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Trends and Practices of Reverse Logistics in Electronic Industry: A Case Study of Samsung Company

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Abstract
Purpose - The paper aims to gain a deeper understanding of the importance of reverse logistics for the electronic industry showing the best practices for handling the e-waste. It seeks to investigate the different trends of electronic companies when they deal with other countries' legislations.
Design - Case study as a qualitative approach will be applied in this paper insofar as it gives a comprehensive description of practical and theoretical reverse logistics' processes of the electronics sector and how a company can deal with its end-of-life product through using what is known as e-waste approach.
Findings - It is necessary to learn from the experiences of the developed system that there is no one perfect system for all countries to manage their e-waste. The system has to be developed and updated according to the countries' situation and culture, with the participation and support of all the stakeholders.
Implications - On the basis of investigating practical practices of e-waste management, an initial model for Samsung to recycle its end-of-life devices in Egypt will suggest depending on the experience of the global Samsung program. Besides, it will provide some recommendations for the Egyptian government, non-governmental organization, and civil society.
Value - The paper provides a practical comparison between the main rules and regulations for e-waste management in European Union as a developed region representative and the Arab area as a developing region representative, demonstrating how the absence of regulations can influence the company's behaviour.

Keywords Reverse logistics, Electronic consumer, E-waste Management, Samsung Company
Paper Type: Applied paper

1. Introduction

Consumer electronics have been considered a vital part of daily life. It revolutionized the way people communicate, entertain themselves, and retrieve information. Over the past few decades, the expeditious developments in the electronics sector achieved an extraordinary growth record in the terms of sales, exports, innovations, and other potential related activities. This development led to a constant stream of new products reaching the end of their life span faster. Accordingly, the disposal rate has been on the rise, the discarded devices have been thrown away, and the volume of e-waste has significantly increased causing different dangerous problems. Hence it was essential to have an effective practice for managing end-of-life electronics which can be named e-waste management. The importance of managing e-waste can be represented in recovering the precious components and reducing the environmental impact by handling the hazardous substance properly (Stoyanov, 2012).

The management of e-waste is not an easy task, it is a long-term activity that needs cooperation between all stakeholders and technological advancements. In most developed counties, dealing with electronics waste has been well developed and adopted. For instance, Europe provides a good example for managing the growing e-waste issues through applying their strict laws and regulation and raising customer awareness (Lymberidi, 2001). Consequently, the electronics manufacturers are committed to in line with their regulations and customers' culture by designing electronics that have longer lifespans, using fewer and less-hazardous materials, and recycling the end-of-life products in a way that protects both human health and the environment.

On the contrary, the rate of e-waste management in most developing countries is still relatively low. They have not adapted themselves to deal with this issue as there are many challenges such as the lack of recycling infrastructure, absence of national regulations, and the breach of laws by some developed countries that export their wastes to developing countries such as Nigeria, Ghana, and other parts of Africa and Asia (Lewis, 2010). Also, some electronics companies do not bear their responsibilities in developing countries as they know that there are no penalties or extra taxes.

2. Literature Review

The literature review starts with the concept of reverse logistics. Then it gives an overview of the consumer electronics sector to explore how End-of-Life electronic devices can be treated illustrating the practical solution of the flow of e-waste around the world. Finally, the paper compares the e-waste policies in Europe which boosts high recycling rates by using the Extended Producer Responsibility (EPR) and the Arab region as a developing area.

2.1 Reverse logistics

Over the past decades, the field of reverse logistics has received attention more than ever before. Moreover, the researchers are realizing their responsibility to increase theoretical knowledge of reverse logistics operations in supply chain management. Beckley and Logan (1948) were the first authors who referred to the idea of returning products without mentioning the name of reverse logistics. Giultinian and Nwokoye (1975) studied the same idea, without any reference to reverse logistics terms. The first definition of reverse logistics was published by the Council of Logistics Management. It was mentioned by Stock in the early 90s as "*The term often used to refer to the role of logistics in recycling, waste disposal, and management of hazardous materials; a broader*

perspective includes all relating to logistics activities carried out in source reduction, recycling, substitution, reuse of materials and disposal".

Pohlen and Farris II, (1992) discussed the problems regarding reverse product flow such as handling, transportation, and high cost which can be as much as nine times more than the normal forward flow. On a larger scale, Krupp (1993) concentrated on reverse logistics in the manufacturing sector where manufacturers did not assume the responsibility of returns after they had been sold to the end customer. Fuller & Allen (1996) showed how a company that can manage their product waste economically has a good opportunity to achieve a competitive advantage and gain customer loyalty.

