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Implementing reverse production systems in ICT companies:
environmental, economic and social sustainability advantages.

Individual assignment INFN25

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Wordcount: 2225

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1 Introduction

In recent years, there has been a tremendous increase of Information and Communications Technologies (ICT) products usage worldwide, the society has been increasingly more dependent on electronic devices (Assavapokee & Wongthatsanekorn 2012). United Nations Conference On Trade And Development (UNCTAD) reported that the increase of ICT usage resulted in rapid changes in computer technology and the emergence of new electronic products as well as increased supply demand as people get more interested in technologies. ICT companies started competing for a market share as they realised a huge supply demand opportunity for electronic products. As a result of this, there has been a mass production of ICT products. However, this led to an increase of electrical waste disposal in landfills since the majority ICT products have a short lifespan. Because of this, it is estimated that the e-waste disposal has produced 2% of global greenhouse gas emission (GHG) (Mingay, 2007). Thus, ICT companies might need to consider the use of reverse production systems to help minimise the disposal of e-waste and improve environmental sustainability.

1.1 Problem

The electronic waste (e-waste) management is been a major problem for most of the countries around the world. It is estimated that the world produces about 20-50 million tons of e-waste annually whereby most of it comes from Asian countries (Herat & Periathamby 2012). This is so because consumer's demand for electrical and electronic equipment (EEE) has continued to expand exponentially whilst their lifespan has been becoming shorter and shorter. Although the use of ICT products improves everyday life of human beings leading to social sustainability. By looking at production of smartphones Fig. 1. below shows the lifespan of each smartphone brand and their contribution in environmental gas emissions.

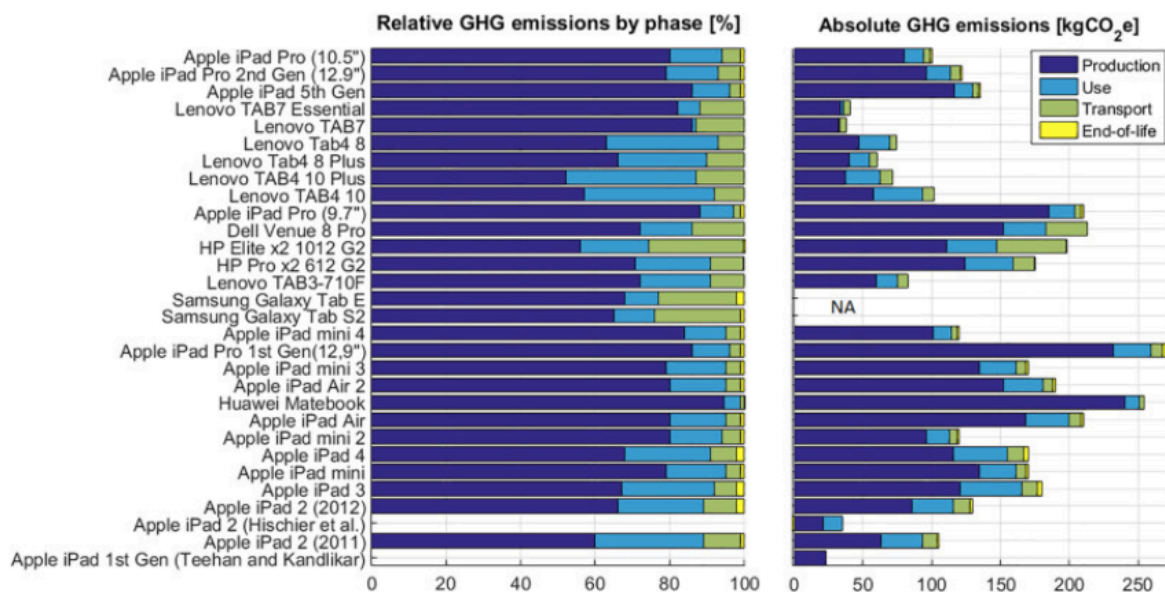


Fig.1. GHG emissions per smartphone by life cycle phase.

Fig.1. shows greenhouse gas emissions (GHG) from smartphones manufacturing companies relative to production, lifespan of their smartphones (use), transportation and their end-to-life cycle. The 2020 life cycle assessment (LCA) shown in fig.1. shows that the ICT sector is not only the source of e-waste but also the generator of GHG emissions which is causing environmental pollution (Clement, Jacquemotte & Hilty 2020).

This has raised concerns that many components contained in the e-waste are hazardous and they do not biodegrade easily. As a result of this, most countries became more strict with environmental regulations as they are struggling to recycle e-waste since the cost of recycling exceeds the revenue recovered from those e-waste (Bhutta, Omar & Yang 2011). Because most governments are failing to deal with this issue by themselves, they have been putting more pressure to the ICT companies to comply with their strict environmental policies. For ICT companies to survive and continue operating, they need to comply with the regulations. However, some of these regulations might force companies to spend more money during their production resulting in more ICT companies struggling to be economically sustainable whilst at the same time considering the environmental aspect of sustainability. This leads to the research question of this paper: By using reverse production system, how can ICT companies contribute to improve environmental sustainability whilst at the same time being economic sustainable?

