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Exploring Circular Economy in the context of IT Hardware: Sustainable Approaches and Stakeholder Incentives from the View of a Large Austrian Company

Masterarbeit

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Kurzzusammenfassung

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Schlagwörter:

Google, ACM-Computing, Classification, System

Abstract

The gradual transition towards the development of a circular economy model is highly essential to ensure sustainable growth, manage resource scarcity and mitigate climate change. This study primarily aims to explore the sustainable incentives and approaches by IT hardware manufacturers in the context of a large Austrian company. The research also attempts to explore and analyze the economic motivation associated with lifecycle management along with the potential differences across various product categories in the IT hardware sector. In order to gather in-depth information and valuable insights, the study takes a qualitative approach to answer the research questions. The study proposes to conduct in-depth semi-structured interviews with major stakeholders such as partner companies including manufacturers which are an essential part of the IT hardware supply chain. The study also suggests that purpose-oriented collaborative coordination among major stakeholders holds a central importance in enhancing the sustainability practices within the IT hardware management. The findings of this research can effectively shape the design and support the implementation of effective product lifecycle management strategies which can achieve industry and environmental goals through reducing environmental footprint, increasing profitability and improving sustainability practices in the IT hardware industry.

Keywords:

IT hardware, Circular Economy, Sustainability, Recycling

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1. Introduction

1.1. Background and Context

The global climate change is posing significant challenges to our planet and its inhabitants [1]. These alarming changes include but are not limited to rising global temperatures, glacial recession, catastrophic weather events, environmental pollution and habitat destruction [1]. In order to mitigate these environmental challenges, the European Union has directed a purpose-oriented attention towards the need for adopting a circular economy model which aims to resolve the challenges of resource scarcity and reduce the environmental footprint of anthropogenic activities [2].

Expanding on the component of circular economy, it aims to create and maintain a sustainable balance between resource consumption and economic growth by facilitating environmentally responsible resource consumption, minimizing the generation of waste and increasing the productive value of IT products [3]. Primarily, the circular economy model encourages the re-use, recycling and recovery of products towards the decline stage of their lifecycles [4]. The European parliament has designed an action plan that highlights efficient strategies that act as a guiding framework in transitioning towards a circular economy [5]. This action plan directs a primary focus towards the collaboration between major stakeholders to achieve the desired shared goals [5], [6].

In the same way, non-governmental organizations are aiming to promote and advocate sustainable operational procedures across the industries where these efforts attempt to develop effective and holistic frameworks for transitioning towards circular economy through achieving resource efficiency, waste reduction and promoting environmental and corporate responsibility [7], [8]. In the context of all these aforementioned efforts for a circular economy, there is unfortunately a lower rate of recycling and resource utilization in the IT manufacturing sector [9]. The statistical data from 2019 reveals that the global electronic waste was estimated to be 53.6 million tons which is primarily attributed to short product lifecycles, unsustainable resource use and product repair limitations [9]. Thus, it can be justifiably argued that the management of decline stage of IT hardware products is a substantial challenge for the IT industry [8], [9].

The successful integration of circular economy guidelines in the IT industry calls for analyzing the measures outlined by manufacturers to strengthen sustainable resource utilization. Due to the contrasting nature of IT hardware products, it is highly needed to explore any possible variations in recycling, re-use procedures or other sustainable approaches [9]. Symbiotic partnerships and collaborative efforts can potentially facilitate

in developing more effective strategies that address resource consumption in the IT industry [10].

1.2. Problem Statement

The alarming rise in the generation of electronic waste is a substantial challenge for large IT companies in the management of end-of-life IT hardware products and strengthening efficient resource consumption. The global electronic waste is primarily attributed to unsustainable consumption, inefficient use of resources, shorter lifecycles and repair limitations as mentioned in the earlier section [11]. Effective mitigation of these factors can potentially lead to sustainable resource utilization, an improved environmental footprint and sustainable operational procedures for the management of IT equipment [12].

Large companies are intense consumers of IT hardware products and therefore they are challenged by permanent IT demand. Consequently, they cause waste generation towards the end stage of a product's lifecycle [12], [13]. There is an ambiguity regarding the measures provided by IT hardware manufacturers to facilitate efficient resource consumption that aligns with the principles of circular economy [13]. The relevant scholarship reveals that 8.6 percent resources were used in 2020 which is a decrease from 2018 [13]. This signifies the need for further exploration to determine and strengthen sustainable resource consumption and support the transition towards a circular economy.