According to Kokkinaki (2001), the benefits of implementing reverse logistics strategy can be summarized in the following points: positive environmental impact, competitiveness advancement, and regaining value. EL-Saadany and Jaber (2011) noticed that reverse logistics has gained more attention in the last decades because of the increasing awareness of environmental protection. They pointed out that reverse logistics include vital processes such as reuse, refurbishment, reclaiming, recycling, remanufacturing, take-back, and disposal.

As shown in figure 1, Stoyanov (2012) classified the main processes of reverse logistics as follows: *Gatekeeping* process is the main key of reverse logistics flows. It includes screening procedures to identify how, and which products are allowed to join the return stream for recovery or proper disposal. In practice, some products may not be included in the reverse logistics flow due to the cost of transporting and processing that might be higher than the product value itself. The *Collection* process is responsible for gathering discarded products from customers to the recovery point through a reverse logistics system either from a retailer's location without testing or by checking products in retailers' locations. *Inspection* is an important process to be implemented when the returns arrive at the recovery area where it includes disassembly, testing, sorting, and rating the returned product. The *Disposition* process is divided into three subgroups according to disassembly degree (Thierry et al, 1995); direct recovery, product recovery management, and final disposal. Direct recovery is implemented when the condition of the returns is evaluated to be "as-good-as-new" or when their condition is satisfactory. Otherwise, return products are moving toward product recovery management including many activities such as repair, refurbishment, remanufacturing, and recycling. Finally, if the returned products could not be recovered anymore, they should be disposed of either by incineration or landfill. The *Distribution* process is the last activity in reverse logistics processes where recovered products, materials, and components are distributed again for potential possibilities in the market.

2.2 Consumer Electronics Industry and E-waste Management

Each year, the electronics consumer sector inspires a leading technology and produces a significant number of products and services where the customer demands on electronics devices is highly renewable. All the members of society are accustomed to use electronics for communication, entertainment, and office efficiency. According to Sinha (2004), the electronics sector is the most dynamic and fast changing sector in the world. There is no other industry can be a competitor to the electronic industry in terms of; the speed of the shrinking of a product's life cycle, the fluctuation of supply and demand, the rapid depreciation of inventory, complex supply chain, multiple sources of supply and consumption, and the unexpected requirements from customers. The boom usage of Electrical and Electronic Equipment (EEE) has been growing around the world, led to reduce the lifespan of devices and to make them obsolete faster (Singh and Siddique, 2012).

Electronic waste is considered one of the most dangerous and fastest waste in the waste streams list. They may contain toxic metals and chemicals which requires an effective solution to reduce the leakage of toxic substances into the environment (Luttropp and Johansson, 2010). Subsequently, e-waste management has become one of the most important global concerns among government organizations, environmentalist groups, private sector and manufacturers (Kim et al., 2011).

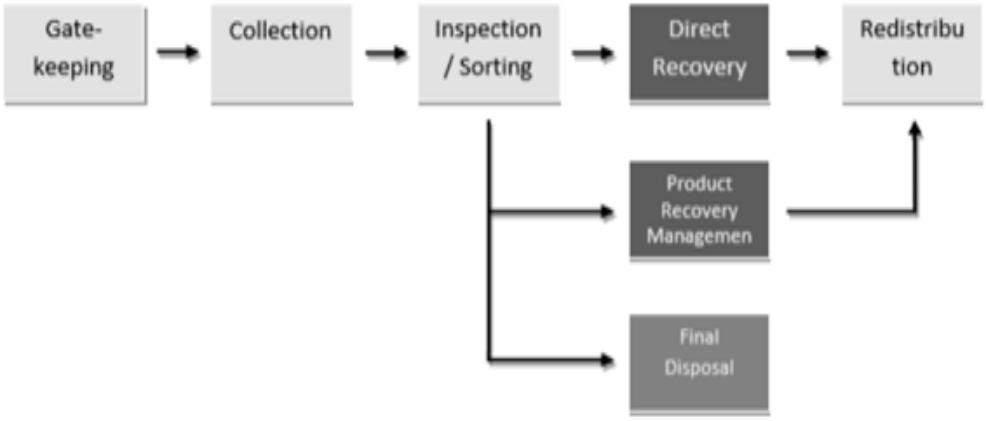

Figure 1: Main Processes of Reverse Logistics (Source: Stoyanov 2012, Adapted from Thierry et al, 1995)

There is no standard definition for e-waste but a number of countries have extracted its own definition. The most widely accepted definition of e-waste has been described as per EU directive and Basel Convention: "*electrical or electronic equipment, which is waste … including all components, subassemblies and consumables, which are part of the product at the time of discarding*". Basel Action Network (BAN) defined the electronic waste as "*encompasses a broad and growing range of electronic devices ranging from large household devices such as refrigerators, air conditioners, cell phones, personal stereos, and consumer electronics to computers which have been discarded by their users*" (Puckett and Smith, 2002). The absence of a clear e-waste definition may restrain the treatment process and multiply a new generation of e-waste. Hence, it is essential to have a specific definition for e-waste as it can help the policymakers and stakeholders to identify the legislations of management electronic waste. Sinha (2004) emphasized on three main reasons for managing e-waste; economic factors, environmental factors and data security factors. Additionally, he explained the relationship between the duration of using EEE and obtaining value where the more percentage of product utilization, the less functional value is obtained.

