Circular Economy in Electronic Equipment Accessories

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Abstract

Technology has undergone a fast evolution nowadays, generating an increase in the global accessories market. Accessories add value to mobile phones. However, the raw materials and manufacturing processes are very harmful and non-modular, being hard to reuse them. It is noticeable that there is a lack of solutions that reduce the waste generated by electronic equipment accessories. On this scope, the current dissertation focuses on studying the implementation of product design within a circular economy perspective, developing new sustainable accessories using of some of the tools and frameworks presented in literature review. The methodology adopted was the five steps of UNLEASH by Delloite (2019) to develop a new product to assist the redesign of electronic equipment accessories and promoting circular economy and eco-design. The sequence of methods adopted allowed the development of a unique methodology. Its application to a real case study results in three final products - charger converter, charger cable, phone case – fully sustainable, that promote circular economy and eco-design, and are capable of being placed on the market. Moreover, the products ensure the improvement of the core problem through their modularity, and the recyclability of the materials.

Keywords: Circular Economy, Eco-Design, Electronic Products Accessories

1. Introduction

The continuous innovation and transformation of technology drives the increasing consumption of the electronic equipment market (Statista, 2020), having registered, in 2017, a total of 9.0 million tonnes of electrical and electronic equipment put on the market in the European Union. Unfortunately, not all EEE sets on the market are collected, treated, reused, or recycled. Several are thrown away with general trash and end up in a trash can, polluting the environment as they are not biodegradable (Eurostat, 2020). Among the various existing EEE are phones, which emerged, after the industrial revolution, from technological advances in electricity. Almost four decades after the insertion of mobile phones in the market, developed countries register at least 90% of this product penetration (Delloitte, 2017). These devices are no longer mere tools. They became intimate and personal objects, making people feel inadequate and uncomfortable without them (Ventä et al., 2008). The potential life span of a mobile phone (excluding batteries) is over ten years, but most users upgrade their phones around four times during this period (Osibanjo, 2008). All electronic equipment, including mobile phones, requires charging,

protection, and even add-ons such as headphones or power banks. These products represent the electronic equipment accessories market that grows with the increase of the mobile phone market. However, the raw materials used to manufacture these accessories are very harmful to the environment and are not biodegradable. Furthermore, it is hard to repair or exchange some parts and put them back on the market since most of them are built using non-modular processes. Therefore, it is necessary to create accessories that incorporate eco-design and the circular economy in their production process, making them more sustainable.

This paper is comprised by five sections. This section corresponds to the introduction of the paper and presents a contextualization of the problem. Section 2 summarizes the literature review on the available methods which are integrated in the five steps of the UNLEASH design process. Section 3 presents the proposed methodology. Section 4 includes the results of all the steps presented in the methodology and their respective discussion. Finally, section 5 presents the main conclusions and some recommendations for future research.

2. Literature Review

UNLEASH is a global innovation program created in 2017 that aim to form solutions that satisfy the United Nations SDGs (UNLEASH, 2020). This program proposes the UNLEASH Innovation Process, which promotes the development of ideas in compliance with the SDGs comprising five phases, depicted in **Figure 1**.

Figure 1: The five phases of the innovation process, adapted from (Delloitte, 2019a)

Problem framing is one of the most significant activities in solving design problems. It involves different levels and a high capacity for framing and reflection (Kvan & Sao, 2006). The problem framing phase was defined by Simon (1984) as the transition from an ill-defined problem to a well-defined and structured one. Kees Dorst (2011) defined a problem frame as a suggestion to deal with a complicated problem. There are other methodologies, namely the one developed by Karl T. Ulrich and Steven D. Eppinger (2016), which gives this phase the name of concept generation. This phase is responsible for identifying consumer needs along with the specifications needed to solve a problem founded (Ulrich; & Eppinger, 2016). Different methodologies and tools can be applied to assist in visualizing and structuring the problem (Madu et al., 2018), among them the problem tree, the mind maps, and the cognitive maps. To understand who is involved in the problem in question it is possible to use the consumer profile framework.

