Behavioral Insights into Personal Electronics Repair

Accelerating the Swedish Transition to a Circular Economy

Mariana Ivette López Dávila

Thesis Advisor:

Carl Dalhammar, Ph.D.

Thesis for the fulfillment of the
Master of Science in Environmental Management and Policy
Lund, Sweden, May 2021

Acknowledgements

Mariana López Dávila, IIIEE, Lund University

Abstract

Sweden is actively seeking to scale up repair activities as part of its strategy to reduce waste, transition to a circular economy, and achieve zero net emissions by 2045. In the last couple of years, several new policies to promote consumer repairs have been adopted or proposed in Sweden. However, very little is known about the socio-cultural and individual factors that shape people's decision to repair their personal electronics. This thesis addresses this gap by applying behavior theory to comprehensively study the factors shaping and influencing people's decision to repair their personal electronics. The study followed a mixed-method research design involving 19 semi-structured interviews and an online questionnaire answered by 190 participants. The interviews and questionnaires were conducted with individuals residing in Sweden and were based on Triandis' theory of interpersonal behavior.

The study revealed that intention and habits determined repair behavior and that social norms, attitudes, and feelings about repair determined participants' intention to repair. Moreover, the interviews and questionnaire uncovered that, in general, attitudes and social norms about repair do not encourage repair behavior and that the physical environment is filled with barriers that discourage people from repairing their broken electronics. Therefore, the study concluded that to scale up repair activities, it is essential to improve the perceived individual benefits of repair, strengthen social norms to make repair the expected solution for broken personal electronics, shape repair habits, and lower contextual barriers. The implications of these findings and specific policy recommendations are discussed.

Keywords: repair; electrical and electronic equipment; theory of interpersonal behavior; circular economy; Sweden

Table of Contents

Figures

Tables

Appendix figures

Glossary of Key Terms

The following glossary defines key concepts used throughout this thesis.

Affect[1]	Refers to the emotional system of an individual. It is the feelings of joy, elation, pleasure, depressions, disgust, displeasure, or hate associated by an individual with a particular act.
Attitude[1]	An idea, charged with affect, that predisposes a class of actions to a particular class of social situations.
Behavior[1]	Broad class of reaction by an organism to any stimuli.
Behavioral intentions[1]	Instructions that people give to themselves to behave in certain ways. They involve ideas such as "I must do X" "I will do X" and "I am going to do X".
Beliefs about outcomes[1]	The affect attached to a consequence. For example, the act of saving is connected with a positive value. Then this value is likely connected to the broader and more abstract values, such as the value of "comfortable life".
Consumer	In this study, consumers are individuals residing in Sweden that have purchased and used personal electronic devices.
Evaluations of the outcomes[1]	The perceived consequence of an act. For example, being healthy might be perceived as a consequence of exercising daily.
Facilitating conditions[1]	Objective factors "out there" in the environment that several observers can agree make an act easy to do. A person may intend to do something but be unable to do it; the geography of the environment may prevent the act.
Habits[1]	Situation-behavior sequences that are or have become automatic so that they occur without self-instruction. The individual is usually not "conscious" of these sequences.
Norms[1]	Self-instructions to do what is perceived to be correct and appropriate by members of culture in certain situations.
Personal electronics	In this study, personal electronics are defined as computers, tablets, printers, electronic watches, music equipment, calculators, cellphones, televisions, projectors, digital cameras, electric toys, videogames, and sports machines.
Roles[1]	Concerned with behavior that is considered correct or appropriate for persons holding a particular position in a group, society, or social system.
Self-concept[1]	Behaviors that people consider appropriate for themselves. Self-instructions to behave in particular ways.

---

[1] Cited from Triandis, 1977

Executive Summary

Introduction

There is sound evidence to assert that electronic products (e-products) are causing significant environmental impacts in our natural world (Laurenti et al., 2017; Lavers Westin et al., 2019). In fact, in Sweden alone, e-products are hot-spot products of urban consumption responsible for between 14 and 58 percent of the total urban emissions causing climate change, acidification, eutrophication, ozone formation and resource use (Lavers Westin et al., 2019). For most personal electronics, the biggest environmental impact happens in the extraction and manufacturing phases, therefore extending their life through repair will generally result in environmental gains (Bachér et al., 2020; C. A. Bakker & Schuit, 2017; Parajuly et al., 2019; Rudenauer & Prakash, 2020). Beyond the environmental benefits, repair also promises to boost local economies (European Commission et al., 2018; King et al., 2006; Llorente-González & Vence, 2020; Mitchell & Morgan, 2015) and bring back a lifestyle centered on caring for our belongings (Bovea et al., 2017; Montalvo et al., 2016).

