-pickers maybe had another activity with a higher share of added value when the listing was designed; collection of non-hazardous waste, for example. We can also suppose that e-waste is now available in higher quantities and is sold at a higher price; therefore its collection becomes the waste-pickers' main activity (higher share of added value compared to non-hazardous waste).

#### ii. Staff composition

71% of collection businesses employ males, and only 46% employ females.

Collection businesses, in the EEE sector, have on average 1.3 staff. Around 62% of these staff are men on average, which can be explained by the hard nature of the waste-picker work. Only 6.2% of the staff are paid; waste-pickers work most of the time for themselves, and only occasionally employ family to help.

**Table 14. Gender and paid staff balances among the collection businesses.**

Business Main Activity	Average number of staff	% Male staff	% Female staff	% Paid staff
Collection	1.3	61.9	38.1	6.2

During the survey, only one collection business respondent (out of 76) had one paid female staff. Only a few businesses had paid male employees, who received on average KHR 9,300 per day (around USD 2.30). Waste-pickers work around 8 hours per day, 7 days per week.

### iii. Training

Most waste-pickers did not receive any training for waste collection, and especially for e-waste collection: only 5% received training, and most of them learned on-the-job (75%; 25% had “other” training, which can refer to training by other businesses, or learned abroad).

#### b) E-waste flow

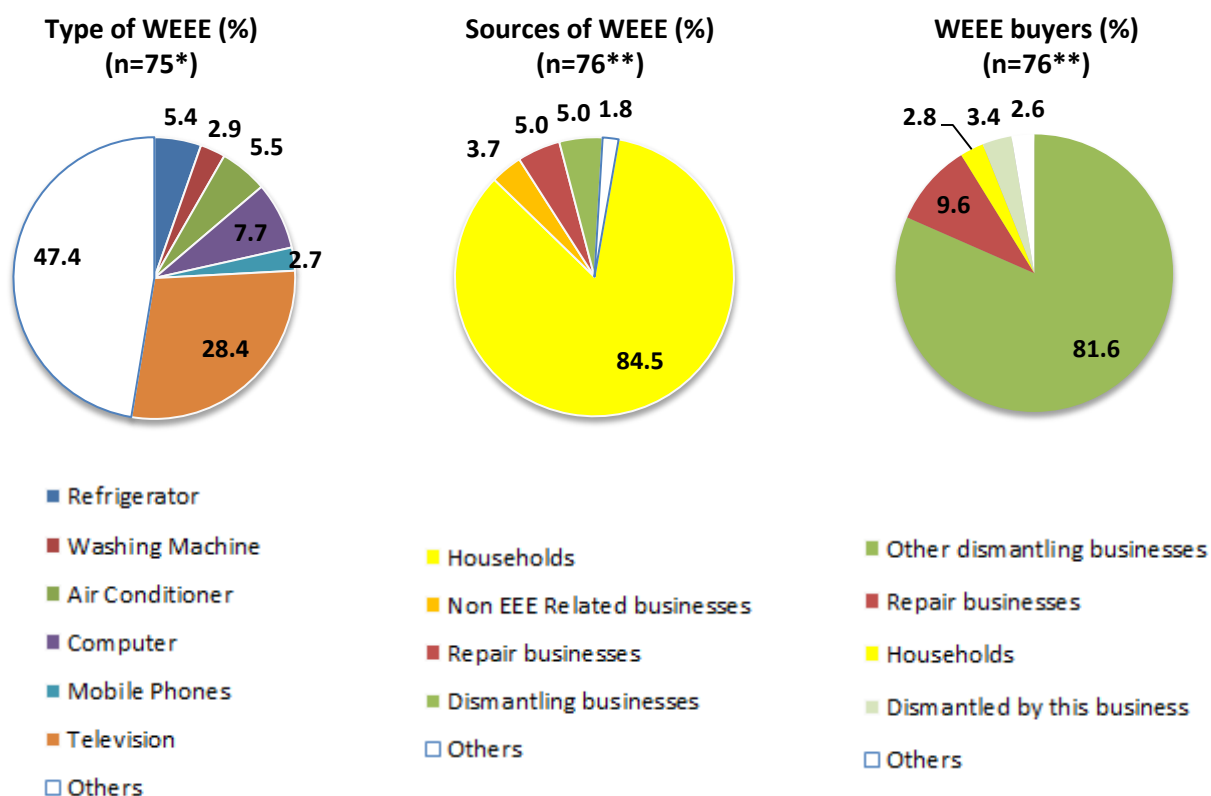
We now consider the overall collection activity, for both the primary and secondary business activities (n=77 businesses concerned).



**Figure 21. DVD player and television frame in a waste-picker hand-driven cart in Phnom Penh (personal picture).**

Figure 22 shows that among the six EEE items UNIDO and MoE focus on, televisions are the most collected, with 28.4% of all the EEE collected (Figure 21). Large appliances (refrigerators, washing machines and air conditioners) are difficult to collect manually and to transport in hand-driven carts, what explains their weak representation among the EEE collected. “Other” items correspond mostly to fans, DVD players and videotape recorders.

Waste-pickers collect e-waste mostly from households (84.5% of the e-waste collected), and in smaller proportions from EEE related businesses (repair and dismantling businesses total 10% together) or even non-EEE related businesses (corporations, 3.7%).



**Figure 22. E-waste flows through collection activity.**

*\*2/\*\*1 businesses excluded because they did not give correct proportions (total different from 100%)*

E-waste is then sold mostly to dismantling businesses such as scrap yards (81.6%). 10% of e-waste is sold to repairers, probably for them to take functioning spare parts from these discarded items. It is interesting to notice that 3.4% of e-waste is dismantled by collectors themselves.

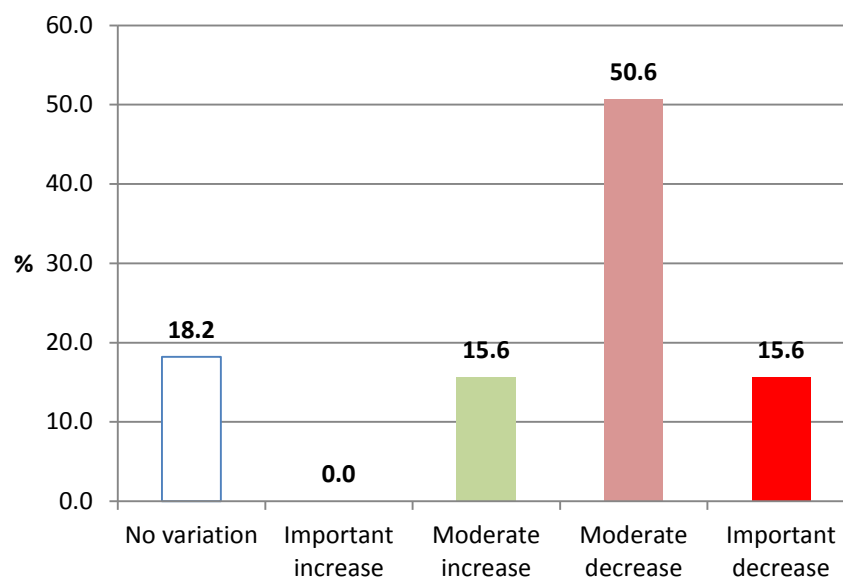
**Table 15. Amount of e-waste collected monthly (kg).**

mean	sd	min	median	max	sum	N
164.7	292.4501	0.5	50	1500	12685.55	77

The high standard deviation we can observe in Table 15 means that the values show a high dispersion (not regrouped) around the mean value. This can be explained by the fact that some waste-pickers collect more large appliances (much heavier), whereas some others focus on mobile phones or smaller devices. We can thus choose the median value of 50kg of e-waste collected monthly, which is more representative of the reality, but which does not take into account extreme values.

If we want to take into account the collection of all the kinds of items, we should consider the mean value of around 165kg collected monthly.

### c) Variations over time



**Figure 23. Variations observed since collection activity started (n=77).**

66.2% of the respondents observed a general decrease in the amount of collected e-waste (15.6% of the respondents describe it as an important decrease). Only 15.6% of the waste-pickers estimated that they collect now slightly more e-waste than when they started their activity.

When asked about their expectations for the future, 44.2% of the respondents think they will collect less e-waste, mainly because of the too high competition (88.2%), and because of a possible lower consumption (5.9%). 37.7% are confident and expect to collect more e-waste in the future. 69% of them explain it by the fact they observe more consumption of EEE in the Cambodian society whereas 24% mention an overall shorter EEE lifespan. 18.2% do not expect any variation in the future.

## DISMANTLING ACTIVITY

Dismantling activities concern WEEE and e-waste only. They produce spare parts, recyclable materials (metals, plastics...) and residue.

### a) Business profile

We consider here businesses whose main activity is dismantling (n=49).

#### i. Starting year

Dismantling businesses started in 1987 for the oldest one, and 2013 for the most recent. We consider the median value for the same reason seen previously (high standard deviation).



Figure 24. Integrated circuits from dismantled televisions in Banteay Meanchey (personal picture).

Table 16. Opening year for dismantling businesses.

	mean	sd	min	p50	max	N
Dismantling	2005	6.9	1987	2006	2013	49

Similar to collection businesses, dismantling businesses started earlier than repair and retail sale businesses (2006). These establishments should also have been reported in the 2009 listing. We can suppose once again that when the listing was designed, dismantling was not their main activity. The large amounts of e-waste available nowadays may have given a higher added value to dismantling, which is now their principal activity.

#### ii. Staff composition

96% of the dismantling businesses employ males, and 73% employ females.

Table 17. Gender and paid staff balances among the dismantling businesses.

Business Main Activity	Average number of staff	% Male staff	% Female staff	% Paid staff
Dismantling	4.7	65.7	34.3	46.5

Dismantling businesses, in the EEE sector, have 4.7 staff on average. They are the EEE businesses with the highest number of staff reported. Around 65.7% of them are male, and 34.3% female on average. Dismantling businesses have also the highest proportion of salaried staff (46.5%).

When paid, male staff earn on average KHR 10,400 per day (around USD 2.6; n = 20) and female staff earn KHR 15,400 (around USD 3.9; n = 4). Dismantling is the only activity for

which women are better paid than men, although the small sample has many limitations. All staff work around 10 hours per day, 7 days per week.

### iii. Training

Even if dismantling businesses employ more staff, only 14% of the businesses employ staff who received training. 100% of this training was on-the-job.

#### b) WEEE flow

We consider here the overall dismantling activity, for both the primary and secondary business activities (n=55 businesses concerned).

36.9% of the e-waste being dismantled is televisions (Figure 25). Large appliances together account for 13.9% of dismantled items. Computers represent 8.3%, whereas dismantling is less concerned with mobile phones. The “Others” category, which accounts for 35.3% of the dismantled e-waste, is composed of fans, videotape reader, kitchen appliances, etc. (Figure 26).

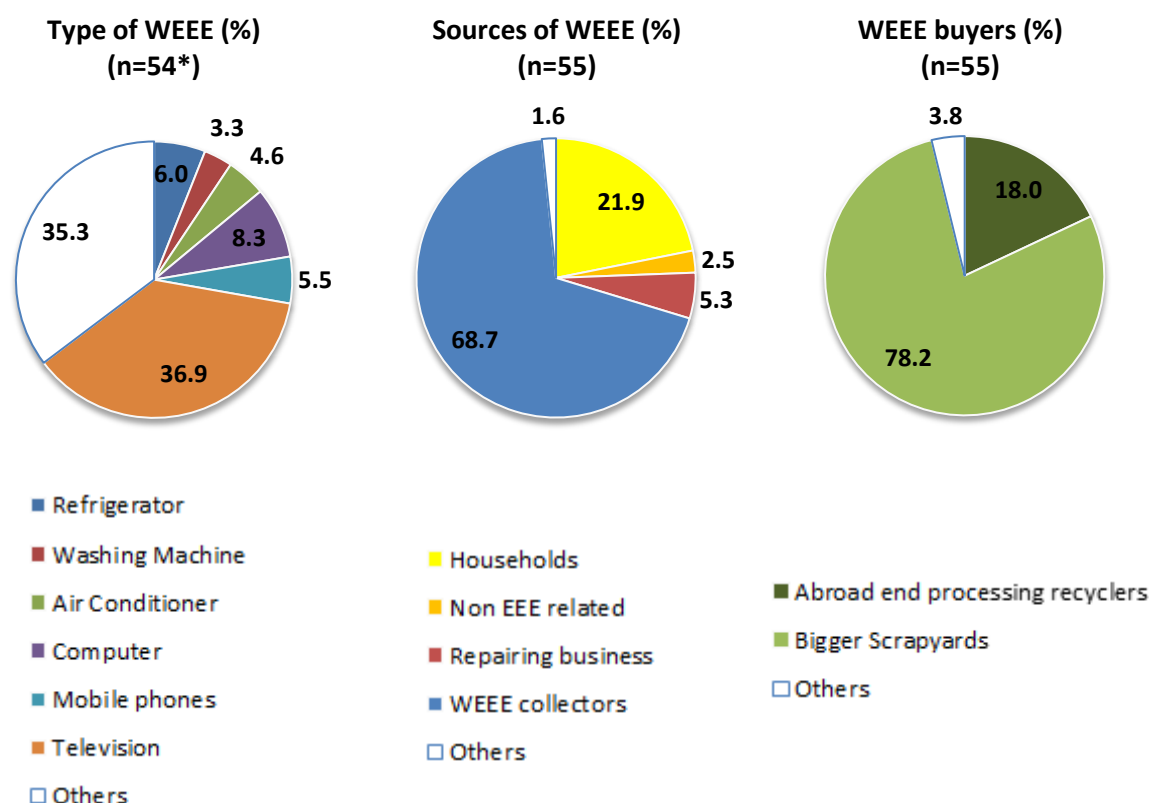
68.7% of the e-waste brought for dismantling comes from waste-pickers (from the collection activity). Households also bring their e-waste directly to dismantling businesses (21.9%). Only 5.3% of the repairing businesses bring their e-waste directly to dismantlers; as seen before, they are more likely to sell e-waste to waste-pickers, who would then sell it on.