Ideation or idea generation, corresponds to the systematic process of creating ideas or solutions for a problem, following the requirements associated with it. This phase involves high innovation since any innovation process is based on a new idea (Dorow et al., 2015). Moreover, after generating ideas, it is necessary to select those that allow an alignment with the mission, vision, and values to be followed so that it is possible to turn an idea into a real

solution (Dorow et al., 2015). There are other methodologies, namely the one developed by Karl T. Ulrich and Steven D. Eppinger (2016), which gives this phase the name of concept generation. At this stage, different concepts should be evaluated based on different criteria. The needs of consumers and the relative strengths and weaknesses of the concepts must be considered. Finally, one or more concepts must be selected for further investigation or development (Ulrich; & Eppinger, 2016). In the ideation process tools could be used, such as brainstorming or six thinking hats. In the idea selection phase, methodologies could be used, such as RWW model, the Pugh Chart, or a multi-criteria decision analysis.

Prototyping is essential in developing innovative products, services, or systems and, therefore, must follow well-planned strategies (Camburn et al., 2017). The result from this process, the prototypes, can be physical or virtual if built from 3D modelling software. To be successful, a sustainable approach must be considered in the development process. The circular economy is a more sustainable model that allows maintaining the value of products, materials, and resources as long as possible in the economy and minimizing the generation of waste (Sarja et al., 2021). Therefore, eco-design seeks to systematically integrate environmental considerations in product and process design (Knight & Jenkins, 2009). The Design for Environment (DfE) concept includes the product development process considering its entire life cycle and its relationship with the environment to minimize or eliminate the environmental impacts of that product (Ulrich; & Eppinger, 2016). Additionally, in this phase, there are specific methodologies that assist in the elaboration of the sketch and the prototype, that are part of eco-design. The impacts of the materials or manufacturing processes to be chosen can be evaluated through a Life Cycle Assessment (LCA) or a Life Cycle Design Strategy (LiDS) wheel. The 3D modelling CAD tools currently allow the integration of non-geometric information in a purely geometric model. This tool allows the integration of characteristics from the sustainable methods used and the extraction of some information to carry out an environmental assessment.

The testing and refining consist not only of testing the prototype achieved, but also subjecting it to a process of successive improvements to the design and the refining process(Camburn et al., 2017). In this step it could be used the focus group, interviews, or scenario analysis.

According to the UNLEASH Innovation Process, the Implementing phase requires the production, dissemination, distribution, sale/commercialization of the solution defined for real customers (Deloitte, 2019). Two methodologies can evaluate the viability of the implementation of the product. Those are the business model and the risk management plan.

3. Methodology

Based on the design process proposed by the UNLEASH Innovation process, developed by Delloitte (2019) and the United Nations, the methodology followed corresponds to the application of different methods. This allows for better model validation, theory testing and better

collection of important information to be considered. **Figure 2** represents the methodology to be followed in the master's dissertation. The five steps are described below.