Both in policy and academia, repair is increasingly referred to as a preferred strategy to extend the life of electronics and achieve circularity (Almen et al., 2020; C. A. Bakker & Schuit, 2017; EEB, 2019; Wieser & Tröger, 2018). However, despite the increased interest in repair demonstrated by the surge in both policies and publications on the subject, there is a lack of understanding of the behavioral factors that shape repair behavior in Sweden (see section 2.1). Instead, repair policies that target consumer behavior are reduced to information provided through manuals and eco-labels (see section 2.1.4). While existing literature has overwhelmingly focused on understanding contextual barriers to repair, such as cost, access, product design, information provision, and guarantees (see section 2.1.3). This is problematic since research shows that behavior is complex and multidimensional, governed by norms, emotions, habits, attitudes, and context (Jackson, 2005; Triandis, 1977). Thus, information provision alone is unlikely to be effective, and a more comprehensive conceptualization and understanding of the factors that shape behavior is needed to successfully design effective behavior-change policies that promote the repair of electronic devices. This thesis addresses this gap by applying consumer behavior theory to comprehensively study the factors shaping and influencing people's decision to repair their personal electronics.

Objective and research questions

This thesis aims to gain behavioral insights into personal electronics repair in Sweden to provide recommendations for scaling this behavior and thus accelerate Sweden's transition to a circular economy. The research questions (RQs) that guided this study are the following:

RQ 1 – What are the behavioral factors that shape consumers' decisions to repair their personal electronics?

RQ2 - Which behavioral factors explain the variance in the frequency of repair? Which factors explain the variance in the intention to repair?

RQ 2a - Are there any significant differences based on demographic characteristics?

Theoretical framework

This thesis is guided by Triandis' Theory of Interpersonal Behavior (TIB). Under TIB, Triandis proposes that behavior is shaped by three overarching factors: Intentions, the strength of habits, and the facilitating conditions that enable or hinder a behavior (see Figure 0-1Figure 0-1. Triandis theory of interpersonal behavior). Triandis theorizes that depending on the type of behavior, situation, or person, the weights of the components of his model will shift (Triandis, 1977). For example, for new, unlearned social behaviors, intentions determine a behavior. However, once the behavior has been repeated multiple times and has been rewarded or punished, the behavior becomes automatic and is determined by habits. Finally, the influence of habits and intention on behavior is moderated by the presence or absence of facilitating conditions (Triandis, 1977).

Figure 0-1. Triandis theory of interpersonal behavior
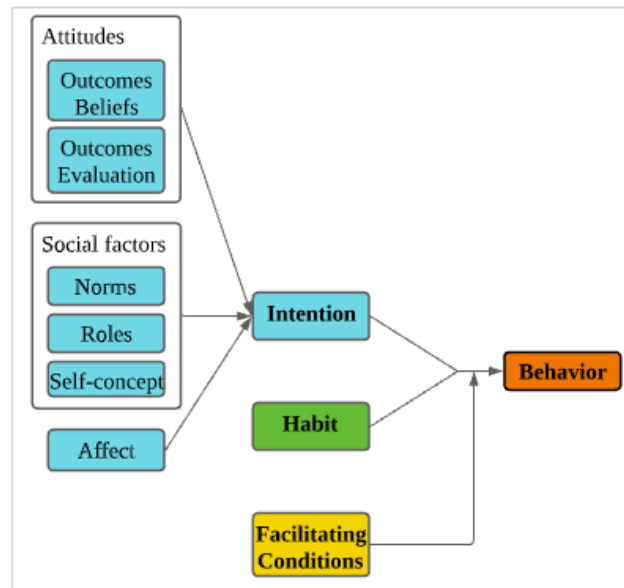
Source: Jackson, 2005 and Page & Sherif, 1980

Research design

This thesis followed a mixed-methods design, including 19 semi-interviews with Swedish residents and an online questionnaire answered by 190 Swedish residents. The interviewees were selected using quota sampling to provide a wide range of perspectives and opinions. The questionnaire participants were selected through convenience sampling based on the author's network. NVivo 10 software was used to conduct thematic analysis on the qualitative interviews. The software IBM SPSS 27 was used to conduct descriptive statistics, Spearman's rank-order correlation analysis, binomial logistic regression, and Mann-Whitney U and Kruskal-Wallis H tests on the questionnaire data. To adequately test Triandis' TIB model, correlation and regression analysis were conducted in two steps: Step 1 examined intentions to repair, and Step 2 frequency of repair behavior. See logic in Figure 0-2.