1.2 Purpose

The purpose of this papers is to suggest how companies can implement reverse production systems to reduce e-waste disposal. This paper also aims to motivate ICT companies to implement reverse production systems by showing environmental, social and economic advantages that comes along with the implementation.

1.3 Delimitation

Since by definition, reverse production systems encompass the flow of both logistic activities and production activities to improve environmental sustainability. This paper will only focus on the flow of production activities. Moreover, suggested ways of implementing reverse production systems in companies which are “trading system” and” e-waste collection system” are more author-centric rather than concept-centric. Thus, terms are explained according to the author’s knowledge in the reverse production systems.

2 Reverse production system in ICT

According to (Fleischmann et al. 2009) “reverse production system encompasses all production and logistics activities related to used products that the consumer no longer requires (end-to-life products) through products that are made to be usable again in the market”. The key objective in a reverse production system is to reverse the flow of both products and logistics activities to improve environmental sustainability. By focusing only on the flow of production activities, Fig. 2. below shows the flow of products in a reverse production system.

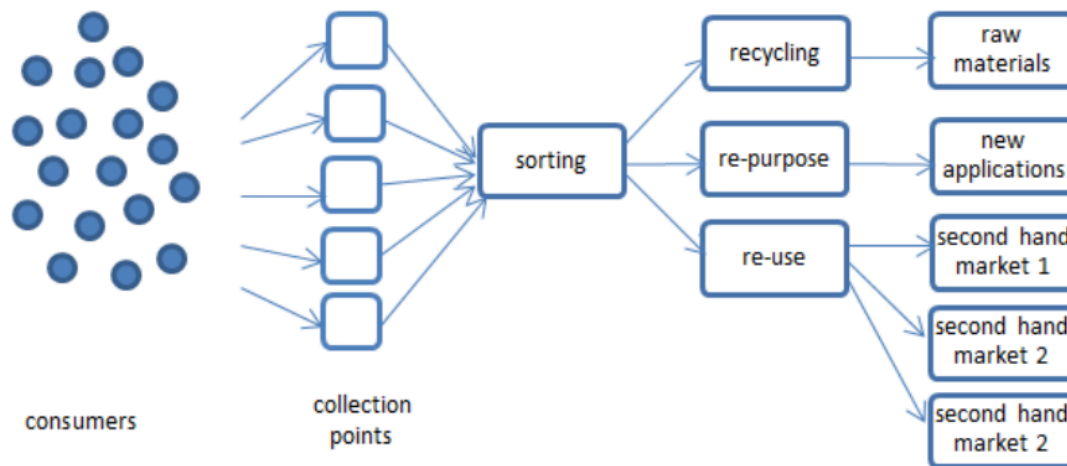


Fig.2. Reverse production cycle.
Source: (Tsiupka & Mason 2015)

The diagram above, Fig.2. Shows a reverse production cycle whereby end-to-life (EOL) products are collected from consumers back to the manufacturing process of the company. In the reverse production system, companies might need to consider implementing activities like: product collection, sorting (separating plastic from metals), re-cycling, re-purpose, re-use and allocation of raw materials. After end-to-life products have been collected from consumers, the company disassembles them and collect metals for re-cycling, plastics for re-use and minerals like gold for re-purpose. This is a strategy which has been used by some of the companies to reduce the number of e-waste disposal in landfills (Assavapokee & Wongthatsanekorn 2011). However, to make it easier for companies to implement the reverse production system. They might need to consider adopting the reverse product cycle as well.

2.1 Adoption of reverse product cycle in ICT companies

Reverse product cycle is whereby end-to-life or products that are no longer in use are collected form consumers for re-use and re-purpose as an innovative way to maximise profits by cutting production costs and in companies (Kaufmann, 2011). This paper explains two ways in which companies can adopt a reverse product cycle to be able to implement the reverse production systems. These two ways are: trading system and e-waste collection system.

2.1.1. Trading system

A trading system is whereby a company or an individual collects second hand or end-to-life products such as smartphones from consumers either by asking them to mail the products to the company or by collecting the products from their nearest shops for reselling purposes (Reebelo,

2020, n.p). In exchange to this, consumers might get an account from the company whereby they can purchase a latest version of the product with a special discount. On the other hand, consumers may also get back their money from the company if they choose not to purchase or upgrade the product.

2.1.2. E-waste collection system

E-waste collection points can be places or location points companies can establish so that their consumers can bring products which are no longer in use for recycling purposes. By doing so, each ICT company will be taking care of their consumers' e-waste by either fixing the product to increase its lifespan or disassembling for re-use and re-purpose.