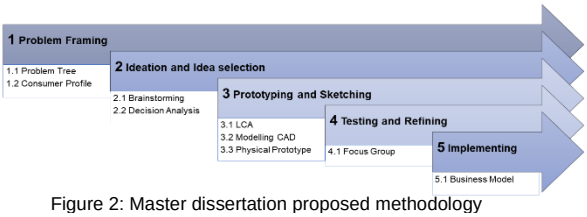

Figure 2: Master dissertation proposed methodology

Problem Framing: The objective of this phase is to define and understand the problem considering what the client/user wants. The problem tree is applied. A problem tree is a conceptual model that analyses the events that give rise to a problem (Zimmermann et al., 2008). It is represented in diagram form and built from the base to the top. Moreover, allows a clear visualization and understanding of the problem, guaranteeing a perfect distinction between causes and consequences. In contrast, mind maps are non-formal and difficult to use in complex problems, and cognitive maps result in a very complex diagram. To develop the problem tree, a group with two experts, one in sustainability and the other in circular economy and eco-design, will be created. The process should take five days to complete. First, each participant must record the possible causes for the excessive waste from electronic equipment accessories. Then, the group should discuss these causes and find the causes for the first ones, successively answering questions such as why? who? how?. The process ends when it is not possible to further develop the causes and find all the underlying problems associated with the core problem. After the group discussion the tree will be organized with causes inherent to the same problem, being organized in the same branch. Moreover, in this step, the consumer profile framework as proposed by Zhao et al. (2019) is applied. The survey was elaborated based on the questionnaire present in the master's dissertation "Sustainable footwear solutions for the scrap tire sector" (Gomez, 2020) and changed to obtain the required information. Its main objective was to collect data referring to the consumption of mobile phones accessories in general. However, a greater emphasis was placed on one type of accessory: chargers. It begins with an introduction and is divided into three sections, with a total of 13 questions. It is mostly composed of closed responses and it was determined 15 days to obtain answers. Also, two versions were distributed (an English and a Portuguese one) to increase the number of answers, and it was distributed online.

Ideation and Idea selection: Consists in the generation of several solutions that can solve the described problem and then the choice of the most viable alternative considering different criteria. The brainstorming technique is applied. The ideas presented must be of low frequency - new - original, and viable, which means that they should have a reasonable potential for application. For Hosam Al-Samarraie and Shuhaila Hurmuzan (2018), traditional or verbal brainstorming (TBS), allows for group environment ideas in which the elements are verbally shared. The brainstorming proves to be less restrictive than the six thinking hats framework. Two groups with clear notions and knowledge on the concepts of eco-design and eco-innovation will be created.

The ideas generated will only be shared at the end of the two brainstorming sessions. Therefore, using these ideas a muli-criteria decision analysis, as suggested by Hermann et al. (2007), is performed.

The multicriteria decision analysis (MCDA) methods are tools that assist in decision-making through criteria and their respective relative weights (Hermann et al., 2007). According to Bana e Costa & Chagas (2004) the MACBETH method will be used. This method is based on the use of the M-MACBETH software and allows to evaluate the impacts of the alternatives on different criteria, translating them into scores through the Additive Model. The RWW model proved to be inadequate since it is not an algorithm, and the Pugh Chart is a matrix with a basic scale that can result in a poor choice of criteria and bad decisions.

Prototyping and Sketching: This step comprises three activities. First, the choice of the most suitable materials for the final solution using the LCA method presented by Ferrari et al. (2021) and ISO 14040 (2006), through the SimaPro software. This software allows not only to easily model and analyse complex life cycles but also to measure the environmental impact of the product at all stages of the life cycle (SimaPro, 2021). The Life Cycle Assessment (LCA) is a tool that allows assessment of the environmental impacts of a product system, which includes its production, distribution, use, and disposal. This process results in the construction of a causal link between the operations carried out (HERTWICH, 2005). Then, the construction of the 3D prototype using a CAD system to ensure that the chosen dimensions and physiognomy are adequate, as suggested by Gaha et al. (2013) is performed. Finally, the fabrication of the physical prototype to be presented to potential users is done.

Testing and Refining: The goal of this step is to obtain feedback from potential users. A focus group is applied. The Focus Group approach involves the gathering of groups of people with similar backgrounds or experiences, to address a specific issue (Seal et al., 1998). Focus groups are group interviews that allow collecting qualitative data by discussing a predetermined topic provided by a moderator (Wilson, 2014). The focus group proved to be the most appropriate for allowing the intervention of several people simultaneously, by being more flexible, faster, and lower cost than the other methodologies like interviews and scenario analysis. First, the groups are dimensioned, and the people are chosen. Then, the sections are organized following a previously developed guide. Lastly, the information is analysed and summarized identifying the suggestions and the “big ideas” given by the participants.

Implementing: The final phase of the methodology is the elaboration of a business model. Since the objective is to introduce the final product within the scope of the circular economy, a circular business model canvas (CBM) will be used. The business model approach involves drawing up a plan responsible for the success or failure of a company. The innovation factor of the business models is crucial for the viability of the business guaranteeing its competitive advantage. These are defined as a model according to which the company creates, delivers, and captures value in a closed

material loop (Lewandowski, 2016). This type of business model, developed based on the principles of circular economy referred in the literature review, is an adaptation of the well-known Business Model Canvas (BMC) and consists of eleven building blocks: Value proposition, Customer segments, Channels, Customer relationships, Revenue Streams, Key resources, Key activities, Key partnerships, Cost structure, Take-Back system, and Adoption factors.