Once dismantled, the recyclable parts are sold to bigger scrap yards (78.2%), which play the role of middlemen between small dismantling businesses and recycling companies abroad. Small dismantling businesses also directly sell metals, plastics, etc. abroad in 18% of the cases.



Figure 25. Plastic frames from dismantled televisions in Banteay Meanchey (personal picture).





**Figure 26. E-waste flows through dismantling activity.**

*\*1 business excluded because it did not give correct proportions (total different from 100%)*

On average, 322.6kg of e-waste are dismantled by small businesses monthly. But this mean value takes all kinds of items into account, and is strongly influenced by the weight of large appliances (leading to a high standard deviation), even if their dismantling is minor compared to televisions, for example. The median value of 100kg is more representative of dismantling businesses overall, but does not take extreme values into account.

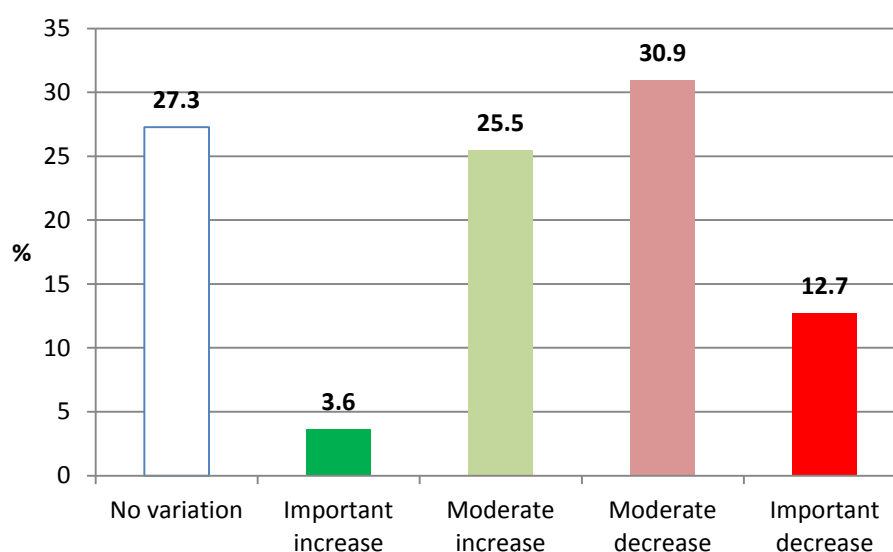
**Table 18. Amount of e-waste dismantled monthly (kg).**

mean	sd	min	p50	max	sum	N
322.6	721.03	0.3	100	5000	17097.3	53*

*\*2 businesses did not answer this question*

**c) Variations over time**

While 27.3% of the respondents do not observe any variation since they started their activity, 43.6% think they dismantle less e-waste than before (12.7% report an important decrease), whereas 29.1% think they dismantle more. These variations are tightly linked to those observed by the WEEE collectors; as stated previously, the large majority of the waste-pickers (more than 66%) observe a general decrease in the amount of collected e-waste. And as e-waste from waste-pickers accounts for almost 70% of the total WEEE amount, we can understand why dismantlers have the feeling that they process less e-waste than before.



**Figure 27. Variations observed since dismantling activity started (n=55).**

43.6% of the respondents think that they will dismantle more WEEE in the years to come, because of the higher consumption (83.3% of the reasons given) and because they notice that EEE product lifespans are shorter (8.3%).

30.9% of the respondents think that they will process less e-waste because there is too much competition in this sector (70.6% of the reasons given). Some respondents mention that new EEE products on the market have longer lifespans (11.8%), and thus these products take more time to arrive in their dismantling business.

#### **d) Dismantling activity residues**

47.3% of the dismantlers recognize that their activity generates some residue which cannot be recycled. 88.5% of them give these residues to the municipal waste collection system, which just take them to dumpsites. The remaining 11.5% of the dismantling businesses burn this waste.

**Table 19. Amount of residues generated monthly (kg).**

mean	sd	min	p50	max	sum	N
31.7	48.67	0.1	10	200	824.3	26

Table 19 shows that the amount of residues varies considerably (from 0.1 to 200kg) in a month. While the mean value is 31.7kg (with a standard deviation of 48.7), the median value is 10kg.



**Figure 28. Mix of televisions non-functioning parts (integrated circuits, plastics, wires...) stocked as residues in a dismantling business in Banteay Meanchey (personal picture).**

## SPARE PARTS TRADE ACTIVITY

Angkor Research decided to dedicate a section to the spare parts trade after it realized the importance of this component in the e-product related sector. Spare parts can be bought new or can be taken from WEEE during dismantling.

### a) *Business profile*

We consider here businesses whose main activity is the trade of spare parts (n=16).

#### i. **Starting year**

The oldest businesses which trade spare parts opened in 1999, and the most recent in 2013. We consider the median value for the same reason seen previously (high standard deviation).

**Table 20. Opening year for spare parts trade businesses.**

	mean	sd	min	p50	max	N
<b>Spare parts trade</b>	2010	3.3	1999	2011	2013	16

We can see that spare parts trade is a rather recent activity as most of the 16 businesses concerned opened in 2011. The success of repair services can explain the new important need for spare parts.

#### ii. **Staff composition**

81% of the businesses trading spare parts employ male staff and only half employ women.

**Table 14. Gender and paid staff balances among the different activities.**

Business Main Activity	Average number of staff	% Male staff	% Female staff	% Paid staff
Spare parts trade	1.6	64.0	36.0	0.0

Spare parts trade businesses, in the EEE sector, have 1.6 staff on average, 64% of them men and 36% women. None of the 16 businesses where spare parts trade is the main activity have paid staff: these businesses employ family members only.

All staff work around 10 hours per day, 7 days per week.

### iii. Training

Only 38% of the businesses have staff who received training. 77% of the trained staff learned on-the-job. The remaining 23% learned from private companies.

#### b) Spare parts flow

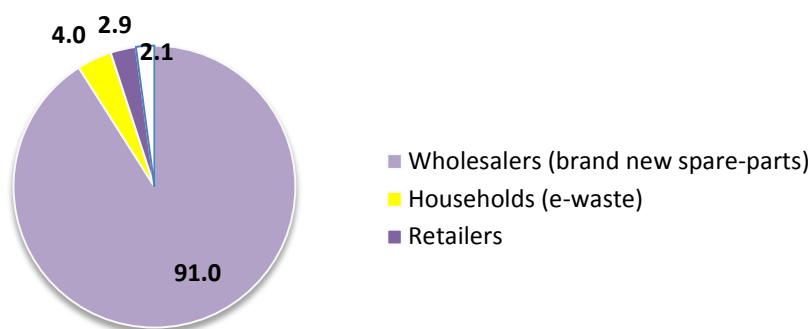
We consider here the overall spare parts trade activity, for both the primary and secondary business activities (n=849 businesses concerned).

35% of the concerned businesses buy spare parts exclusively to re-sell them, and 15.8% exclusively for their repair activity. The remaining 49.2% purchase spare parts for both re-sale and repair activity (Figure 29). As not all of the businesses sell their spare parts, we decided to deal separately with the components being bought and the components being sold in order to provide a better idea about the flows in question.



**Figure 29. Spare parts seller in Siem Reap (personal picture).**

### i. Spare parts purchased



**Figure 30. Sources of spare parts (%) (n=844\*).**

\*5 businesses excluded because they did not give correct proportions (total different from 100%)

Spare parts are mostly bought new from wholesalers (91%), but can also be supplied by households discarded EEE, and by retailers (4% and 2.9%, respectively).

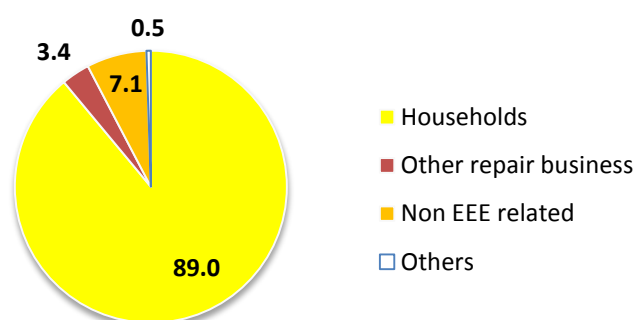
**Table 21. Amount of spare parts purchased monthly (kg).**

mean	sd	min	p50	max	sum	N
10.7	42.49	0.01	2	800	8985.43	837*

\*12 businesses did not answer this question

We observe important variations among the estimated amounts of purchased spare parts reported, from a minimum of 0.01 to 800kg. Indeed, some businesses just buy the spare parts they know they need for the repair activity, whereas others are specialized in spare parts trade and buy a stock of them every month. The mean value is 10.7kg and the median is 2kg of spare parts bought per month.

### ii. Spare parts sold



**Figure 31. Spare parts buyers (%) (n=715\*).**

\*715 out of the 849 businesses sell the spare parts they buy.

Spare parts are mainly sold to households (89%) and corporations (7.1%). Only 3.4% of the spare parts are sold to repair businesses, which agrees with Figure 30, which shows that wholesalers are the main suppliers of spare parts to small businesses.

**Table 22. Amounts of spare parts sold monthly (kg).**

mean	sd	min	p50	max	sum	N
8.35	33.23	0.01	2	450	5847.24	700*

*\*15 businesses did not answer this question*

The amounts of spare parts sold monthly varied from 0.01 to 450kg, for the same reason mentioned before; some businesses are specialized in spare parts trade and thus sell much more components than the repair businesses, which just buy the small quantities they need. The mean value is 8.35kg and should be chosen if we want to take all of the answers into account; the mean value for sold spare parts being less than the mean value for purchased spare parts, we can suppose that the difference actually corresponds to components used for repair activity within the business. The median value is 2kg, and should be preferred if we want a value representative of more businesses.