Along the same lines, there is no clear understanding regarding the lifecycle procedures for covering different product categories such as switches, firewalls, routers, servers and client devices such as computers, laptops and monitors which might need different lifecycle approaches [12]. Developing an understanding of these differences is pivotal for the implementation of efficient lifecycle management strategies and strengthening sustainable resource consumption [12], [13]. As mentioned in the earlier sections, sustainable coordination and partnerships can potentially encourage innovative strategies and redefine customer attitudes but the current situation of these collaborative partnerships is still unclear in the IT sector.

Bridging the aforementioned gaps and addressing the challenges is highly significant for large companies as they are challenged by unsustainable resource consumption, increased resource demand and high waste generation. Additionally, IT hardware manufacturers and partners along the supply chain could improve their strategy by having a better understanding by having insights and the perspective from a demand driven company.

1.3. Objectives

The major objective of this research is to explore the approaches of IT hardware manufacturers and outlined measures to facilitate effective recycling and re-use of their products towards the end stage of their lifecycle. This study will develop in the context of a large Austrian company which will act as a guiding framework for the international

IT industry. The study also attempts to investigate the economic incentives and other perspectives associated with these approaches and outline the potential variations in the recycling procedures across different IT product categories. The study will inform the development of effective strategies that aim to facilitate the transition towards a circular economy. Similarly, the study will also attempt to build an understanding of the current collaborative partnerships and the current incentives that aim to strengthen these partnerships.

1.4. Research Questions

The study will address the following research question to achieve the aforementioned objectives:

1. Which approaches and offerings do IT hardware manufacturers provide to ensure sustainable recycling of their products at the end of their lifespan in a company?
2. Which economic incentives and perspectives accompany these approaches?
3. Which differences exist in terms of recycling processes among different IT hardware product categories?

1.5. Scope and Limitations

The current study aims to investigate the approaches towards the circular economy in the context of a large Austrian company. The proposed study primarily aims to investigate and analyze the approaches and measured of IT hardware manufacturers that are employed to achieve sustainable and efficient recycling along with re-use of the IT hardware products towards the decline phase of their lifecycle. The study derives a primary focus towards the use and recycling or lifecycle management of multiple IT hardware products such as clients' devices, routers, servers and switches. Expanding further on the scope of this research, the investigation of approaches to IT hardware products lifecycle management can effectively guide and inform the future lifecycle management practices as it will effectively delineate the opportunities and challenges associated with IT products lifecycle management. The research includes questions about manufacturing, reverse logistics and effective usage of ressources.

Besides the scope of this paper, the findings and conclusions of this research has certain limitations such as focus on a single company. This might not effectively represent the whole IT hardware manufacturers due to difference in structural and operational procedures. It is also possible that the results can be influenced by the company's policies and its organizational environment. Therefore, it can be justifiably argued that the findings of this study might not be generalized to other IT hardware manufacturers and different contexts. Similarly, the qualitative nature of this study might result in biased and influenced information.

Along the same lines, the research derives a primary focus towards investigating the approaches and measures of IT hardware manufacturers for effective recycling along with economic incentives and other perspectives that are connected with these strategies. Additionally, the study aims to examine a large Austrian company in the current time. It should be noted that the evolving nature of technology and sustainability practices might decrease the relevance of this study in the future.

2. Methodology

2.1. Research Design

The proposed research employs a qualitative research design to investigate the subject matter and gather in-depth insights into the approaches and measures of IT hardware manufacturers for sustainable and effective management of their products at the decline stage of their lifecycle in a large Austrian company. In the context of this research, qualitative research facilitates the detailed investigation of research questions and effective collection of perspectives and experiences of the partner companies and manufacturers in the IT hardware lifecycle management.

2.2. Sampling Strategy and Participant Selection

Purposive sampling will be employed in order to select relevant participants who are knowledgeable and experienced in the IT hardware lifecycle management sector. The study participants will constitute major partners and manufacturers, who can effectively provide detailed information regarding the strategies, measures, challenges, opportunities and other activities related to environmental sustainability and circular economy. In order to ensure data density and gathering diversified perspectives, the sample size will be determined once no new information is obtained which will indicate the point of thematic saturation.

2.3. Data Collection Process

In-depth qualitative interviews will be used as the primary data collection tool along with relevant arguments from the current literature. Semi-structured interviews with open-ended questions will be held with the study participants in order to investigate the subject matter. Subject to the availability of participants, interviews will be either conducted in physical presence or through online communication. The interview questions will be informed by the research questions along with arguments from the current literature in order to ensure that all the components are sufficiently addressed. Audio from the interviews will be recorded and transcribed with participants' consent.