4. Results

The results obtained were established through the application of the methodology presented above. For each of the five phases, the methods and tools determined were implemented.

In the **problem framing phase** a problem tree and consumer profile were executed. The problem tree of excessive waste from electronic equipment accessories allowed to distinguish seven direct causes for this core problem and is represented in **Figure 3**.

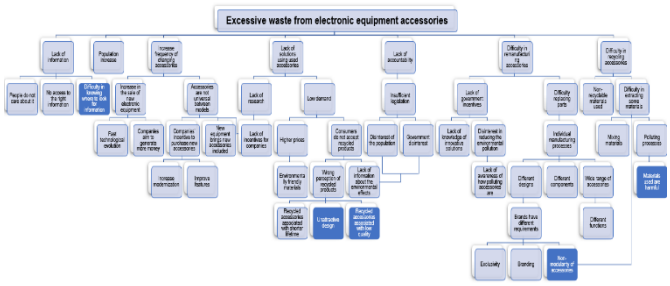

Figure 3: Problem Tree of excessive waste from electronic equipment accessories

The tree consists of seven levels of detail, with the first level corresponding to the excess of waste from electronic equipment accessories. To achieve this level issue each bottom level must be addressed first. Therefore, the solution must be a product that meets the five causes founded and represented in blue in **Figure 3**. These causes can be solved with the creation of a product to be marketed that uses sustainable materials, that are modular, and that allows consumers to stop associating products made with recycled materials with low quality, shorter lifetime, and unattractive design. The product should also contain in its label the necessary information for the consumer to understand not only the materials used but also the environmental problems that its use can avoid. From the survey carried out with 271 persons, 261 valid answers were gathered. After separating the survey results by gender, two consumer profiles were determined. Consumer 1: Portuguese male aged between 46 and 55 years old, who changes the mobile phone only when there is no repair possible. He has high environmental awareness in terms of electronic equipment accessories, and an essential accessory is a charger. This person considers very important that this accessory can be repaired. He is available to use accessories made from recycled materials and to recycle accessories, valuing the production of chargers with recycled materials and their quality and durability. He would be available to purchase a charger sold separately from the equipment that promotes a circular economy for a value between 10€ and 20€ (13.54€). Consumer 2: Portuguese female aged between 18 and 22 years old who changes the mobile phone only when there is no repair possible. She has high environmental awareness in terms of electronic equipment accessories, and the two significant accessories are a charger and a phone case. She is available to use accessories made from recycled materials and to recycle accessories, valuing the

production of accessories with biodegradable and recycled materials and their quality and durability. Also, she considers important the design and the price of the phone case. This person considers very important that the charger can be repaired. She would be available to purchase a charger sold separately from the equipment that promotes a circular economy for a price between 10€ and 20€ (14.53€).

In the **ideation and idea selection phase** two brainstorming sessions were done and the M-MACBETH software was used. Different alternatives based on eco-design and circular economy came up. From these ideas six were evaluated through de M-MACBETH software and in agreement with a decision maker. The alternatives were: 1.Universal phone case adaptable to different models of equipment using an extensible system. 2.Phone case that allows changing colours through a fitting system on the back. 3.Charger cable with multiple tops to be able to connect to different mobile phones. 4.Charger converter with a mechanism that allows to open the converter and subsequent recycling it external part. 5.Portable speakers capable of being adapted through a fitting system at the front side. 6.Expandable car holder adaptable to any mobile phone, with a plastic reduction in the main and capable of replacing the sideburns. Then, the criteria to be used were chosen. First, universality: **T**o develop a sustainable product, it must be as universal as possible not only to be acquired by more people but also to be adaptable to more equipment, resulting in a more durable product. Second, design conditions: Due to the problems found in the problem tree, one of the core problems is the non-modularity of the accessories. Moreover, the product must be more sustainable based on eco-design and circular economy and must be recyclable. This criterion classifies, through qualitative levels, each alternative using the combination of these two characteristics. Third, production cost: Since the price was considered the second most important feature when purchasing an accessory by the survey respondents, the production costs must be as low as possible to guarantee the appropriate profit, and a sale price which meets customer expectations. Fourth, importance of the accessory**:** Regarding the results and the decision-makers opinion, the larger the importance of an accessory, the higher its consumption. Fifth, features: For most respondents, quality and durability was the most important feature when purchasing all the accessories. After applying all the MACBETH process, the three most recommended options were charger converter, charger cable and phone case colours.