The practical solutions for recovering e-waste can be summarized by King et al. (2006). The appropriate solution is selected depending on the condition of returned products which is represented in many activities as shown in figure 2. Repairing is the first solution which is not a complicated process as the product needs a simple service and easy correction of a specified error in its components. Sometimes the cost of repairing an electronic device is too high when compared to purchase a new one as well as the warranty may not include the whole product and it only covers

the replaced parts. The second solution is reconditioning, it contains less work compared with remanufacturing, the defective or broken components of an electronic device would be replaced or repaired to extend its functional life and to be fit for reuse. Wolf et al., (2013) pointed out that the cost of reconditioning devices could be less than 50% of the cost of new ones. Remanufacturing is the third solution, it occurs using either the previous components which have been taken from electronic waste or the new components, if needed to restructure the product until it becomes as new (Gregory et al, 2009). The capital investments in remanufacturing operations is typically 40 to 65 percent less than the investment of manufacturing operations as most of the raw materials have already been done before. The fourth solution is recycling in which discarded devices are completely disassembled converted into raw materials, all the components are tested and inspected to evaluate their performance in order to determine if they will be sold to smelter or plastics recyclers or used in the production of new products (Chick, A. & Micklethwaite, P. 2002). The rest of waste which could not be recovered is supposed to be dumped in special sites for hazardous waste such as landfill or incineration (Niu & Li, 2007).

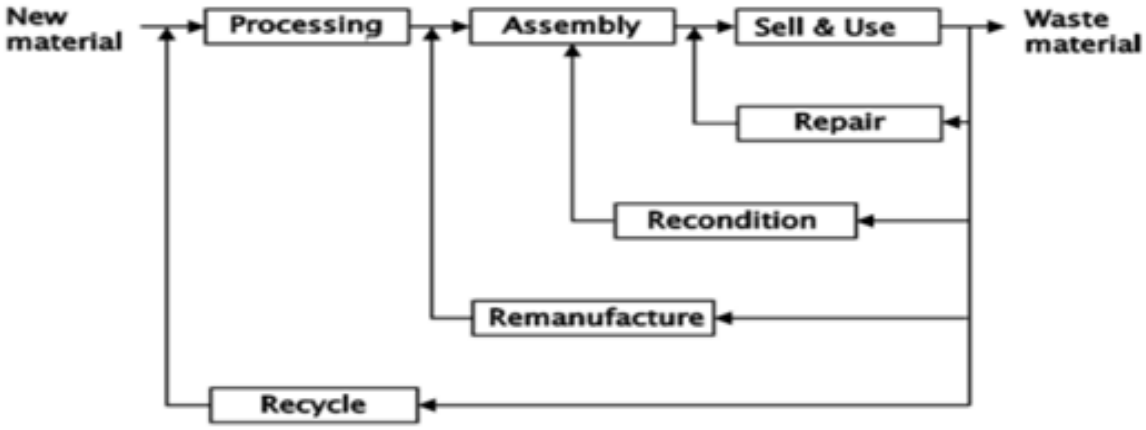

Figure 2: Practical options for end-of-life electronic products (Source: King et al., 2006)

2.3 Scale and International Flow of E-waste

The global generation of e-waste statistics in 2019 grew by 9.2 Mt since 2014 to reach 53.6 Mt, and is projected to grow to 74.7 Mt by 2030. This growth is due to the higher consumption rates of EEE, short life cycles, and few repair options. Although Europe ranked third in e-waste generation, the most widely legal regulations for managing e-waste can be found there. Particularly, Norway, Denmark, Netherlands, and Germany have strict environmental regulations to implement a successful system subjected to the EU legislation for treatment of discarded electronic equipment (Lundgren, 2012). The highest collection and recycling rate in 2019 was in Europe with 42.5%. On the contrary, Africa had the lowest rate for recovering its e-waste at 0.9% (Forti, et al. 2020).