### **c) Variations over time**

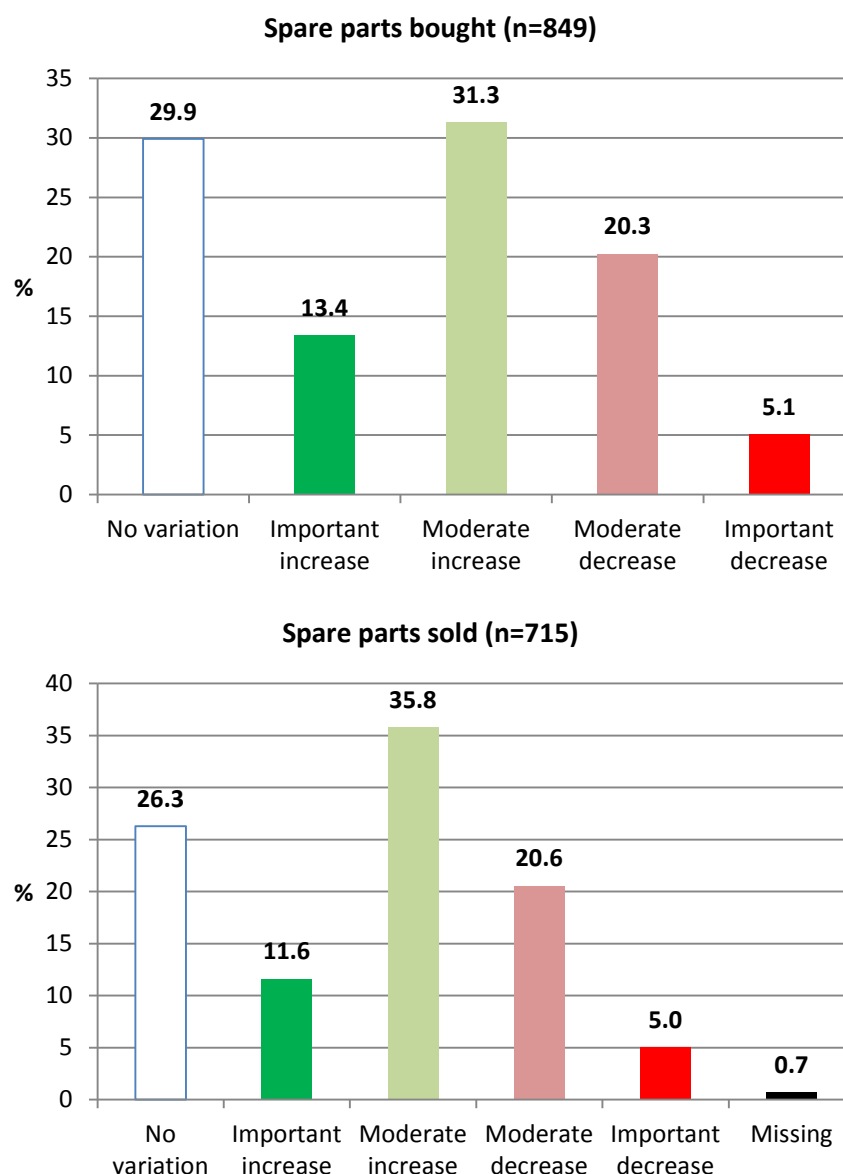
Although 30% of the businesses do not notice any variation in the quantity of spare parts they bought since they began their activity, 44.7% of the respondents buy more spare parts than before, whereas 25.4% think they buy less parts.

Concerning the sales of spare parts, 47.4% of the respondents estimate that they sell more spare parts than before, whereas 25.6% think they sell less.

This confirms that spare parts are an essential point to consider in the e-waste sector. As stated before, the popularity of repair services may be the cause of this increasing need for spare parts.

When we asked spare parts trade businesses their expectations about the future, 55.8% of them think they will buy more spare parts in the future, mainly because Cambodian society consumes more (78.7%). 17.7% think they will buy less, for 49.3% of them because of the heavy competition. Some respondents also think that people now prefer to buy new products instead of repairing their UEEE.

Concerning the spare parts sales, similarly to purchases, 57.7% of the respondents think that they will sell more because of the consumption society. 19.4% think they will sell less mostly because of the competition (60.1%) with other businesses.

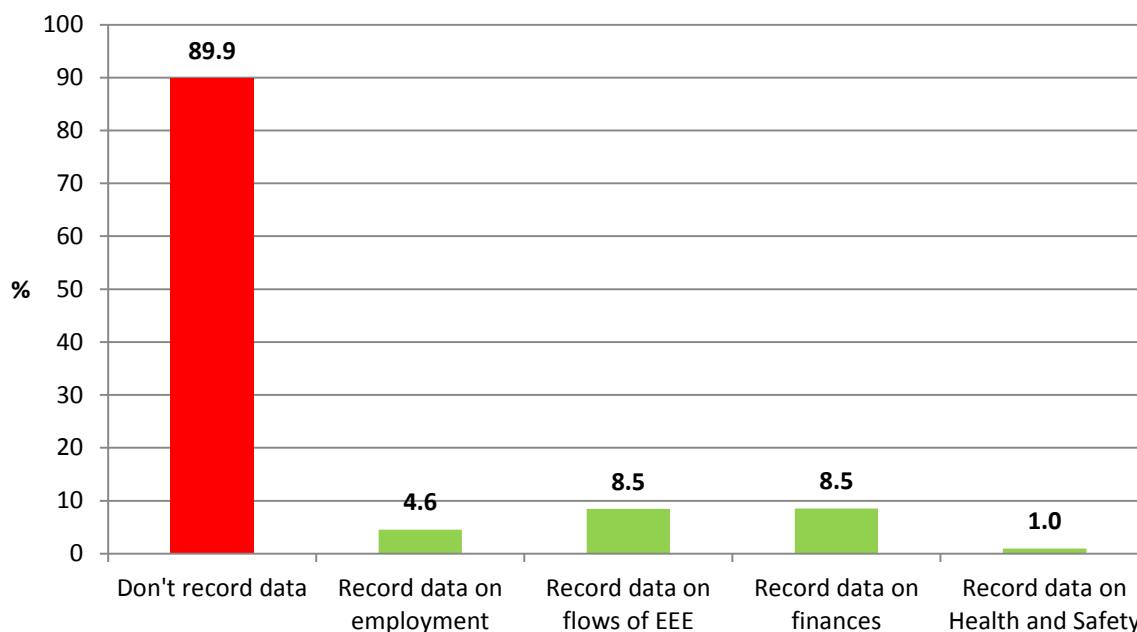


**Figure 32. Variations observed since spare parts trade activity started.**

## MANAGEMENT SKILLS, LEVEL OF AWARENESS AND ISSUES ENCOUNTERED

### **a) Data recording habits**

89.9% of the businesses do not record any data (Figure 33). However, 8.5% record data about flows of EEE through their business (purchases, stock, sales, etc.), and the same percentage record data about finances. But management skills are low in the EEE sector, and only 4.6% of the businesses record data about employment. Even fewer businesses (1%) collect data about health and safety (H & S) or environmental issues.



**Figure 33. Data recording habits in the EEE sector (n=1,359\*).**

*\*1 business did not answer this question*

The concerned businesses generally began to collect data on the same year they started their activity. Almost all of these businesses (97.1%) refuse to share their data with anybody. The few businesses (n=4) which agree to share their data communicate it to other businesses (three of them) and to the government (only one business).

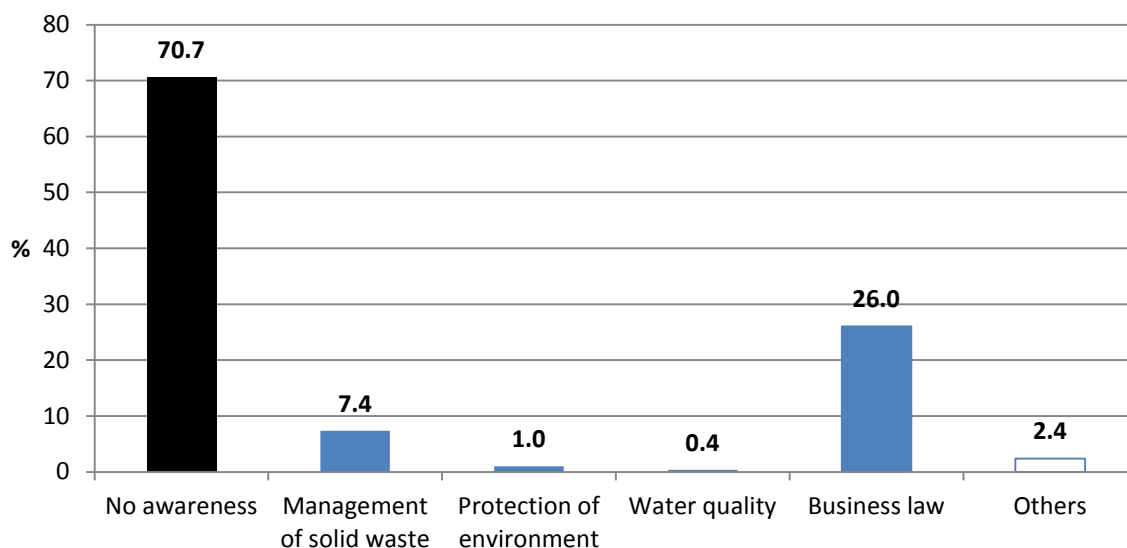
#### **b) Levels of awareness**

Angkor Research tried to assess the EEE related businesses level of awareness on two components: law and Health & Safety:

##### **i. Knowledge of the law**

70.2% of the respondents do not know any law related to their activity (figure 34). Interviewees who have heard of some law mention the “Law on Commercial Enterprises” most of the time (26%). 7.4% know about the “Sub-decree on solid waste management” and very few know about the more environmental laws (1.4% for the “Law on Environmental Protection and Natural Resources Management” and the “Sub-decree on Water Pollution Control” together).

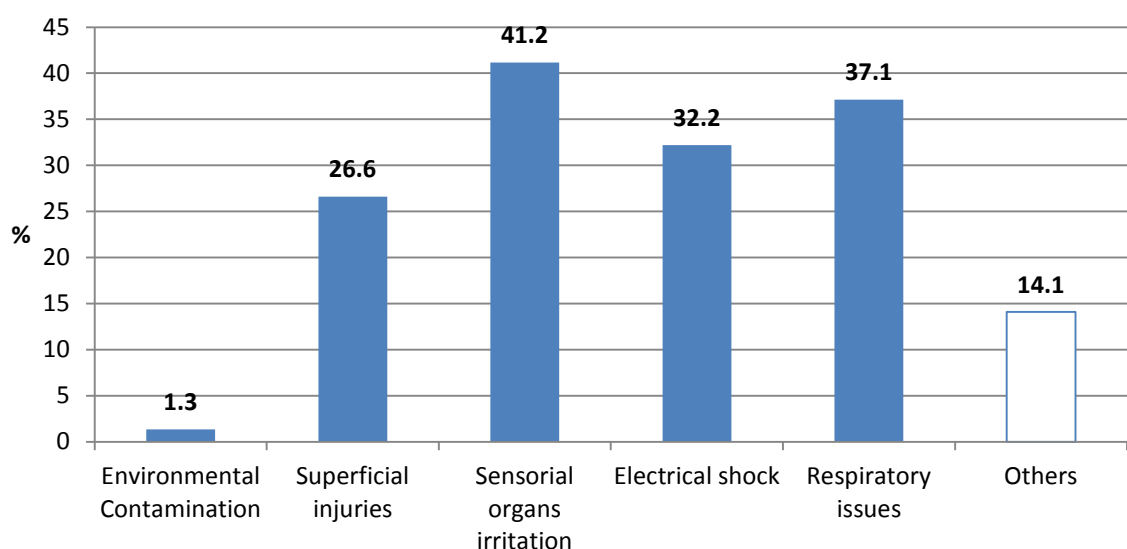




**Figure 34. Level of legal awareness in the EEE sector (n=1,360).**

#### ii. Knowledge about health and environment issues

65.5% of the respondents have no knowledge about issues related to e-products and e-waste management and the potential risks for their health and the environment (Figure 35 and Figure 36). But 32.9% of the respondents have already been confronted to health issues which they think could be related to their activity: Figure 14 shows that these respondents consider their activity to be responsible for their superficial injuries (skin cuts, light burns, etc., for 26.6% these respondents), eyes/ears/nose irritation (41.2%), electrical shock (32.2%) and respiratory issues (37.1%). Environmental issues are almost unnoticed (only 1.3% for pollutant leakage). Other issues observed by the respondents include different kinds of health issues (fever, headache, arthritis, etc.).



**Figure 35. Environmental and health issues observed (n=447).**

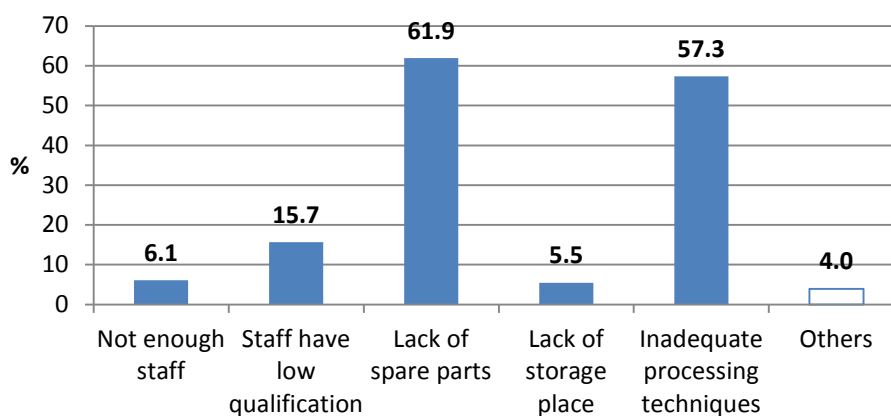


**Figure 36. Working and living area; children play and sleep next to e-product repair activity in Siem Reap (personal picture).**

### **c) Technical issues**

Angkor Research wanted here to know more about the technical issues encountered by businesses in the e-product related sector. If some of the answers given seem specific to a kind of activity, they nevertheless bring some important clues about how to improve the overall sector.