In the **prototyping and sketching phase** were evaluated the materials that should be used in the production of each of the three accessories through an LCA analysis. Three boundaries were selected. The geographical boundary is Europe since the product will be manufactured in Portugal, and the materials to be used must be collected from European suppliers to reduce transport impacts. The temporal boundary is subject to the useful life of the product, which depends on the use of each consumer, but which must be greater than three years because it is the average time between changing a mobile phone. The physical boundary is Gate-to-

Gate, which only includes the product manufacture impacts. Therefore, the materials extraction processes were not considered. Only the production of products was considered to allow a fairer comparison between the different materials and to simplify the analysis since this is a preliminary selection. Then, the defined functional unit was 1 kg of material. The comparison was made between virgin PP, recycled PP, and recycled nylon, using SimaPro software. The results of single score obtained are depicted in **Figure 4**.

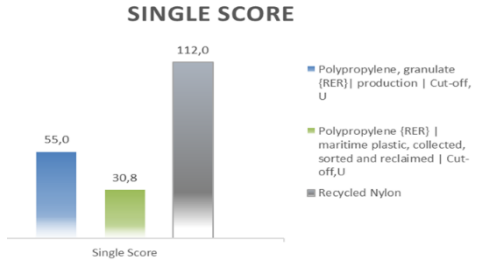

Figure 4:Single Score values for PP, Recycled PP and Recycled Nylon

It was concluded that recycled PP should be used in the accessories production. Then a virtual prototype was made for each of the products using a 3D CAD software – OnShape – and considering the dimensions of existing accessories. **Figure 5** depicts the virtual prototypes.

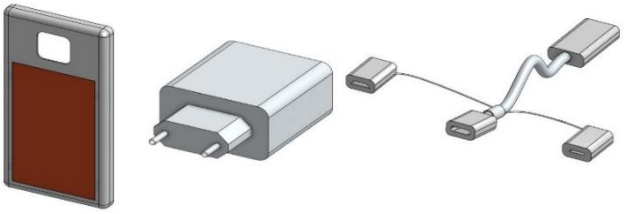

Figure 5: Charger converter, charger cable and phone case 3D prototypes

Regarding the virtual prototypes, in a conversation with an expert, it was concluded that the charger converter could be printed in 3D, for the cable charger it was possible to print the new plug-in parts, and the phone case colours were not possible to print. **Figure 6** represents the final prototypes.

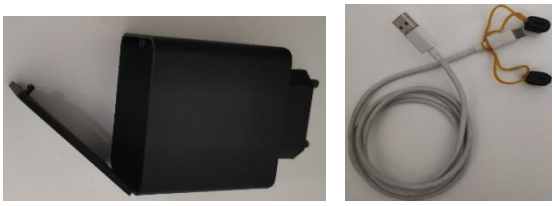

Figure 6: Physical prototypes

In the **testing and refining phase**, the prototypes were presented to possible consumers to validate the products through a focus group session. To have consistency between the answers provided in the survey and the insights from the focus group, the group was made up of women aged between 18 and 22 years and men aged between 46 and 55 years. The activity was divided into three different parts. The first part consisted on the presentation of the three prototypes, along with the introduction of the scope, materials, and objectives of the project. In the second part, the participants received the prototypes to touch and evaluate. Finally, some questions were asked about the three products, and feedback from the participants was obtained. Regarding the answers obtained, it is essential to improve the main points addressed which are mainly focused on product design. Although the survey revealed that price, quality, and durability are the most important characteristics, the focus group allowed to conclude that design is also an important factor and that it should be used to highlight these products in the market. Finally, it was concluded that the sustainability of the products is not enough to make them preferable to others.