Innovation often manifests itself via the adoption of reverse product cycle in companies as an effective way of reducing environmental contamination through e-waste disposal. As an example, Apple Inc company has since started to recycle e-waste of their products and they even established a system whereby their consumers can send their Iphones to the company and the company will do an assessment to decide whether the phone can be fixed to increase its lifespan or disassembled for recycling. Their recycling process is made of three major steps which are: collection, pre-processing and end-processing. To be able to manage the disassemble and recycling of huge amounts of Apple e-waste, Apple Inc designed a robot called Liam which can do the reverse product cycle by disassembling Iphones within 11 seconds (Rujanavech, et al 2016).

3 Advantages of implementing reverse production systems.

Implementing reverse production systems comes with sustainability advantages especially in ICT companies. In this paper, environmental, social and economic advantages of using reverse production systems will be explained.

2.1.2. Environmental advantages

Environmental benefits of using reverse production systems in companies helps to reduce disposal of e-waste in landfills as well as reducing the emissions of CO₂ (Achillas et al, 2010). Once the disposal of e-waste waste has been reduced, it means more plastics and metals will be collected for recycling.

Recycling of plastics and metals does not only reduce its disposal in landfills but also reduces the use of electrical energy that will be used for the production of the same new materials. The production of products from recycled materials will be using less electricity energy than making them from new raw materials (Kumar & Holuszko, 2017). Hence, producing new materials like aluminium from recycled products uses 95% less energy than producing materials from scratch. Other materials like steel uses 70% less as well when recycled (Olivieri, Romani & Neri 2010). The use of less energy reduces the amount of toxic fumes released by power plants to produce energy therefore, reducing the risk of damaging the ozone layer (SaveOnEnergy, 2020, n.p)

Since in the manufacturing of most ICT products like mobile phones and computers require the use of many different materials with minerals like gold, aluminium, zinc, iron and nickel (Stewart, 2019). By having more ICT companies adopting reverse production system, there will be less mining of the aforementioned minerals which helps to reduce erosion, loss of biodiversity and contamination of soil by the chemicals emitted from mining processes. Moreover, the processing of recycled materials needs less resources than the production of new raw materials.

2.1.2. Economic advantages

Although companies will need to spend more money to buy recycling machines, there are more benefits of adopting the reverse production system when looking from an economical perspective of both companies and consumers (Ndubisi, Nygaard & Chunwe 2019). Since more companies especially the small medium enterprises have started seeing business opportunities in recycling industry, adoption of reverse production system ignites innovation.

In the survey by New Jersey WasteWise (2015), they realised that some American companies like Lockheed Martin saved \$145,562.57 UDS just by recycling e-waste for re-use of materials during their production. Companies can improve their economy by cutting costs of production and transportation of new raw materials by adopting the reverse production system.

Urban mining is one of the reasons why ICT companies should adopt reverse production system. This is whereby both formal and informal sectors collect e-waste so that they can extract gold (Au) and other minerals like aluminium from motherboards and CPUs. However, gold (Au) is the most valuable material that can be collected from e-waste, accounting for over 70% of the overall metal price (You & Park 2014). As a result of this, companies can benefit gold from e-waste recycling, but this can only help the company's economy if they adopt the reverse production systems where they can get a chance to collect e-waste from their consumers.

Consumers can also benefit from the adoption of reverse production system in companies by reducing their total expenditure when buying or upgrading their electrical devices. Although

this stretches to social advantage, most consumers will be able to afford any electric product they need because they will be getting a discount or money from taking their devices which are no longer in use to the companies for recycling.

2.1.2. Social advantages.

The adoption of reverse production system in ICT companies can to create sustainable successful places that promote wellbeing by considering what people need, how they work and how they live as well Bouzguenda, Alalouch & Fava (2019).

As people will be spending less when buying electrical products from a company which uses reverse production system through trading and getting money from e-waste collection points. This results in the wellbeing in the sense that people will be able to afford electrical products they want which makes their daily life easy. For example, more people will be able to communicate well because they will be able to afford mobile phones through the reverse production system.

Increased job opportunities is the other benefit of adopting reverse production system in ICT companies. According to Beccarello and Foggia (2018), there has a significant increase in Job creation in the recycling industry whereby more people are now working informally collecting and sorting e-waste for urban mining. As a result of this, more people will be getting money through urban mining hence, improving their wellbeing and as well avoiding the exploitation of natural resources in the expense of future generation.

Conclusion

For ICT companies to implement reverse production systems, they need to adopt a reverse product cycle whereby end-to-life ICT products are recycled, re-used and re-purposed. To adopt this type of cycle, they need to use trading system and e-waste collection system. Companies must not only see the use of reverse production system as a way to improve environmental sustainability but also as an opportunity to be innovative. Not only does the implementation of reverse production drives innovation but also comes with environmental sustainability advantages. Minimum use of electricity during production, reduced e-waste disposal and mining of minerals are some of the environmental advantages of reverse production system. Moreover, companies are also well able to cut electricity costs and create more job opportunities as the use reverse production systems. This improves the economy of companies and human beings as they will be able to save more money as well as creating ways for gaining more money. Overall, as a result of more jobs created to recycle e-waste. More people will be able to afford basic needs such as food, shelter and clothing. Thus, implementation of reverse production systems comes with social sustainability advantages to improve well-being.

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