SAICM (2009) clarified that there is no sufficient data available for the national statistics organizations to be able to gather information about where untreated e-waste is moving to. This is due to the incomplete reporting by many parties, ambiguous definitions, incorrect categorization among the parties, and discrepancies in reporting. According to Lundgren (2012), 80% of e-waste is being shipped (often illegally) to developing countries to be recycled by hundreds of thousands of informal workers and such globalization of e-waste has adverse environmental and health implications. Lewis (2010) illustrated that China and India are surrounded by many e-waste

exporters, receiving a huge amount of e-waste coming from some developed countries. Australia, Japan, South Korea, U.S.A, and Canada feel free in trading hazardous e-waste despite the 1989 Basel Convention, as they pass their responsibilities, risks, and hazards to the developing countries. They strongly oppose the Basel Convention to maximize their profit, even if they violate the laws of importing countries (Puckett and Smith, 2002). The transboundary movement of e-waste is contrary to the principle of environmental justice because most receiving countries cannot recover the waste in the right way (BAN, 2011). Basel Convention expected that West Africa will be the most common destination for e-waste in the future instead of South-East Asia due to the remarkable growth of e-waste and the stricter policies.

2.4 European Union directive and Arab Area regulations

The following part illustrates the European Union directive as a good example for handling e-waste and the current stance of the Arab region towards e-waste and the role of international institutes in addressing this global problem.

2.4.1 E-waste policy in European Union

The EU is known for having the most advanced electronic waste laws and legislations in the world. There are significant recovery facilities and policies that are specifically designed to recover precious and heavy metals which are found in electronic waste (Maxianova, 2008). Firstly, the Restriction of Hazardous Substances Directive (RoHS) was adopted in February 2003 and each EU member state is adopting its own enforcement and implementation policies using the directive as a guide. It aims to prevent the high volume of e-waste, reduce the hazardous materials in the electronic equipment, and create an efficient recycling system to solve the issue of electronics waste. (European Commission official website). Secondly, the Waste Electrical and Electronic Equipment Directive (WEEE) is the European Community directive that works in tandem with the RoHS Directive. It imposes take-back obligations on manufacturers, importers, distributors, and all other actors because they are considered as a part of the product life cycle (Nakajima & Vanderburg, 2005). Finally, REACH regulation that stands for Registration, Evaluation, Authorisation, and Restriction of Chemicals. Although it was adopted for the chemical industry, it also includes other industries which use hazardous substances such as: cleaning products sector, painting companies, furniture, and electrical appliances (European Commission official website).

2.4.2 E-waste policy in Arab Region

The efforts for recovering e-waste in the Arab region have been very limited and restricted to random and small-scale initiatives. There is no regional policy or legislation for e-waste in the Arab area such as the legal framework of the EU in the format of the WEEE and RoHS directives. Consequently, the Arab region has received many initiatives from international organizations that are affiliated with developed countries regarding the electronic waste management system (Allam, 2010). The first initiative was in 1998 when the Basel Convention established the first centre in Cairo to serve 22 Arab countries. The main aim of this centre is to support the region and embrace e-waste management by publishing the guidelines of best practices among the members (Kamel, 2013). The second initiative was introduced by the Centre for Environment and Development for the Arab Region and Europe (CEDARE). It enhances the collaboration action between the Arab World, Europe, and the International Community by conducting many awareness campaigns and publishing more information about electronic waste in Arabic through e-learning programs

(Khordagui, 2004). Another initiative project was presented in 2009 by the Regional Network for Integrated Solid Waste Management (GIZ/SWEEP-Net). It was commissioned by German Federal Ministry for Economic Cooperation and Development. This basic principle of the project is to establish a legal framework for e-waste to its members to ensure the continuity and sustainability of the regional network. Despite the lack of legal standards, norms, and functioning organisational structures in the Arab region, Bahrain, Saudi Arabia, and the United Arab Emirates are some of the first countries that established a legal framework that helps in regulating the problem of e-waste (Nassour et al., 2016).

By focusing on Egypt, the private sector enterprises and NGOs had taken the lead in thinking about how to manage the electronic waste by encouraging customers to bring back their old devices to recycling companies (Allam, 2009). The Egyptian Electronic Recycling Co. (EERC), which is considered as the first specialized company which can recycle waste in a greenway. As well, Recyclobekia is an e-waste collection company that offers green recycling with a recycling army that protects the earth. Additionally, the International Technology Group (ITG) is the first factory not only in Egypt but also in the Middle East in the field of e-waste recycling and refurbishing electronic and electrical equipment. Eco Integrated Industrial Systems Company is another private initiative that was established in 2015. The business cycle of the company is collecting, sorting, dismantling, and selling the dismantled parts to local and foreign refiners (Shakra & Awny, 2017). Despite these initiatives reflect the community's awareness, there are no tangible achievements till now as they cannot recycle all the volume of generated e-waste.