Lastly, in the **implementation phase** a circular business model canvas was developed. The results are represented in **Figure 7**.

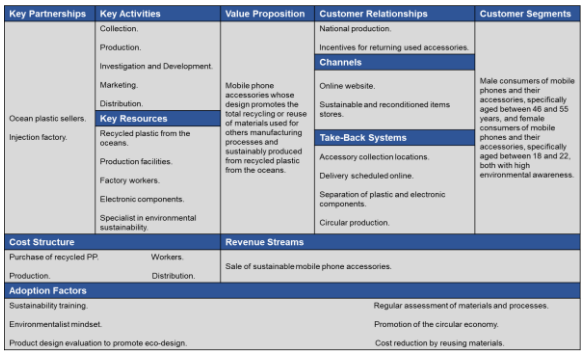

Figure 7: Circular Business Model Canvas for Electronic Equipment Accessories

Key Partnerships: Establishing a partnership with an ocean plastic supplier to obtain raw materials, that must be European and have high-quality plastic, and with a factory that must be National and use injection as a process. Key Activities: There are five activities: the collection of plastic from the oceans so that it can be sorted and treated, the production of accessories, from recycled PP, at appropriate factories, the investigation and development of product design, a marketing strategy that enables communication about the materials chosen and the processes adopted, and the distribution of both production materials and products that will be sold online or in stores. Customer Relationships: It is important to establish incentives for consumers to return damaged or old accessories so that they can be recycled, through discounts obtained when returning old accessories. Customer Segments: The accessories produced are indicated for male consumers aged between 46 and 55 years, and female consumers aged between 18 and 22, both with high environmental awareness. Since these profiles were obtained based on the results of the survey carried out, and these was obtained from a convenience sample, the results may be biased. Thus, the profiles obtained are not unique, and there may be others suitable for this problem that were not considered. Key Resources: Includes all materials needed for production, the factory, and the workers for manufacturing. The final accessories must always consider sustainable processes and materials. Also, their design must allow product circularity, so it is necessary to have a specialist in environmental sustainability. Channels: Initially, the products will be launched on the online market to reduce distribution costs and promote environmental sustainability. Then, the accessories should be sold in physical stores based on reconditioned and sustainable accessories and equipment sales. Take-Back System: In this system, customers are encouraged to return damaged or old accessories, through coupons given on delivery of used accessories and discounted when purchasing new accessories. The return of accessories will be made through the collection in specific locations whose delivery must be scheduled online. In these accessories, the electronic components are sent to landfills or repaired and the plastic components should be used again in other accessories. Thus, there will be a circular production by recycling the outer plastic or by reusing fixed accessories. Cost Structure: The costs considered refer not only to obtaining raw materials but also to the entire production and distribution process. Revenue Streams: Revenue is generated from the sale of the accessories produced. According to the focus group, it was realized that the consumers are willing to pay 15.75€ for a charger converter, 16.50€ for a cable charger, 13.00€ for a phone case, and 26.40€ if the charger converter and the charger cable were sold together. Adoption

Factors: The human resources involved both at the manufacturing and sales level must have regular training in sustainability and have an environmental mindset.

5. Conclusion

The excessive waste caused by mobile phones and their accessories is an urgent problem. In this dissertation, the mobile phone accessories market is studied, and a solution is presented. At all stages of development, the circular economy strategies and eco-design practices were considered ensuring compliance with this dissertation objectives - to develop a solution for electronic product accessories made with sustainable materials, and that promotes a circular economy. The objective of this dissertation was reached. Although, more work needs to be done. First, it is necessary to consider important issues regarding the consumer profiles defined. It was used a convenience sample, so the results may be biased. Therefore, in future research, a broader questionnaire must be designed to obtain results representative of the world population. Secondly, it is necessary to develop the main pain points obtained in the focus group. The design of the charger converter must be studied, making it possible to transform it into a more attractive product with smaller dimensions. In addition, a new design for the phone case should be considered, to be more attractive. Finally, the addition of one more USB port on the charger converter or changing the charger cable to allow simultaneous charging of different equipment should be studied. Thirdly, it is necessary to develop partnerships with key entities so that it is possible to obtain quality plastic. This project could represent an advance in the technological sector in terms of sustainable and circular growth.