48.2% of the 1,360 businesses interviewed already met some technical problems. The two major issues mentioned are for 61.9% of the lack of spare parts (mostly concerning repair businesses) and the techniques used for the different processes (repair, dismantle...) that respondents recognize to be outdated and/or inadequate (57.3%). The low qualification of the staff seems to be a problem in only 15.7% of the cases, whereas only 6.1% of the business owners think they do not have enough staff. 5.5% lack storage place. ("Others" refers to the lack of equipment, to the poor quality of imported products (for retail sale businesses mostly), to the low-reliability of the electricity supply...)



**Figure 37. Technical issues met in the EEE sector (n=656).**

## **PART D: CONCLUSIONS**

The conclusions given here consider the overall e-product sector in Cambodia.

### **E-PRODUCT RELATED ACTIVITIES IN THE TARGET AREA**

During this survey, Angkor Research interviewed businesses whose main activities were e-waste dismantling and e-waste collection (primarily small scrap yards and waste-pickers, respectively). These establishments are not reported in the 2009 business listing, probably because e-waste dismantling and e-waste collection didn't become their primary activities until after 2009.

The ratio between the different kinds of EEE activities is not the same in the five provinces chosen for this project. Repair and dismantling businesses seem to be more present in Phnom Penh Municipality and Battambang province, while retailers are more present in Siem Reap and Kampong Cham. Banteay Meanchey has an intermediate profile, between the other two groups of provinces surveyed.

Considering the ratios for the different kinds of activities, including primary and secondary business activities, collection and dismantling activities are still largely under-represented in Cambodia. Specialized spare parts businesses have appeared recently, in response to growing demand.

### **BUSINESSES PROFILE**

Many businesses in the EEE sector have appeared recently, mostly since 2000. Indeed, with close to 10% annual economic growth in the past few years, Cambodia has undergone many important developments, and its people now have easier access to e-products.

The policy of the Cambodian government to import second-hand e-products, which are more affordable for the population, is determining the e-product management system. As the quality of imported UEEE is rather low and not stringently controlled, consumers need to use repair services frequently. This explains the high number of UEEE repair businesses in the targeted survey areas. One of the consequences of this is the high demand for spare parts, which has also led to shortages. A lack of spare parts is one of the main technical issues reported by EEE-related businesses.

Concerning employment in the EEE sector, we saw that in small businesses (which were the principal survey targets), the number of staff are rather low. Among all the businesses surveyed, there were an average of 2.2 staff per business. Of these staff, there are 1.4 males and 0.8 females, which shows that the ratio between men and women is slightly unbalanced. However, the sex ratio is not consistent across all types of EEE businesses; retail sale businesses have almost a balanced staff sex ratio, while repair businesses employ considerably more men than women.

On average, 82% of staff in all surveyed businesses are unpaid (on average, 1.8 out of 2.2 staff are unpaid) which is normal for small businesses, as the staff are commonly members of the family. While these staff are not salaried, they probably receive financial or in-kind compensation from the profits of the business. Women are generally less paid than their male counterparts (mean daily salary of KHR 12,701 for men, and KHR 9,597 for women across all sectors), although they all work on average 10.6 hours per day, 7 days per week. Dismantling businesses are the only ones where the average salary of women is reported to be higher than men's salary, but our sample of women in those businesses was too small to be significant.

Among all the businesses interviewed, only 58% affirm that their staff have received some training in their respective fields. 47.7% of this training consists of on-the-job training; another 44.4% are more formal trainings provided by private institutes or companies.

### **THE E-PRODUCT VALUE CHAIN: NEW EEE, UEEE, E-WASTE AND BY-PRODUCTS**

The flows of e-products for each kind of activity are detailed in Part C, above. They allow us to understand some important results. First, although many stakeholders in the sector say that second-hand e-product sales are increasing, new EEE sales make up two-thirds of the sales reported by retail EEE businesses. Among the six categories of EEE followed by UNIDO and the Cambodian government, mobile phones are the most sold and repaired e-products. Televisions are the items which are the most collected and dismantled in terms of proportions.

In the findings from this survey, computers do not represent a major portion of the e-products sold, repaired, collected or dismantled. Yet, some reports state that the efficiency of an e-waste management system depends primarily on the amount of computers available, as they contain higher proportions of recyclable materials (including precious metals) than other e-products. This lack of computers in the EEE system in Cambodia could be detrimental to its efficiency.

The survey also shows that households are extremely important in the Cambodian e-product value chain; they are the main UEEE suppliers for retail sale businesses; the main consumers of both new EEE and UEEE; the main customers of repair services; and, the main source of e-waste for waste-pickers. However, as stated above, the improving economic situation in Cambodia has seen the establishment of numerous corporations and institutions (including government institutions) with increasing needs for ICT. Thus, institutional EEE value chains are an unexplored sector of the e-waste market, which is set to grow considerably in the coming years.

The flow of e-products between the different kinds of activities are described and summarized in Figure 38 and Figure 39, below. The different e-product quantities have been calculated based on the survey results and percentages given in Part C. Figure 38 shows the mean values for each e-product flow, and can be used if the reader wants to consider all

the kinds of items (from large appliances to mobile phones). Figure 39 shows the median values of e-product flows, and is more representative of the situation of most small businesses in Cambodia, as it does not take the heavy weight of large appliances (which are rather rare compared to other items) into account.

All the calculations presented in Figure 38 and Figure 39 are from respondent estimations, and may not reflect reality. These e-product flows concern the different kinds of activities if undertaken by an “average” business in that sector. For example, we can read this chart as follows (Figure 38):

- In one month, an average retail sale business sells 64.8kg of new EEE to households and 4.7kg to corporations (non-EEE related businesses). They also sell 39kg of UEEE products to households and 2.8kg to corporations.
- An average waste-picker, in one month, collects 8.2kg of e-products from repair businesses, 6kg from corporations, 139.2kg from households and 8.2kg from dismantling businesses. They then sell 134.4kg to dismantlers and 16.5kg to repair businesses, and dismantle 5.6kg by themselves.

The trends observed by the respondents and reported in this study show that the different stakeholders are divided about the current and future states of their activities. The most optimistic interviewees believe that a continued increase in EEE consumption by Cambodian society will sustain their activities. But, many respondents cite increasingly intense competition between businesses to explain decreases in their business activities. Retailers, repairers and spare parts dealers are confident that their businesses will increase in the future, because they think that more poor people will soon have enough money to afford UEEE (which needs more repair services, and thus more spare parts). Dismantlers and collectors, on the other hand, think the improved quality of e-products overall will decrease the amount of e-waste available for collecting and dismantling.

## MANAGEMENT PRACTICES AND LEVEL OF AWARENESS

89.9% of the businesses surveyed do not record data. The remaining 10% mostly record data about finances. 70.7% of the businesses have never heard of any law regarding their business activities; the most known law among the other respondents is the Law on Commercial Enterprises. Very little attention is given to health and safety, and environmental effects of their business activities. This is seen by the practices of e-waste and by-product disposal; for the dismantling and repair businesses, e-waste and by-products are generally sent to the municipal dumpsite without treatment, or worse, burned on site. However, many interviewees recognize that they are encountering technical problems (low spare parts supply, inadequate processing techniques, etc.) related to their management practices, and health issues (including respiratory and sensory ailments) due to their current business practices.

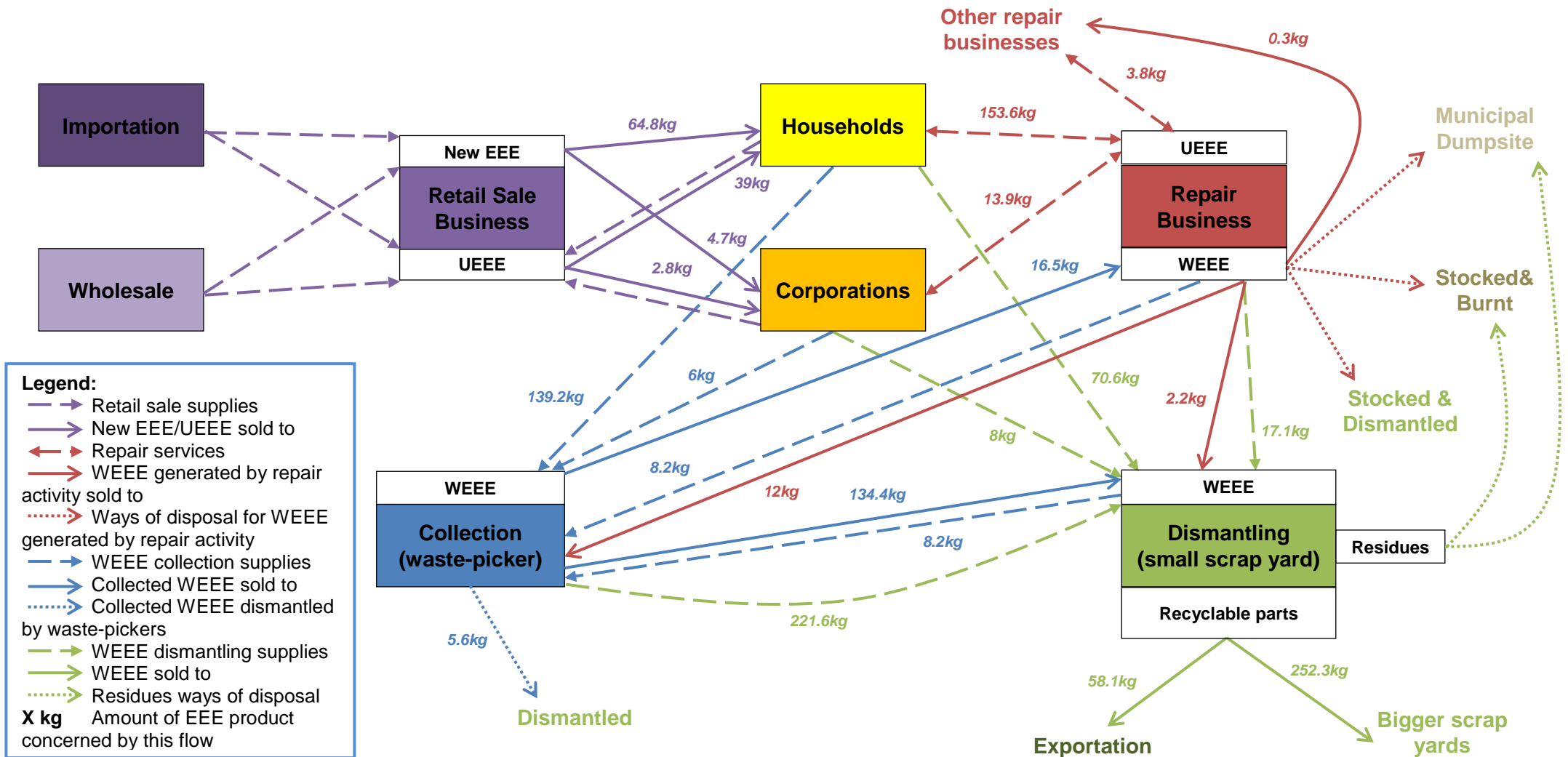


Figure 38: Monthly e-product flows within the EEE sector, using e-product mean values (kg).