3. Methodology

The qualitative research method used for this study is suitable insofar as it gives a comprehensive description of practical and theoretical reverse logistics' processes of the electronics sector through using what is known as the e-waste approach. Then the case study is examined to underline the role of electronic companies in treating their e-waste, taking Samsung as an example of one of the largest electronic companies. The research design will follow the descriptive method as it is important for innovative industries to shed light on their management, motivations, and applied practices. The study is limited to hazardous waste management which comes from the end of electronics products' life. Further, this research looks for some initial steps which could help in overcoming the challenges of applying true e-waste management in Egypt by Samsung Electronics Company. The objectivity of this study is high since multiple independent sources are used. Additionally, the researcher does not have prior engagements within Samsung or any other connections which can decrease the objectivity of the study. Since there is little relevant data regarding the e-waste recycling program of Samsung Company, this paper follows the triangulation research approach where it involves using more than one method to gather data, such as interviews, observations, and documents. The primary data in the case study is obtained from Samsung's official website, annual sustainability reports, Samsung press, and electronic interviews, together with observations from scavengers and garbage dealers during field visits to the informal e-waste markets. The secondary data collection has been done by specifying the main search words include reverse logistics, e-waste management, consumer electronic business, Samsung Electronics Company, and Egypt recycling network that can be found in books, scholarly journals, articles, websites, annual reports, and governmental documents.

4. Finding and Discussion

4.1 Samsung E-waste Programs Overseas

Samsung Electronics Company considers e-waste management as one of its international priority issues. It has taken a leadership role in product recycling through understanding the significance of e-waste management and defining accountability and curves of obligation. Samsung is one of the strong supporters of Individual Producer Responsibility (IPR), which is considered a critical technique for manufacturers to reduce the waste level of EEE. Furthermore, Samsung is engaged with governments, industry associations, and Non-Governmental Organizations (NGOs) and follows the European authorities to be sure that the suitable legal framework is in the right place (Samsung Environmental & Social report, 2007).

Samsung aims to recover all its e-waste generated by its workplaces or emitted from its customers. To make the pickup process as easy as possible, it establishes a multiplicity of collection programs in many countries. It established a nationwide system for collecting and recycling end-of-life electronic devices which are known as Samsung Recycling Direct (SRD) program. The idea behind the program is to offer drop-off locations to encourage people to back their end-of-life electronic products (Samsung Sustainability Report, 2013). In 2008, SRD operated 175 drop-off locations in the USA around 50 states. In Canada, the SRD program had been initiated in 2009 to offer drop-off facilities for electronic consumers with 1,476 collection centres.

In 2010 over the border in India, Samsung operated 235 collecting centres across 21 cities (Samsung e-Waste Management and Activity Report). In 2011, Samsung signed an agreement with a Switzerland supply chain company called CEVA Logistics, it is responsible for organizing the pickup returns from Samsung's service partners in Switzerland and bringing them back to the Samsung central laboratory (CEVA Logistics official webpage). As well, in May 2012, Samsung set up a take-back program in Australia. Since the e-waste management in Europe is covered by the strict directive, Samsung offers several recycling sites in each EU member regarding the particular law of each country. Samsung is running e-waste take-back programs in more than 60 countries regarding the legal requirements of the recycling laws in the place where they exist. From 2009 until 2019 and due to the establishment of take-back programs, Samsung was able to collect a total of 4.03 million tonnes of e-waste (Samsung Sustainability Report, 2020).

4.2 Samsung E-waste Management in Egypt

Although Samsung has one of the biggest factories in the Arab region and more than 70 Samsung brand shops in Egypt, it did not initiate any programs for recycling the end-of-life mobiles or empty cartridges like the global ones (Seddik, G, personal communication, April 20, 2014). Further, all the Samsung discarded devices end up like any other electronic equipment in the informal Egyptian e-waste recycling network as the private sectors mentioned above cannot recycle the huge volume of generated e-waste. The current situation of e-waste management in Egypt can be explained as follow; the collection process is the first step of the e-waste recycling chain; it is done through various informal channels and irregular sector represented in:

- E-waste brought and bought by street peddlers locally known as "Robabkia" who wander the streets using carts or pickup trucks calling for obsolete household devices and buying them at cheap prices.
- E-waste is bought by bidders (often big waste dealers) in tons when some private or public organizations offer their WEEE for sale informal bidding as a method to get rid of the outdated equipment (Abdel Aziz, 2014).

- E-waste sorted out by scavengers from formal and informal dumpsites.
- E-waste from maintenance and repair workshops.

After that, scavengers accumulate the waste in their garbage villages, and the waste is being sorted and separated into several components and parts. The informal sector is known not only for collecting and transporting the waste but also for recovering primary materials and trading with intermediary dealers. Furthermore, they classify the waste into different categories and sell them independently to the recyclers, second-hand shops, or any other beneficiary party. The recycler can dismantle the collected e-waste and sell the parts by piece to the raw materials companies or burn the integrated circuit boards and wires to extract the copper, without any control procedures. While second-hand shops repair the old electronic devices to resell them or dismantle the equipment to use the usable materials as spare-parts in other devices (Abdel Aziz, 2014).