References

Camburn, B., Viswanathan, V., Linsey, J., Anderson, D., Jensen, D., Crawford, R., Otto, K., & Wood, K. (2017). Design prototyping methods: state of the art in strategies, techniques, and guidelines. *Design Science*, *3*, e13. https://doi.org/DOI: 10.1017/dsj.2017.10

Delloitte. (2017). *Global mobile consumer trends, 2nd edition*. https://www2.deloitte.com/global/en/pages/technology-media-and-telecommunications/articles/gx-global-mobile-consumer-trends.html

Deloitte. (2019). *Overview of the UNLEASH Innovation Process*.

Dorow, P., Davila, G. A., Varvakis, G., & Vallejos, R. (2015). Generation of Ideas, Ideation and Idea Management. *Navus - Revista de Gestão e Tecnologia*, 51–59. https://doi.org/10.22279/navus.2015.v5n2.p51-59.248

Eurostat. (2020). *EEE put on the market and WEEE collected in the EU*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics_-_electrical_and_electronic_equipment&oldid=214948#EEE_put_on_the_market_and_WEEE_collected_in_the_EU

HERTWICH, E. G. (2005). Critical Review Life Cycle Approaches to Sustainable Consumption: A Critical Review. *ENVIRONMENTAL SCIENCE & TECHNOLOGY*, *39*. https://doi.org/10.1021/es0497375

Knight, P., & Jenkins, J. O. (2009). Adopting and applying eco-design techniques: a practitioners perspective. *Journal of Cleaner Production*, *17*(5), 549–558. https://doi.org/10.1016/j.jclepro.2008.10.002

Lewandowski, M. (2016). Designing the Business Models for Circular Economy—Towards the Conceptual Framework. *Sustainability*, *8*(1). https://doi.org/10.3390/su8010043

Madu, Adesope, O., And, & Ogueri, E. (2018). *APPLICATION OF PROBLEM TREE ANALYSIS IN SOLVING POVERTY RELATED ISSUES*. *13*. https://www.researchgate.net/publication/346059430_APPLICATION_OF_PROBLEM_TREE_ANALYSIS_IN_SOLVING_POVERTY_RELATED_ISSUES

Osibanjo, O. (2008). Material flows of mobile phones and accessories in Nigeria: Environmental implications and sound end-of-life management options. In *Environmental Impact Assessment Review*. https://www.sciencedirect.com/science/article/pii/S0195925507000789?casa_token=4Di4e_f1RMUAAAAA:pFFmI1b26nWtUv2d5cjrigTSJhGVbcWXHGVRGyuYpOYlVKsynBGV1Zmv_J06sGYC3YhMMpNn#fig4

Sarja, M., Onkila, T., & Mäkelä, M. (2021). A systematic literature review of the transition to the circular economy in business organizations: Obstacles, catalysts and ambivalences. *Journal of Cleaner Production*, *286*, 125492. https://doi.org/10.1016/j.jclepro.2020.125492

Seal, D. W., Bogart, L. M., & Ehrhardt, A. A. (1998). Small group dynamics: The utility of focus group discussions as a research method. *Group Dynamics: Theory, Research, and Practice*. https://booksc.org/book/21809215/4de727

SimaPro. (2021). *About SimaPro*. https://simapro.com/about/

Statista. (2020). *Consumer Electronics Report 2020*.

Ulrich;, K. T., & Eppinger, S. D. (2016). *PRODUCT DESIGN AND DEVELOPMENT*.

UNLEASH. (2020). *UNLEASH - A Global Innovation Program for the SDGs*. https://unleash.org/

Ventä, L., Isomursu, M., Ahtinen, A., & Ramiah, S. (2008). *"My phone is a part of my soul" – How People Bond with Their Mobile Phones*. https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4641353

Wilson, C. (2014). *Interview Techniques for UX Practitioners A User-Centered Design Method*. https://1lib.eu/book/2314104/5b4929