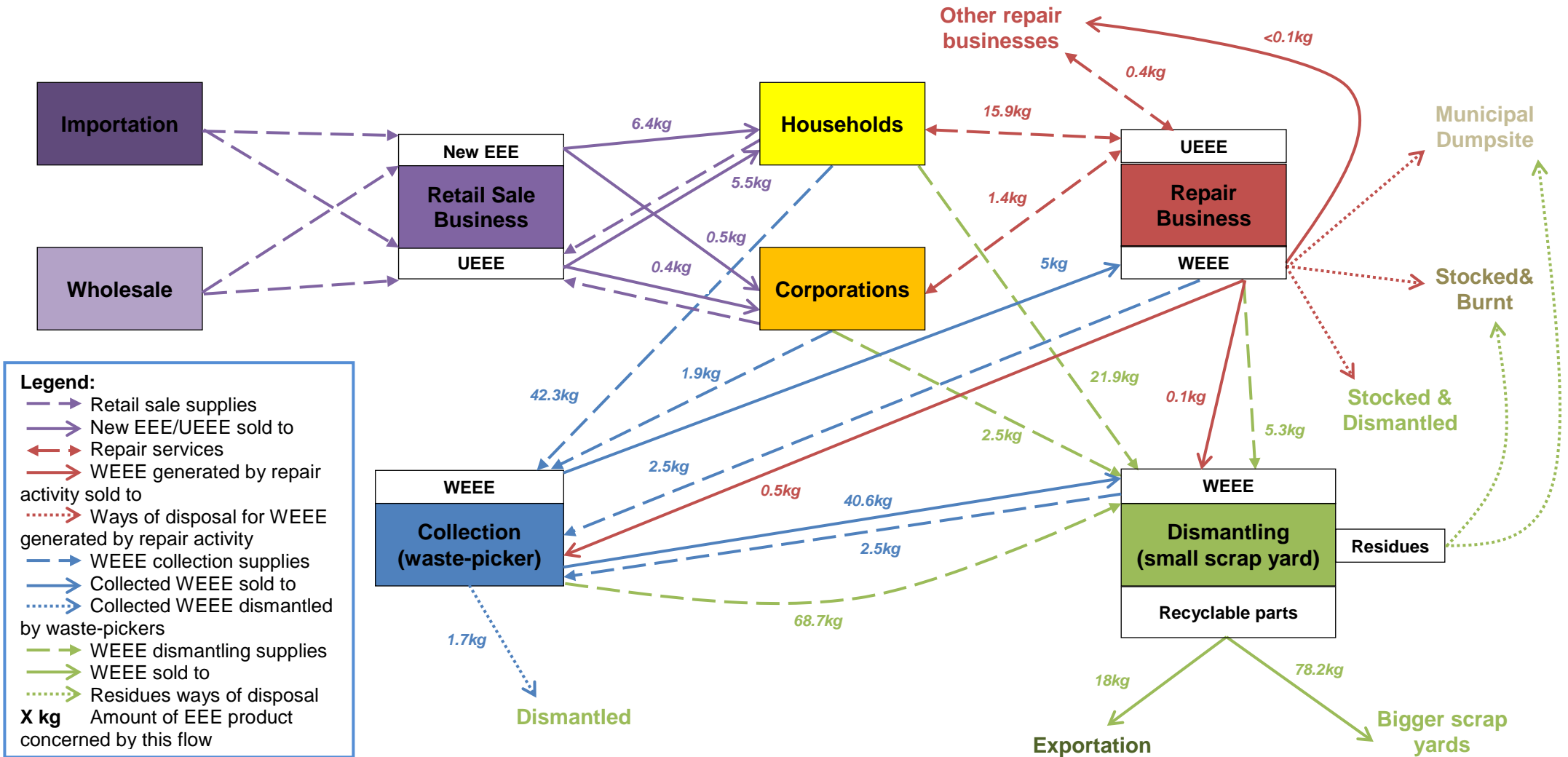


Figure 39: Monthly e-product flows within the EEE sector, using e-product median values (kg).

## PART E: STRATEGIC RECOMMENDATIONS FOR SMALL BUSINESSES AND POTENTIAL ENTREPRENEURS

This section provides strategic recommendations to improve the EEE-related sector in Cambodia, based on the results and observations from the survey. First, we will present the most relevant recommendations mentioned by respondents in the survey, and then propose our own recommendations.

### RECOMMENDATIONS FROM SMALL BUSINESSES IN THE E-PRODUCT SECTOR

First, all of the surveyed businesses were asked for recommendations to help establish new businesses in the EEE-related sector.

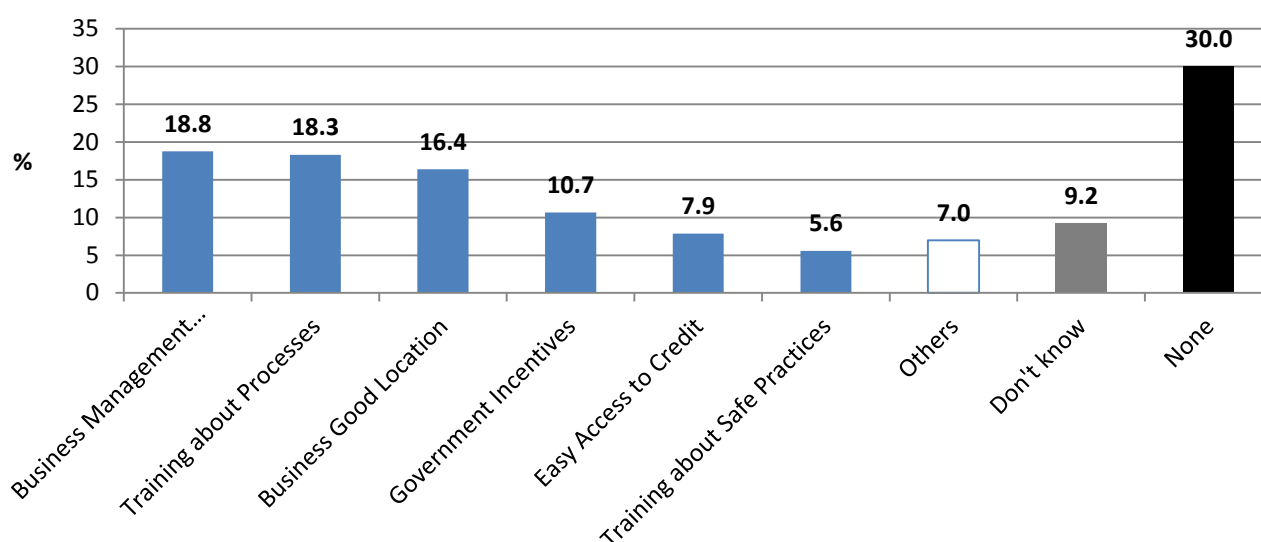


Figure 40. Respondent recommendations for support to new EEE businesses (n=1,360).

Figure 40 presents the six main recommendations proposed by the respondents. Some of the other answers given by respondents were reclassified into these six principal categories during data analysis. We will now detail them according to their importance (most mentioned to least mentioned):

- 1. Business management training.** Mentioned by 18.8% of the small businesses interviewed, this training would deal with modern management practices and data recording (accounting practices; record keeping for EEE flows and health incidents, etc.), staff management (contracts and salaries), and working conditions (working hours per day, days per week, holidays, etc.).
- 2. Training on technical processes.** 18.3% of the respondents recognize that more formal training about EEE-related techniques (including retail sales, spare parts, repair, collection and dismantling) is necessary. This training would help workers to specialize in their specific fields, and increase the efficiency of different activities, and



thus improve the overall sector. Marketing lessons, geared towards each type of business, could also be part of this training (advertising, promotions, after-sales service...).

3. **Support for selecting an appropriate location.** Surprisingly, 16.4% of the respondents mentioned location as one of the main factors of success for any business. They deplored the fact that no help is available for new businesses to find the most suitable and profitable locations. Such assistance would help new businesses calculate the ease of access for e-product suppliers and customers (transport distances should be minimal), distances from competing businesses, etc., and improve efficiencies within the sector.
4. **Government incentives.** 10.7% of the respondents would like to see more intervention from the government in their sector, including: price regulation (minimum guaranteed prices for each kind of e-product at each stage of the value chain), facilitation of e-product importing/exporting for small businesses, etc.
5. **Easy access to credit.** 7.9% of the respondents think that the private financial sector (banks, MFIs...) should support entrepreneurs who want to establish a new EEE-related business. Indeed, many respondents affirmed that the lack of initial capital was a significant barrier for them to open their own businesses.
6. **Training about safe practices.** Only 5.6% of the respondents think that proper training about best practices for their business activities are needed. This training would teach workers: to wear protection (glasses, gloves, mask, etc.); to prevent risks of electrical shock and fire (safe electrical systems, fire extinguishers, etc.); and, to avoid impacts on the environment (prevent hazardous substance leaks, sort and store dangerous components away from other materials, etc.).

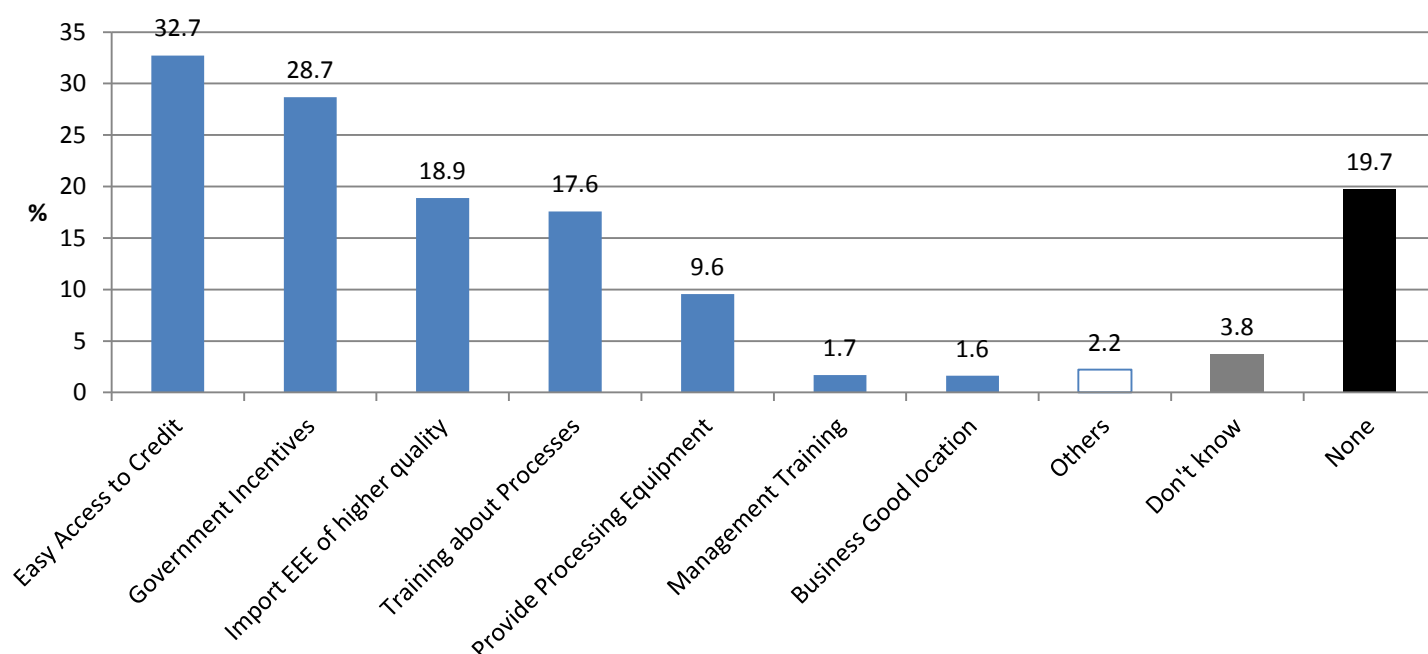
More than one-third of the respondents did not give any recommendations (“none”), or did not know what to answer to this question (39.2%). Indeed, most of them were reluctant to give advice about how to establish new businesses, fearing it could lead to increased competition. The other answers which could not be reclassified, given by 7% of the respondents, suggest the diversification of services proposed by a business, the diversification of e-products a business can sell/repair/dismantle, and increased access to spare parts.

Next, Angkor Research asked the respondents what kind of help they would need to improve or scale up their own businesses. Figure 41 presents the seven primary recommendations provided by respondents, as classified and categorized by Angkor Research:

1. **Easy access to credit.** One-third of the respondents (32.7%) agree that they need easier access to low-interest credit in order to scale up and invest in their businesses.
2. **Government incentives.** Many businesses (28.7%) feel that the Cambodian government should do more to promote and improve the EEE-related sector. Primarily, they would like to see price regulation on e-products at each stage of the value chain, to avoid excesses. For example, scrap yards currently dictate the price of the e-waste they buy from waste-pickers, who cannot really afford to negotiate. Price is often dependent on the competition between local businesses and, for dismantling, on the price of raw materials (plastics, metals, etc.).

Many respondents also suggested that: the government should encourage the consumption of e-products in Cambodia; support should be provided to increase the production and sale of locally made Cambodian EEE items; tourism, which is thought to represent an important segment of consumers, should be promoted; and, there should be increased customs enforcement to prevent people from purchasing e-products in neighboring countries. In summary, the government is expected to find a way to protect the Cambodian EEE-related market.

In addition, lower taxes and enforcement of business registration requirements are also part of the incentives that respondents want to see from the government.



**Figure 41. Respondent recommendations for the improvement of their own businesses (n=1,360).**

3. **Importing higher quality EEE.** Primarily provided by retail sale businesses, this recommendation highlights the fact that EEE-related businesses are aware that Cambodia imports most of its e-products, but without sufficient quality control. Sellers are often considered to be responsible for the low quality of the products they sell, which can make it difficult for them to establish a good reputation, especially for retail businesses specializing in UEEE. On the contrary, repair and dismantling businesses profit from these low quality imports, as consumers require their services more often with these products.
4. **Training on technical processes.** Coming only in fourth position (17.6% of businesses), this training would help existing and willing businesses to improve their specialization in a field. The staff of these businesses cannot generally afford to follow a public or private school program (as seen in Part C), and would also benefit from subsidized training in their area of expertise. This would be a key point to improve the efficiency of the existing EEE sector in Cambodia.