Accordingly, Samsung devices are among those devices which pass through these informal networks because Samsung doesn't have any programs to recycle its discarded products. Based on the findings from the literature review, Samsung does not strongly care to apply the e-waste approach in Egypt due to the following; it negotiates the contracts of recycling e-waste according to the rules and legislation of each country, and the Egyptian government policies are not strict and need to be clearer and push all companies to abide by sustainability. As well as, the electronic customer in Egypt does not take the sustainability factor into account during the purchase decision.

4.3 Proposal of E-waste management model for Samsung in Egypt

The initial below model is proposed for Samsung Electronics Company to aid in solving the e-waste problem in Egypt. As shown in figure 3, the model is based on the relevant information which is studied in the literature part and investigated from global Samsung programs for e-waste. Additionally, the system can be described as a cooperative system as it is in line with the efforts of the private sector, NGOs, social community, consumers, the Egyptian Ministry of State for Environment, and the Ministry of Communication and Information Technology. Each stage of this model is designed to be profitable for all participants creating thousands of green jobs. The collection stage depends on various channels to collect the e-waste efficiently; *direct collection* through Samsung drop-off location, *indirect collection* by cooperation with Samsung retailers, negotiating directly with the *informal sector*. Then the discarded products should be transported either by Samsung transportation system or another transportation contracted company. The destination area will be to the Samsung warehouse or the Samsung treatment facility according to the number of collected devices. After the dismantling stage, the separated parts pass through the recovering approach, which is represented in repair, refurbish, remanufacture, and recycle. These recovered parts in the form of new material that can be sold or used by the Samsung factory. The rest of the materials which are not suitable for recycling must be disposed of whether through incineration or sanitary landfills. As Egypt doesn't have sanitary landfills, Samsung will be responsible for shipping them to an affiliated recycling centre abroad.

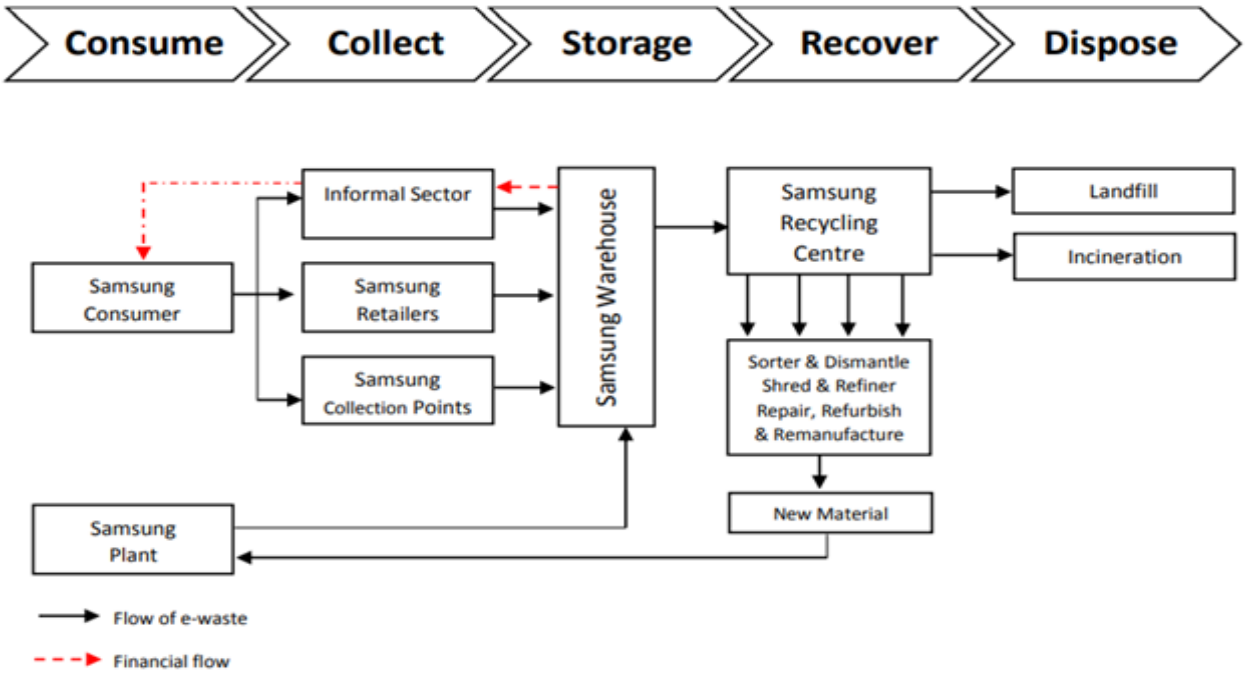

Figure 3: Proposed e-waste network for Samsung in Egypt (Source: adapted from Blaser, F. & Schluep, M, 2011)