3. Findings and Analysis

3.1. Presentation of Interview Data

The qualitative data for this study will be collected through semi-structured qualitative interviews with participants selected through purposive sampling as mentioned in the earlier section. Key findings will be described and similarities as well as differences across interview partners will be highlighted.

3.2. Anticipated Findings

Based on the inferences from current literature, the proposed research methodology is anticipated to reveal a plethora of valuable insights delineating the approaches and measures of IT hardware manufacturers for effective recycling along with the associated economic incentives and difference in recycling processes for various categories of IT hardware products within a large Austrian company. With the help of qualitative interviews with major stakeholders, it is expected to obtain a detailed understanding of the procedures implemented by the IT hardware manufacturers to strengthen effective lifecycle management and facilitate the transition towards circular economy. These procedures might include eco-friendly design strategy, collaboration with certified recyclers, taking-back initiatives and prescribed guidelines for eco-friendly waste management.

4. Significance and Potential Contributions

This chapter delineates the potential significance and contributions of the study for the approaches and measures of IT hardware manufacturers for effective recycling, associated economic incentives and variations in recycling procedures for various IT hardware categories within a large Austrian company.

4.1. Significance

The proposed research holds substantial importance as it aims to address the urgent need for sustainable resource consumption and efficient IT hardware lifecycle management strategies. Through exploring the approaches and measures of IT hardware manufacturers, this study attempts to facilitate the development of circular economy procedures and facilitate a transition towards circular economy. From an environmental perspective, this research can potentially reduce the environmental footprint of IT industry and support preserving the environment.

4.2. Potential Contributions

This research can effectively contribute to the enrichment of current knowledge and improve the operational procedures of the IT industry. The anticipated results can effectively bridge the identified research gaps in developing an understanding of the approaches and measures of the IT hardware manufacturers to improve their product lifestyle management practices. The provision of in-depth and valuable insights into economic incentives along with the varying recycling techniques for different IT hardware product categories can effectively strengthen the understanding of IT hardware lifecycle management practices. It can be justifiably argued that the contributions of this research can be extended beyond the context of Austria to the international IT industry where the findings of this study can effectively improve the decision-making process and guide other industries in implementing sustainable practices in their product lifecycle management procedures. Along the same lines, the economic incentives can encourage companies to invest in sustainable industrial practices that aim to support the transition towards a circular economy.

4.3. Implications

The expected findings of this research study have profound implications for the operational procedures and corporate success of the IT hardware manufacturing industry. This study will identify approaches of the IT industry to recycling, re-use and effective lifecycle management of IT hardware products which can potentially strengthen the lifecycle management practices of other companies operating in either similar or different domains. Implementation of strategies like take-back programs, eco-friendly design, and effective waste management can lead to sustainable resource consumption and decrease waste generation. Additionally, the economic incentives that are linked with sustainable industrial procedures infer the economic opportunity of reducing costs and increasing profitability. Industries can effectively use these incentives and integrate sustainable practices to facilitate their transition towards a circular economy. Similarly, the comparison of recycling procedures for different IT hardware product categories can help companies in designing and implementing specifically designed strategies that consider the resource availability, technical challenges, recycling needs and security aspects of each product category.

5. Conclusion

The increasing environmental footprint of the industry and unsustainable resource consumption patterns are driving the shift towards a circular economy model. In the context of IT Industry, the proposed research aims to explore the approaches of IT hardware manufacturers for effective and sustainable recycling, economic incentives and variation in recycling techniques for different IT hardware product categories. The anticipated findings are likely to highlight effective and sustainable lifecycle management strategies such as eco-friendly design, taking-back initiatives and safe waste management techniques which will facilitate the integration of sustainable practices and a smoother transition towards circular economy. Similarly, specifically designed recycling procedures will help in effective resource allocation and sustainable resource consumption according to the needs of every IT hardware product category. The proposed research effectively strengthens the understanding of IT hardware lifecycle management procedures and facilitates the integration of sustainable practices in the IT industry's operational procedures. The proposed research holds high relevance for companies who seek to improve their product lifecycle management procedures. The integration of sustainable practices and circular economy principles can effectively contribute to the reduction of industry's environmental footprint and increase revenue generation.

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A. Anhang: Mein toller Code

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B. Anhang: Meine tollen Transkripte