- 5. Provide access to technical equipment.** As seen previously in the Part A, there is a lack of modern and appropriate equipment in the EEE sector. Especially in the repair and dismantling sectors, most technicians work barehanded with very basic equipment. Thus, any training about modern technical processes would be useless if the concerned businesses do not have the required equipment to undertake the different procedures. Therefore, 9.6% of the surveyed businesses suggested that improved access to more modern technology and equipment, would improve their working conditions and their efficiency. This recommendation also concerns the supply of spare parts, which is currently lower than the demand in the sector.
- 6. Business management training.** This training, suggested by only 1.7% of the small businesses interviewed, would deal with modern management practices and data recording (accounting practices; record keeping for EEE flows and health incidents, etc.), staff management (contracts and salaries), and working conditions (working hours per day, days per week, holidays, etc.).
- 7. Support for selecting an appropriate location.** 1.6% of the respondents mentioned that they would like some support to find a new and better location for their business. Indeed, as competition seems to be the main reported cause for low business activity (Part C), many business owners are considering moving to another location where they could reduce their competition.

23.5% did not give any recommendation to this question, which is lower than for the previous question about recommendations for opening a new business. Indeed, respondents feel more concerned about their own business than about a potential competitor. The 2.2% of respondents who gave other answers mentioned “training about safe practices” (for health and environment), and “help to recruit skilled staff” as further recommendations. In addition, some businesses proposed an interesting system where “existing businesses with best practices could train future workers and entrepreneurs.”

## RECOMMENDATIONS FROM ANGKOR RESEARCH AND CONSULTING

Based on the results of this survey, field observations, the desk review, and the recommendations by respondents, Angkor Research has formulated recommendations for UNIDO and the project stakeholders to transform e-waste into job and business opportunities.

As seen in the reports mentioned in Part A, so far most recommendations in this sector have focused on the environmental component of e-waste recycling activities, which is almost completely absent in Cambodia. However, the recommendations from Angkor Research will consider two components: economic and environmental recommendations. As these findings demonstrate, EEE retail and repair businesses are far more numerous than collection and dismantling businesses. These businesses are the main sources of employment and the most active and lucrative segments of the e-product sector in Cambodia, and thus cannot be ignored when examining the sector.

Moreover, when asked about their knowledge of legislation, data recording practices and issues encountered by their business activities, the answers always concern the financial aspects. When available, surveyed businesses only have knowledge of commercial law, and record financial data about the business, issues related to business efficiency, and the availability of spare parts. Environmental issues are hardly ever mentioned. Although this component has to be developed, the real market situation indicates that entrepreneurs would be more likely to learn how to improve their financial situation through improved business practices (including environmental safety procedures), rather than to “only” protect the environment.

That is why we have proposed economic recommendations, in addition to further environmental recommendations. We also think that a census of EEE-related businesses is necessary, to understand the whole sector and include all the stakeholders in the implementation of the following recommendations.

**a) *Short-term environmental and health recommendations***

The environmental recommendations provided here also include worker health and safety issues.

Obviously, the e-product sector needs to become aware about the potential impacts of their activities on their environment and health.

A campaign to raise businesses’ awareness in these areas can be proposed, detailing the relevant good practices to protect the environment and ensure the workers’ safety. National standards can also be proposed in each sector where a risk is identified:

- Required protection: gloves, masks, glasses, appropriate footwear;
- Standards for a sufficient number of fire extinguishers, and training for people to use them appropriately;
- Standards for installation of safe electrical systems, to prevent electrical shocks and fire risks;
- Standards for appropriate ventilation (e.g. utilization of an exhaust hood, fans, etc.) in areas dealing with hazardous EEE materials;
- Standards to safely handle toxic e-waste components;
- Standards to safely and environmentally dispose of these toxic components;
- Standards to safely stock hazardous components and prevent any leakages;
- Standards to safely transport these hazardous components;
- Standards to implement wastewater collection and treatment systems;
- Standards related to working conditions: availability of drinking water, sufficient number of toilets, etc.

Although considered short-term recommendations (because they can easily and quickly be studied and established), it could take time for these standards to be studied, accepted and implemented. All of these initiatives and standards should be constructed in compliance with existing regulations and legislation.

The awareness raising campaign can be conducted using focus groups, provincial meetings, or training sessions that all the concerned actors would be invited to attend. Best practices would be presented and practiced, and follow-up meetings could be conducted to monitor whether the different businesses implemented the lessons or not. The training could be entitled “Appropriate Practices for Environmental and Health Safety”.

Probably less efficient, an easier, faster and cheaper tool would be to design and distribute an illustrated guidebook, where the best practices and potential risks would be clearly detailed.

### ***b) Short-term economic recommendations***

The fastest activity that can be implemented to improve the overall economic situation in the sector is capacity building and training. Targeted groups would be current EEE-sector staff, current and future entrepreneurs willing to invest in the e-waste sector, students studying the field, etc. This economic training would deal with two major components for the sustainability of the business: management practices and technical processes.

The management practices training will teach workers, current and future entrepreneurs to collect all the necessary data about their business: employment; finances; e-product stock and flows; technical, health and safety, and environmental issues, etc. By doing so, the businesses will improve their overall management over time, as they will be able to see their strengths and weaknesses, and correct them accordingly. Managers need to learn about legal employment and working conditions. They also need basic accounting skills, to be aware of monthly incomes and expenses, and to balance them in order to generate sufficient salary for paid staff and guarantee the sustainability of the business. E-product flows should be reported, to understand variations and learn how to anticipate possible changes. Technical, health and safety and environmental issues should be noted, in order to identify and prevent them in the future. Management lessons could also include marketing, advertisement, and recommendations for business location targeting (as support for finding a good business location was frequently mentioned by the survey respondents).

Training about technical processes has to be taught by specialists in the concerned sectors. They will teach workers the related processes for selling, repairing, collecting and dismantling of various e-products. These techniques should of course take into account the equipment available in Cambodia, which could be a limitation for the training (which is addressed in the long-term recommendations, below).

These trainings can be provided through a training course over several weeks, organized in each province. Invitations should be sent to all concerned businesses (increasing the need for a census). During these trainings, a session devoted to communication between the participants could also be established. Indeed, many respondents during the survey mentioned “competition” as one of the main negative factors for their businesses. It would thus be interesting to help e-product businesses transition from competitors to collaborators. During this session, people from the same field of activity could exchange information about techniques, problem encountered and the solutions they found.

These trainings would also represent a good opportunity for current managers to find potential staff to hire for their businesses, with the guarantee that these staff will have completed the training course already. This could, on the long term, increase the value of these staff and give them access to higher salaries.

Trainings for environmental, health and safety, and economic issues are not incompatible, and should be given at the same time. Moreover, if implemented, the recommendations proposed for environmental and health issues would also help businesses increase efficiency. Similarly, if managed correctly with efficient technical processes, an e-waste management-related business would have fewer potential impacts on the environment and workers' health.

### ***c) Long-term recommendations***

In the long term, protection of the environment and economic development in Cambodia will depend on the efficiency of its waste (including e-waste) management system. This efficiency is composed of several components: infrastructure; workers' skills; quantity, quality and nature of waste (including e-waste) available for treatment; regulatory framework; and, governmental support and assistance. As seen before, the fastest recommendation to implement concerns the workers' skills. The two longest recommendations concern the infrastructure and regulatory framework (legislation) in Cambodia.

Infrastructure for e-waste management in Cambodia is very poor. Infrastructure here concerns the collection/transportation system, the treatment sites and the equipment available in the country. The lack of infrastructure is well illustrated by the most informal segment of the e-product value chain: e-waste collection and dismantling.

Collection of e-waste, mainly conducted by waste-pickers, has a very low efficiency, which could be improved by implementing several activities:

- Improve access for people in the collection sector to motorized vehicles (collection primarily happens on foot or by bicycle);
- Improve access to remote areas (improved roads and infrastructure);
- Encourage collectors to specialize in e-waste exclusively;
- Diversify collection to include corporations, institutions, etc.;
- Improve efficiency in e-waste collection by increasing the number of recycling (dismantling) centers, and locating them in strategic areas;
- Implement the relevant standards mentioned in short-term recommendations;

Under these conditions, the collection system would improve its efficiency, which would impact the subsequent recycling phases.

Recycling centers specialize in dismantling and sorting waste (including e-waste) in Cambodia. These are essentially scrap yards, which eventually sell the recyclable parts of the e-waste abroad for end-process recycling (such as refining, smelting, removing the various metals, etc.). There are very few of these centers in Cambodia; this activity was not even reported in the 2009 Nationwide Establishment Listing of Cambodia. Depending on the amount of e-waste available (and the collection system's efficiency), more dismantling centers may need to be built. It would furthermore be interesting to consider investing in end-

process recycling; currently, no such facility exists in Cambodia. However, the informal and uncertain system currently in place does not provide sufficient guarantees for many entrepreneurs to risk investing in the sector yet.

Equipment is neither technical nor specific along the e-product value chain in Cambodia. Thus, any technical training provided would be useless if the requisite equipment is not available. Spare parts are among the materials most in demand by respondents. Repair businesses obviously need considerable amounts of them, as more UEEE are being imported. Incentives should also be proposed for the establishment of specialized spare part businesses (see government incentives).

The quantity, quality and nature of available e-waste determine the direction of the market and the need for infrastructure. Corporate and institutional providers of e-waste are untapped by the current market. When this sector will be taken into account (by collection systems, and possibly because of governmental measures such as extended producer responsibility), another comprehensive, exhaustive and rigorous national census should be conducted to assess the different flows of e-products between the different activities. This will allow us to assess e-waste management needs (infrastructures, employment...), the potential financial benefits and trends for the future. As mentioned in this report, the overall efficiency of the system is dependent on the quantity of computers available for dismantling and recycling. We can expect that in the years to come, with Cambodia's increasing economic development and the addition of institutional e-waste supplies, the amount of computers should increase.

As stated in Part A, the government of Cambodia needs to officially define "e-waste" and provide standards for the sector (as seen in the short-term environmental recommendations). Development, improvement and enforcement of a regulatory framework are necessary for each segment of the e-product value chain.

Support and assistance can be provided by the Cambodian government (for example, through government incentives or subsidies), or by other organizations (e.g., development agencies, international/local NGOs, banks, MFIs, etc.). One of the government incentives most requested by businesses is price regulation. Indeed, the price of e-products along the value chain varies considerably, and depends on numerous factors (e.g., competition, price of raw materials, availability of EEE, technology, time and skills required to process the device, etc.). Surveyed respondents felt that standardized prices, for each kind of item and each activity, would help them manage and plan their businesses more effectively. Other government incentives, such as decreased taxes for e-waste management-related businesses, could improve both environmental protection and the economic value of the related activities. This would encourage more businesses to open, and thus the recycling of more discarded items. In addition, the Cambodian government could envisage the implementation of an EPR policy, based on the model in developed countries. Under an EPR, producers and/or retailers have the obligation to take back the devices they initially sold, and to dispose of them in a safe and environmentally friendly way.

The e-waste management sector needs strong support from the private sector. New entrepreneurs especially need easier access to credit to start up their new business. MFIs, banks and other financial partners should encourage new investors by proposing low rate interest loans.

Finally, we recommend the creation of an inter-professional EEE sector association, gathering the different stakeholders of the sector together. This association could centralize all the related information in the sector, to ease national e-product and e-waste inventories, and organize assistance for business members that need it. They could also collaborate with the government on the establishment of standards and regulation, including price regulation. The creation of this association would also help transform the current informal sector into a more official and organized market. The assistance that members receive from this association could add quality and value to their business.



## GLOSSARY

**Accession:** the act whereby a state and/or regional economic integration organization accepts the opportunity to become a party to the convention after it entered into force. It has the same legal effect as ratification.

(<http://www.basel.int/Countries/StatusofRatifications/Definitions/tabid/1404/Default.aspx>)

**EEE:** “Electrical and electronic equipment” or “EEE” means equipment which is dependent on electric currents or electromagnetic fields in order to work properly, equipment for the generation, transfer and measurement of such currents and fields and designed for use with a voltage rating not exceeding 1,000 volts for alternating current and 1,500 volts for direct current. (Directive 2012/79/EU). We will also use the term “e-product” as an equivalent of EEE in this report.

**Establishment:** An establishment is an enterprise or part of an enterprise which is situated in a single location and in which only a single (non-ancillary) productive activity is carried out, or in which the principal productive activity accounts for most of the value added. (United Nations Statistics Division)

**Hazardous waste:** Hazardous waste refers to “radioactivity substances, explosive substances, pathogenic substances, irritating substances, corrosive substances, oxidizing substances, or other chemicals substances which may cause to danger to human (health) and animal or danger to plants, public property and environment”. (Article 3 of the Sub decree on Solid Waste Management). This definition may change according to the new law on Environment Pollution Management.