If we can consider this proposal as a preliminary business plan, the main target service is to manage the e-waste friendly through the cooperation of all stakeholders. The target market for this model is the electronics market, which is characterized by large quantities of waste due to the rapid development in components, systems, and technologies. As the management of e-waste requires the participation of various stakeholders from the government, public and private sectors, civil society, and consumers. Community participation is the best way to achieve the desired environmental outcomes in a short term through promoting environmental awareness related to the recycling process. It is really important to encourage every citizen to go to the nearest waste collection points, e-waste recycling location or retail stores which have joined the recycling e-waste network and drop the old equipment. There are different barriers and challenges to managing the global e-waste crisis for example, increasing the volume generated, limited forecasting and planning, poor design and complexity of electronics, and lack of authoritative data and regulation to address the e-waste problem. Furthermore, The Egyptian government should take serious steps to allocate sufficient resources to rigorously enforce the existing environmental regulations. As well as, developing an e-waste legal framework that incorporates responsibilities to importers, manufacturers, and owners. It is recommended that the government should conduct a nationwide study and statistical analysis to know the quantities and types of waste generated, who owns them, and how they are currently collected and treated. The existence of an effective monitoring and evaluation system in each governorate, with specific roles and penalties can encourage stakeholders to carry out their duties toward their waste. The availability of all the aspects in managing electronic waste provides the opportunity for other electronic companies to simulate the proposed model to manage their waste efficiently.

5. Conclusion

Looking at e-waste from one perspective is that of an environmental disaster. The other side is a rich source of valuable resources that could be recovered profitably. Moreover, the paper investigates the particularities of e-waste management in the EU and Arab Region, exploring several approaches which have been adopted in managing e-waste. The experiences of the developed countries in this field reveal that the legislation must serve broader societal goals. It means that national laws and regulations are necessary to identify the roles, obligations, and responsibilities of all the stakeholders. Additionally, the absence of regulation concerning e-waste and a relaxed approach in enforcement allows the electronic manufacturer to not deal with their wastes in a friendly way. The case study emphasized that the relaxed legislations and handling practices in Egypt as one of the countries in the Arab region prompted Samsung not to adhere to implement any programs to manage their waste. Hence, the paper presents an initial model for Samsung to manage its discarded devices depending on the experience of the global Samsung program. It is clear that there is no one perfect system, and there is no one right solution for all countries to manage their e-waste. The e-waste system must be developed and updated according to the countries' situation and culture, with the participation and support of all the stakeholders considering that the laws and regulations influence the companies' behaviour towards e-waste management. At the same time, leading companies should feel obliged to implement the recycling strategy in the place which has a factory, customers, and products for ethical, environmental, and economic reasons regardless of the country's regulations. Nonetheless, it is possible and necessary to learn from the experiences of the developed system and to take what is appropriate.

6. References

Abdel Aziz, E. (2014). E-waste management in Egypt, facts and challenges, MSc. Water quality Management Environmental, Development General Director. *Hazardous Substances & Waste Consultant*.

Allam, H. (2009). E-waste management in the Arab region: status and opportunities. *Centre for Environment and Development for the Arab Region and Europe*.

Allam, H. (2010): E-waste Management in the Arab Region: Status and Opportunities (PowerPoint). *Centre for Environment and Development for the Arab Region and Europe*, Cairo, Egypt.

Beckley, D. K., & Logan, W. B. (1948). *The retail salesperson at work*. McGraw-Hill.

Blaser, F. & Schluep, M. (2011) Current Situation and Economic Feasibility of e-Waste Recycling in Morocco, EMPA, SWISS e-waste programme.

CEVA Logistics, official website

Chick, A., & Micklethwaite, P. (2002). Obstacles to UK architects and designers specifying recycled products and materials.

EL-Saadany, A. M., & Jaber, M. Y. (2011). A production/remanufacture model with returns' subassemblies managed differently. *International Journal of Production Economics*, *133*(1), 119-126.

Forti, V., Balde, C. P., Kuehr, R., & Bel, G. (2020). The Global E-waste Monitor 2020: Quantities, flows and the circular economy potential.

Fuller, D. A., Allen, J., & Glaser, M. (1996). Materials recycling and reverse channel networks: The public policy challenge. *Journal of Macro-marketing*, *16*(1), 52-72.

Gregory, J. (2009). *E-waste take-back system design and policy approaches*. StEP Initiative, United Nations University.