**Management:** Collection, transport and disposal of hazardous waste or other waste, including after-care of disposal sites. (Basel Convention)

**Ratification:** Consent of a state and/or regional economic integration organization to become a party and be bound by the convention.

(<http://www.basel.int/Countries/StatusofRatifications/Definitions/tabid/1404/Default.aspx>)

**Wastes:** Substances or objects which are disposed of or are intended to be disposed of, or are required to be disposed of by provisions of national law. (Basel Convention)

**WEEE or e-waste:** “Waste electrical and electronic equipment” or “WEEE” means electrical or electronic equipment which is waste within the meaning of Article 1(a) of Directive 75/442/EEC, including all components, subassemblies and consumables which are part of the product at the time of discarding. (Directive 2012/79/EU)

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## **ANNEXES**

Here is the English version of the survey instrument designed and implemented by Angkor Research and Consulting.



### Baseline Survey Questionnaire

Province:						
District:						
Commune:						
Street and house numbers						
Name of the business:						
	1 <sup>st</sup> attempt	1 <sup>st</sup> appointment	2 <sup>nd</sup> attempt	2 <sup>nd</sup> appointment	3 <sup>rd</sup> attempt	
Date	/ /12	/ /12	/ /12	/ /12	/ /12	
Time						
Location						
Interviewer						
<b>Result Codes</b> - Circle the correct code						
Completed						1
Incomplete-respondent termination						2
Incomplete-third party interruption						3
Respondent refusal						4
Third party refusal						5
Respondent absent at last appointment						6
Could not interview (dumb, deaf, mental health problem, drunk etc)						7
	Interviewer	Editor	Supervisor	Data Entry 1	Data Entry 2	
ID code						
Date	/ /13	/ /13	/ /13	/ /13	/ /13	
Signature						

## Introduction

Hello. My name is \_\_\_\_\_ and I am working for Angkor Research and Consulting, a survey firm specialized in research, in collaboration with **the United Nations Industrial Development Organization (UNIDO), the Ministry of Labor and Vocational Training through the National Technical Training Institute (NTTI) and the Ministry of Environment**. Angkor Research and Consulting is currently conducting a baseline survey which will bring all the needed data related to e-product related businesses, which will promote business development in the e-waste sub-sector. This survey is conducted in the provinces of Phnom Penh, Kompong Cham, Siem Reap, Banteay Meanchay and Battambang as the project pilot areas.

If you agree to participate in this study, we will interview you for about 20 minutes. Your responses will be strictly confidential and will be used for research purposes only. The survey asks questions about your business profile, about your business activities (collection, repairing, dismantling/sorting, retailing, or related to spare parts), about the flows of e-products through your business with their origin and destination, about the way you may collect and record data and finally about all of the issues you may have encountered so far. We will also ask you to share your ideas to improve the e-product related businesses in Cambodia.

The information that we will collect in this interview will not be used for providing any assistance to your mill. Participation in this study is voluntary. You may refuse to participate or not answer any question that you do not wish to answer. If you want, I can skip any question or stop the interview at any time.

**Do you have any questions for me?**

**Can I start asking questions now?**

**Before the interview:**

- If you interview a waste picker (collection), make sure that he is used to collect Electrical and Electronic Equipment, Used (2<sup>nd</sup> hand) or Waste (e-waste).
- Non EEE related corporations are government institutions, private/public businesses, offices...

I. Business profile		
1	What is your business <b>main</b> activity?	Collection of UEEE or e-waste 1 Repairing/Refurbishment of UEEE 2 Dismantling/Sorting of e-waste 3 Retailing of new EEE or UEEE 4 Buy/Sell spare parts 5
2	Does your business have <b>other</b> activities?	No (skip to 4) 0 Yes 1
3	What are your business <b>other</b> activities? (multiple answers) (read answers)	Collection of UEEE or e-waste 1 Repairing/Refurbishment of UEEE 2 Dismantling/Sorting of e-waste 3 Retailing of new EEE or UEEE 4 Buy/Sell spare parts 5 Other 88
4	When did you start this business?	Year
5	How many paid male staff works in this business?	Paid Males:
6	How many unpaid male staff works in this business?	Unpaid Males:
7	Number of working hours per day for males?	Hours :
8	Number of working days per week for males?	Days :

9	What is the daily wage for male employees? (If only unpaid, write "0")	riels :	
10	Does your business have female staff?	No(skip to 16)	0
		Yes	1
11	How many paid female staff works in this business?	Paid Females :	
12	How many unpaid female staff works in this business?	Unpaid Females:	
13	Number of working hours per day for females?	Hours :	
14	Number of working days per week for females?	Days :	
15	What is the daily wage for female employees? (If only unpaid, write "0")	riels :	
16	Did you or your employees receive any training for the business activity?	No(skip to 18)	0
		Yes	1
17	Which kind of training did you or your employees follow? (percentages) (read answers)	School program (%)	
		On the job training (%)	
		Training Courses in private companies or other EEE businesses (not school) (%)	
		Training Courses in NGOs (%)	
		Others (%)	
<p><b>II. Business activities: e-waste collection</b>  <i>Businesses collecting e-waste go from home to home, corporations, government institutions... to pick them. They mostly have hand-driven carts, or motorbike with trailer, or truck... They are mostly waste-pickers.</i></p>			
18	Does your business have an e-waste collection activity?	No (skip to 28)	0
		Yes	1
19	Which WEEE does your business collect? (percentages) (read answers)	Refrigerator (%)	
		Washing Machine (%)	
		Air Conditioner (%)	



		Computer (%)	
		Mobile Phones (%)	
		TV (%)	
		Others (%)	
<b>20</b>	Who does your business collect the e-waste from? (percentages) (read answers)	Households (%)	
		Non EEE related (%)	
		Repairing/refurbishment businesses (%)	
		Dismantling/Sorting businesses (%)	
		Retailing businesses (%)	
		Dumpsites (%)	
		Others (%)	
<b>21</b>	Who does your business supply the collected e-waste to? (percentages) (read answers)	Dismantling/Sorting other businesses (%)	
		Repairing businesses (%)	
		Dumpsite (%)	
		Households (%)	
		Dismantling/Sorting by this business (%)	
		Others (%)	
<b>22</b>	What is the average monthly quantity of e-waste collected by your business?	Kg:	
<b>23</b>	Did you observe any variation in this quantity since you began your collecting activity?	No (skip to 25)	0
		Yes	1
<b>24</b>	What kind of variation did you observe? (read answers)	Important increase (>50%)	1
		Moderate increase (<50%)	2
		Moderate decrease (<50%)	3
		Important decrease (>50%)	4

25	How do you think this quantity will vary in the future? (in the next 5 years)	<table border="0"> <tr> <td>Increase</td> <td style="text-align: right;">1</td> </tr> <tr> <td>No variation (skip to 28)</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Decrease (skip to 27)</td> <td style="text-align: right;">3</td> </tr> </table>	Increase	1	No variation (skip to 28)	2	Decrease (skip to 27)	3								
Increase	1															
No variation (skip to 28)	2															
Decrease (skip to 27)	3															
26	Why do you think that you will collect more? (main reason) (skip to 28)	<table border="0"> <tr> <td>More consumption so more e-waste supply</td> <td style="text-align: right;">1</td> </tr> <tr> <td>EE goods lifespan decrease</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Easier to collect, (new moto or car to collect faster, better management...)</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Government incentives</td> <td style="text-align: right;">4</td> </tr> <tr> <td>Others</td> <td style="text-align: right;">88</td> </tr> </table>	More consumption so more e-waste supply	1	EE goods lifespan decrease	2	Easier to collect, (new moto or car to collect faster, better management...)	3	Government incentives	4	Others	88				
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Others	88															
27	Why do you think that you will collect less e-waste? (main reason)	<table border="0"> <tr> <td>Less consumption</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Initial product of better quality and lifespan</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Too much competition for collection</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Others</td> <td style="text-align: right;">88</td> </tr> </table>	Less consumption	1	Initial product of better quality and lifespan	2	Too much competition for collection	3	Others	88						
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<b>III. Business activities: UEEE repairing/refurbishment</b> <i>Repairing businesses only apply to UEEE.</i>																
28	Does your business have a repairing/refurbishment activity?	<table border="0"> <tr> <td>No (skip to 42)</td> <td style="text-align: right;">0</td> </tr> <tr> <td>Yes</td> <td style="text-align: right;">1</td> </tr> </table>	No (skip to 42)	0	Yes	1										
No (skip to 42)	0															
Yes	1															
29	Which UEEE does your business collect? (percentages) (read answers)	<table border="1"> <tr> <td>Refrigerator (%)</td> <td></td> </tr> <tr> <td>Washing Machine (%)</td> <td></td> </tr> <tr> <td>Air Conditioner (%)</td> <td></td> </tr> <tr> <td>Computer (%)</td> <td></td> </tr> <tr> <td>Mobile Phones (%)</td> <td></td> </tr> <tr> <td>TV (%)</td> <td></td> </tr> <tr> <td>Others (%)</td> <td></td> </tr> </table>	Refrigerator (%)		Washing Machine (%)		Air Conditioner (%)		Computer (%)		Mobile Phones (%)		TV (%)		Others (%)	
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30	Who are your customers? (repairing activity, percentages)	<table border="1"> <tr> <td>Households (%)</td> <td></td> </tr> </table>	Households (%)													
Households (%)																

	<i>(read answers)</i>	Non EEE related (%)	
		Other repairing/refurbishment businesses (%)	
		Retailing businesses (%)	
		Wholesaler (%)	
		Others (%)	
<b>31</b>	What is the average monthly quantity of UEEE repaired by your business?	Kg:	
<b>32</b>	Did you observe any variation in this quantity since you began your collecting activity?	No ( <b>skip to 34</b> )	0
		Yes	1
<b>33</b>	What kind of variation did you observe? <i>(read answers)</i>	Important increase (>50%)	1
		Moderate increase (<50%)	2
		Moderate decrease (<50%)	3
		Important decrease (>50%)	4
<b>34</b>	How do you think this monthly quantity of UEEE repaired will vary in the future? <i>(in the next 5 years)</i>	Increase	1
		No variation ( <b>skip to 37</b> )	2
		Decrease ( <b>skip to 36</b> )	3
<b>35</b>	Why do you think that you will repair more UEEE? ( <b>main reason</b> )(skip to 37)	More consumption so more UEEE supply	1
		EE goods lifespan decrease	2
		Easier to repair, (new technic, new equipment...)	3
		Government incentives	4
		This business proposes higher quality services, is more famous, cheaper than competitors	5
		Others	88
<b>36</b>	Why do you think that you will repair less UEEE? ( <b>main reason</b> )	Less consumption	1
		Initial product of better quality and lifespan	2

		Too much competition	3
		New technology devices too difficult to repair	4
		People prefer to buy new than repair device	5
		Others	88
<b>Focus on the becoming of non-functioning components and un-repairable UEEE (e-waste)</b>			
<b>37</b>	Do you sell the non-functioning components or the UEEE that you cannot repair (thus becoming WEEE)?	No (skip to 39)	0
		Yes	1
<b>38</b>	Who do you sell it to? (percentages) (read answers)	WEEE collectors (%)	
		E-waste dismantlers/sorters (%)	
		Other repairing businesses (%)	
		Others (%)	
<b>39</b>	Do you have a way of disposal for e-waste?	No (skip to 41)	0
		Yes	1
<b>40</b>	How do you <b>mainly</b> dispose of these e-wastes?	Dismantled/sorted by this business	1
		Stocked and burnt	2
		Municipal dumpsite	3
		Others	88
<b>41</b>	What average quantity of e-waste does your business generate per month?	Kg:	
<b>IV. Business activities: e-waste dismantling/sorting</b> <i>Dismantling/sorting businesses are part of the recycling process (pre-process) and only care about e-waste.</i>			
<b>42</b>	Does your business have a dismantling/sorting activity?	No (skip to 55)	0
		Yes	1
<b>43</b>	Which e-waste does your business dismantle/sort? (percentages) (read answers)	Refrigerator (%)	
		Washing Machine (%)	