Giultinian, J. P., & Nwokoye, N. G. (1975). Developing distribution channels and systems in the emerging recycling industries. *International Journal of Physical Distribution*.

Kamel, Mostafa (2013) "Where does Africa stand on the global e-waste issue" director of BCRC-Egypt, e-waste Africa alliance, UNEP

Khordagui, Hosny (2004) "The role of international, regional & the role of international, regional & sub-regional institutions in regional institutions in supporting SD in the Arab region" water & environment team leader, UN-ESCWA. Regional Workshop on National Sustainable Development Strategies and Indicators for Sustainable Development in the Arab Region, Cairo House, Egypt

Kim, K. K., Ryoo, S. Y., & Jung, M. D. (2011). Inter-organizational information systems visibility in buyer–supplier relationships: the case of telecommunication equipment component manufacturing industry. *Omega*, *39*(6), 667-676.

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

Kokkinaki, A., Dekker, R., Lee, R., & Pappis, C. (2001). *Integrating a web-based system with business processes in closed loop supply chains* (No. EI 2001-31).

Krupp, J. A. (1993). Structuring bills of material for automotive remanufacturing. *Production and Inventory Management Journal*, *34*(4), 46.

Lewis, A. (2010). Europe breaking electronic waste export ban. *BBC News*, *4*.

Lundgren, K. (2012). *The global impact of e-waste: addressing the challenge*. International Labour Organization.

Luttropp, C., & Johansson, J. (2010). Improved recycling with life cycle information tagged to the product. *Journal of Cleaner Production*, *18*(4), 346-354.

Lymberidi, E. (2001). Towards waste-free electrical and electronic equipment. *Brussels, European Environmental Bureau*.

Maxianova, K. (2008). Shipments of electronic waste: providing the right incentives through regulation and enforcement. *Review of European Community & International Environmental Law*, *17*(3), 268-276.

Nakajima, N., & Vanderburg, W. H. (2005). A failing grade for WEEE take-back programs for information technology equipment. *Bulletin of Science, Technology & Society*, *25*(6), 507-517.

Nassour, A., Elnaas, A., Hemidat, S., & Nelles, M. (2016). Development of waste management in the Arab Region. *Waste management. TK, Neuruppin*, 117-128.

Network, B. A. (2011). Toxic trade news:"Cochin Port a safe conduit for imported e-waste"; "Most aspects of e-waste not regulated in US, Va.";"Research identifies US electronic waste as likely source of toxic jewellery imports from China";"178 countries agree to allow the ban on exports of toxic wastes to developing countries to become law.".

Niu, X., & Li, Y. (2007). Treatment of waste printed wire boards in electronic waste for safe disposal. *Journal of Hazardous Materials*, Vol.145, No.3, pp.410-416.

Pohlen, T. L., & Farris, M. T. (1992). Reverse logistics in plastics recycling. *International Journal of Physical Distribution & Logistics Management*.

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

Samsung Electronics Company, official website

Samsung Environmental & Social report, 2007

Samsung e-Waste Management and Activity Report, 2011

Samsung Sustainability Report, 2013 and 2020

Shakra, E. H., & Awny, M. (2017). A model for E-Waste Recycling System Case Study in EGYPT. *International Journal of Engineering and Management Research (IJEMR), 7*(3), 338-345.

Singh, G., & Siddique, R. (2012). Effect of waste foundry sand (WFS) as partial replacement of sand on the strength, ultrasonic pulse velocity and permeability of concrete. *Construction and building materials*, *26*(1), 416-422.

Sinha, D. (2004). The management of electronic waste: a comparative study on India and Switzerland. *St. Gallen7 University of St. Gallen*.

Stock, J. R. (1998). Development and implementation of reverse logistics programs. In *Annual Conference Proceedings, Council of Logistics Management.*

Stoyanov, S. (2012). *A theoretical model of reverse logistics network for end-of-life vehicles treatment in Bulgaria* (Doctoral dissertation, Master thesis, Aarhus School of Business, University of Aarhus).

Strategic Approach to International Chemicals Management (SAICM). 2009. Background information in relation to the emerging policy issue of electronic waste, paper presented at the International Conference on Chemicals Management, Geneva, 11–15 May (SAICM/ICCM.2/INF36).

Thierry, M., Salomon, M., Van Nunen, J., & Van Wassenhove, L. (1995). Strategic issues in product recovery management. *California management review*, *37*(2), 114-136.

White, J. A. (1994). Reverse logistics moves forward. *Modern Materials Handling*, *49*(1), 29-29.

Wolf, M. I., & Gutowski, T. G. (2013). EOL product remanufacturing and reuse economics: consumer side and producer side. In *Proc Int Symp Sustain Syst Technol v1*.