		Air Conditioner (%)	
		Computer (%)	
		Mobile Phones (%)	
		TV (%)	
		Others (%)	
<b>44</b>	Who do you buy the e-waste from? (percentages) (read answers)	Households (%)	
		Non EEE related (%)	
		Repairing/refurbishment businesses (%)	
		WEEE collectors (%)	
		Others (%)	
<b>45</b>	Who do you sell the dismantled parts to? (percentages) <i>Dismantled parts = plastics, metals...</i> (read answers)	Abroad end-processing recyclers (%)	
		Scrapyard (%)	
		Others (%)	
<b>46</b>	What is the average monthly quantity of e-waste dismantled/sorted by your business?	Kg:	
<b>47</b>	Did you observe any variation in this quantity since you began your dismantling/sorting activity?	No (skip to 49)	0
		Yes	1
<b>48</b>	What kind of variation did you observe? (read answers)	Important increase (>50%)	1
		Moderate increase (<50%)	2
		Moderate decrease (<50%)	3
		Important decrease (>50%)	4
<b>49</b>	How do you think this monthly quantity of e-waste dismantled/sorted will vary in the future? (in the next 5 years)	Increase	1
		No variation (skip to 52)	2
		Decrease (skip to 51)	3
<b>50</b>	Why do you think that you will dismantle/sort more e-waste? (main	More consumption so more e-waste supply	1

	reason) (skip to 52)	EEE lifespan decrease	2
		Easier to dismantle/sort, (new technic, new equipment...)	3
		Government incentives	4
		New devices too difficult to repair so more e-waste produced	5
		Others	88
51	Why do you think that you will dismantle/sort less e-waste? (main reason)	Less consumption	1
		Initial product of better quality and lifespan	2
		Too much competition	3
		New technology EEE too difficult to dismantle	4
		Others	88
52	Are there some parts of the e-waste that you cannot dismantle? <i>Because too small, too difficult, toxic...</i>	No (skip to 55)	0
		Yes	1
53	How do you mainly dispose of these e-wastes residues?	Municipal dumpsite	1
		Stocked and burnt	2
		Others	88
54	What average monthly quantity of e-waste residues is generated by your business?	Kg:	
<b>V. Business activities: brand new EEE, UEEE retailing</b> <i>Retailing is about buy and sells of equipment: new or 2<sup>nd</sup> hand.</i>			
55	Does your business have a retailing activity?	No (skip to 75)	0
		Yes	1
56	Which kind of EEE do you buy/sell? (percentages) <i>(read answers)</i>	Brand new EEE (%)	
		UEEE (%)	
Focus on brand new EEE (check with question 56, if "Brand new = 0%" skip to 66)			
57	Which brand new EEE does your business sell? (percentages)	Refrigerator (%)	

	<i>(read answers)</i>	Washing Machine (%)	
		Air Conditioner (%)	
		Computer (%)	
		Mobile Phones (%)	
		TV (%)	
		Others (%)	
<b>58</b>	Who do you buy the brand new EEE from? (percentages) <i>(read answers)</i>	Local wholesaler (%)	
		Import from abroad (%)	
		Others (%)	
<b>59</b>	Who do you sell brand new EEE to? (percentages) <i>(read answers)</i>	Households (%)	
		Non EEE related (%)	
		Repairing businesses (%)	
		Others (%)	
<b>60</b>	What is the average monthly quantity of brand new EEE sold by your business?	Kg:	
<b>61</b>	Did you observe any variation in this quantity since you began your retailing activity?	No ( <b>skip to 63</b> )	0
		Yes	1
<b>62</b>	What kind of variation did you observe? <i>(read answers)</i>	Important increase (>50%)	1
		Moderate increase (<50%)	2
		Moderate decrease (<50%)	3
		Important decrease (>50%)	4
<b>63</b>	How do you think this monthly quantity of brand new EEE sold will vary in the future? <i>(in the next 5 years)</i>	Increase	1
		No variation ( <b>skip to 66</b> )	2
		Decrease ( <b>skip to 65</b> )	3
<b>64</b>	Why do you think that you will sell more brand new EEE? ( <b>main</b> )	Less expensive	1

	reason) (skip to 66)	People have more money 2 Society new needs/More consumption 3 Better quality than 2 <sup>nd</sup> hand 4 Others 88																
65	Why do you think that you will sell less brand new EEE? (main reason)	Too expensive 1 Too difficult and expensive to repair 2 More competitors 3 Others 88																
Focus on UEEE (2 <sup>nd</sup> hand EEE) (check with question 56, if "UEEE = 0%", skip to 75)																		
66	Which UEEE does your business sell? (percentages) (read answers)	<table border="1"> <tr><td>Refrigerator (%)</td><td></td></tr> <tr><td>Washing Machine (%)</td><td></td></tr> <tr><td>Air Conditioner (%)</td><td></td></tr> <tr><td>Computer (%)</td><td></td></tr> <tr><td>Mobile Phones (%)</td><td></td></tr> <tr><td>TV (%)</td><td></td></tr> <tr><td>Others (%)</td><td></td></tr> </table>	Refrigerator (%)		Washing Machine (%)		Air Conditioner (%)		Computer (%)		Mobile Phones (%)		TV (%)		Others (%)			
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67	Who do you buy the UEEE from? (percentages) (read answers)	<table border="1"> <tr><td>Households (%)</td><td></td></tr> <tr><td>Non EEE related (%)</td><td></td></tr> <tr><td>Repairing/refurbishment businesses (%)</td><td></td></tr> <tr><td>Wholesalers (%)</td><td></td></tr> <tr><td>Import (%)</td><td></td></tr> <tr><td>Other retailing businesses (%)</td><td></td></tr> <tr><td>Pawnshop (%)</td><td></td></tr> <tr><td>Others (%)</td><td></td></tr> </table>	Households (%)		Non EEE related (%)		Repairing/refurbishment businesses (%)		Wholesalers (%)		Import (%)		Other retailing businesses (%)		Pawnshop (%)		Others (%)	
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68	Who do you sell UEEE to? (percentages)	Households (%)	
		Non EEE related (%)	
		Repairing businesses (%)	
		E-waste collectors	
		Others (%)	
69	What is the average monthly quantity of UEEE sold by your business?	Kg:	
70	Did you observe any variation in this quantity since you began your retailing activity?	No (skip to 72)	0
		Yes	1
71	What kind of variation did you observe? (read answers)	Important increase (>50%)	1
		Moderate increase (<50%)	2
		Moderate decrease (<50%)	3
		Important decrease (>50%)	4
72	How do you think this monthly quantity of UEEE sold will vary in the future? (in the next 5 years)	Increase	1
		No variation (skip to 75)	2
		Decrease (skip to 74)	3
73	Why do you think that you will sell more UEEE? (main reason) (skip to 75)	Less expensive	1
		People get poorer	2
		Easier to repair than brand new	3
		More consumption	4
		Higher quality than new	5
		Others	88
74	Why do you think that you will sell less UEEE? (main reason)	Low quality compared to brand new	1
		People can afford new	2
		New EEE cheaper	3

		More competitors	4
		Others	88
<b>VI. Business activities: buy/sell spare parts</b> <i>We focus in this section on the spare parts only.</i>			
<b>75</b>	Does your business buy/sell spare parts?	No (skip to 92)	0
		Yes	1
<b>76</b>	Why do you buy spare parts?	Re-sell them	1
		Repairing activity	2
		Both	3
<b>77</b>	Where do you buy the EE spare parts from? (multiple answers) (read answers)	Functioning parts from e-waste (collectors) (%)	
		Retailer (selling spare parts) (%)	
		Functioning parts from e-waste (households) (%)	
		Functioning parts from e-waste (other repairing business) (%)	
		Brand new spare parts (wholesalers) (%)	
		Non EEE related (%)	
		Others (%)	
<b>78</b>	What is the average monthly quantity of EE spare parts bought by your business?	Kg:	
<b>79</b>	Did you observe any variation in this quantity since you began your retailing activity?	No (skip to 81)	0
		Yes	1
<b>80</b>	What kind of variation did you observe? (read answers)	Important increase (>50%)	1
		Moderate increase (<50%)	2
		Moderate decrease (<50%)	3
		Important decrease (>50%)	4
<b>81</b>	How do you think this monthly quantity of EE spare parts bought will	Increase	1

	vary in the future? (in the next 5 years)	No variation (skip to 84)	2
		Decrease (skip to 83)	3
82	Why do you think that you will buy more EE spare parts? (main reason) (skip to 84)	More consumption	1
		EEE lower quality : need to repair more often	2
		This business proposes higher quality services, is more famous, cheaper than competitors	3
		Others	88
83	Why do you think that you will buy less EE spare parts? (main reason)	Too expensive new technology	1
		Brand new EEE of higher quality: need to repair less often	2
		Too much competition	3
		New technology more difficult to repair	4
		People prefer to buy new EEE rather than repair with spare parts	5
		Others	88
84	Do you sell functioning EE spare parts?	No (skip to 92)	0
		Yes	1
85	Who do you sell them to? (percentages) (read answers)	Households (%)	
		Other repairing businesses (%)	
		Non EEE related (%)	
		Others (%)	
86	What is the average monthly quantity of EE spare parts sold by your business?	Kg:	
87	Did you observe any variation in this quantity since you began your retailing activity?	No (skip to 89)	0
		Yes	1
88	What kind of variation did you observe? (read answers)	Important increase (>50%)	1
		Moderate increase (<50%)	2

		Moderate decrease (<50%)	3
		Important decrease (>50%)	4
<b>89</b>	How do you think this monthly quantity of EE spare parts sold will vary in the future? (in the next 5 years)	Increase	1
		No variation (skip to 92)	2
		Decrease (skip to 91)	3
<b>90</b>	Why do you think that you will sell more EE spare parts? (main reason) (skip to 92)	More consumption	1
		EEE lower quality: need to repair more often	2
		Easier to repair (new technics and equipment...)	3
		This business proposes higher quality services, is more famous, cheaper than competitors	4
		Others	88
<b>91</b>	Why do you think that you will sell less EE spare parts? (main reason)	People prefer to buy new than repair	1
		Longer lifespan for EEE so need less repair	2
		New technology EEE difficult to repair	3
		More competitors	4
		Others	88
<b>VII. Data collection, Record Keeping</b>			
<b>92</b>	Does your business record any data? <i>Financial, employment...</i>	No (skip to 100)	0
		Yes	1
<b>93</b>	Does your business record the data about employment?	No	0
		Yes	1
<b>94</b>	Does your business record the data about the flow of EEE (received/bought, processed, disposed of/sold)?	No	0
		Yes	1
<b>95</b>	Does your business record the data about finances?	No	0

		Yes	1
96	Does your business record the data about Health & Safety and about environment issues (ex: leak of CFC from fridge, sick staff and injuries due to manual handling...)?	No	0
		Yes	1
97	When did the business begin to record the data?	Year	
98	Does the business share its data?	No (skip to 100)	0
		Yes	1
99	Who does the business share the data with?	Other e-waste related business	1
		Government (MoC, MoE, MoLVT...)	2
		EE producers (ex: Samsung...)	3
		Others	88
<b>VIII. Level of awareness, issues encountered and recommendations</b>			
100	Are you and your employees aware of the laws related to your business?	No (skip to 102)	0
		Yes	1
101	Which laws are you aware of? (multiple answers)	Management of solid wastes	1
		Protection of Environment	2
		Water Quality	3
		Business Law	4
		Others	88
102	Did your business meet any technical problem since it entered into activity? <i>Number of staff, skills, equipment...</i>	No (skip to 104)	0
		Yes	1
103	Which kinds of technical problems did your business meet? (multiple answers)	Not enough staff	1
		Staff low level of qualification	2
		Lack of spare parts	3
		Lack of storage space	4

		Inadequate e-waste processing technics (low efficiency)	5
		Others	88
<b>104</b>	Do you and your employees know about the risks for Health and Environment related to e-wastes management?	No	0
		Yes	1
<b>105</b>	Did your business meet any Health & Safety or Environment problem since it entered into activity?	No ( <b>skip to 107</b> )	0
		Yes	1
<b>106</b>	Which kinds of H & S or Environment problems did your business meet? (multiple answers)	Environmental contamination	1
		Cuts, Burns... on hands, skin	2
		Irritation (nose, eyes, ears)	3
		Electrical shock	4
		Respiratory problems	5
		Others	88
<b>107</b>	What do you think should be done to encourage entrepreneurs to start a new business? (multiple answers)	Help to find a location to install new business	1
		Management Training	2
		Government incentives (lower taxes to register new business)	3
		Training about a safe for Health and Environment e-waste management	4
		Ease the access to credit	5
		Training about processes (repair, recycle...)	6
		Others	88
<b>108</b>	Which kind of assistance would help your business to improve? (multiple answers)	Ease the access to credit to scale up the business	1
		Training about processes (repair, recycle...)	2
		Provide processing equipment (to repair, recycle or collect...)	3
		Increase the selling price of e-waste	4

		Encourage people to buy/repair in small businesses	5
		Imported EEE of higher quality	6
		Government incentives	7
		Others	88
<b>Extra information given by the respondent during the interview.</b>			
Mobile phone:			

**Thank you for your cooperation to this interview -  
End of the questionnaire.**