Figure 0-2. Statistical analysis steps

Key findings

Research question 1

Attitudes: Repair has a tainted image. Although people think repair is beneficial for the environment, the economy, and society as a whole, they think it is complicated, time-consuming, and expensive.

Social Factors: Repairing broken personal electronics is seen as something people "should" but as something they "must" do. The prevalent norm is to replace broken personal electronics without trying to repair them.

Affect: Professional repairs are associated with negative emotions such as frustration, uncertainty, and stress, especially for participants under 26 years old who reported more negative feelings than other groups. Conversely, emotions for those who self-repair are more optimistic, including excitement, fun, and satisfaction.

Habits: About half of the study participants claimed to try to repair their personal electronics when they break. Most participants also said they remember growing up in households that repaired personal electronics when they broke.

Facilitating conditions: To create the optimal conditions to repair personal electronics, participants wished to have the following facilitating conditions in place:

- <u>Contextual.</u> Repair should be as easy and convenient as buying new. Repair shops should be more visible, the entire repair process should happen online, and repair technicians should be more encouraging. The cost should be transparent, lower than the cost of replacing, and the guarantees should be as good as those of new devices. Consumers should know what to expect upfront and have access to information about repairability and maintenance.
- <u>Cultural.</u> To increase their engagement with repairing personal electronics, participants want others to be doing it. They want society to tell them it is important to repair and encourage them in the same way they have been encouraged to buy secondhand, eat less meat-based products, bring their bags to the supermarket, and take the train instead of the plane. They want to know their friends and colleagues are repairing to hear about their experiences and get their recommendations about the good repair shops.

Research question 2 and 2a

Intention to repair. Regression analysis revealed that intention to repair is determined by social norms, evaluations about the outcomes of repair (i.e., you think repair will result in your device working as well as new), and emotions evoked by the process of repairing a device. Participants who believed there was an expectation of repairing broken electronics and/or reported positive evaluations about repair outcomes were more likely to report high intentions to repair their broken electronics. Participants who reported neutral or negative emotions associated with the process of repair were more likely to report high intentions to repair. Correlation analysis uncovered that the more positive participants' attitudes, social norms, and affect were, the higher the intention to repair broken electronics they reported.

Repair behavior. Regression analysis revealed that repair behavior is determined by intention to repair and habits. Participants who reported high intentions to repair and strong repair habits were more likely to report high frequencies of repair behavior. Facilitating conditions did not explain repair behavior. Correlation analysis uncovered that the higher the intention to repair and the stronger the habit, the more frequently participants reported repairing broken devices.

Group differences: The study found that people ages 42 and older have more positive feelings towards repair than those ages 26 and younger, who, on average, reported negative and neutral emotions.

Conclusions

The prevalent norms for broken personal electronics do not favor repair behavior. Therefore, to scale personal electronic repairs, it is key to change the social norms for broken electronic devices to favor repair over buying new.

The existing perception that repair is complicated, time-consuming, and expensive does not encourage repair behavior. This is important because attitudes are key in shaping people's repair intention and behavior. Therefore, to encourage repair it is essential to improve the perception of the individual benefits of repairing personal electronics.

Repair is a habitual behavior. Therefore, understanding how to encourage and shape repair habits is essential to scale up repair activities of personal electronic devices.

Facilitating conditions of repair should not be dismissed. The overrepresentation of people with pro-environmental values in this study could explain why facilitating conditions did not explain repair behavior. Facilitating conditions should be improved since it can be assumed that other types of consumers who were not captured in this study would engage in repair if there were no significant contextual barriers.

Recommendations

Based on this research, policymakers should consider the following measures:

Make repair the norm for broken personal electronics. Efforts to promote repair need to focus on normalizing repair activities. Examples of interventions that could contribute to establish repair as an expected behavior include: fund and develop media campaigns to promote repair, introduce principles of electronics repair to high school curriculums, regulate advertising to ban promotion of early renewals and promote longer use (HOP, 2020), introduce mandatory repairability and durability labels in personal electronics (HOP, 2020), and adopt the repairability criteria proposed by the European Union green public procurement guidelines.

Adopt regulations to increase the value of personal electronic repairs. Policymakers need to step in to create a conducive environment for repair services to flourish and thus change the current perception that there are not many individual benefits to repairing personal electronics. Some recommendations include: require producers to create repair funds as part of anti-waste laws (HOP, 2020), push for adopting and implementing right to repair legislation, and extend Ecodesign regulations to cover personal electronic devices and include criteria to limit software obsolescence (HOP, 2020).

Introduce habit-shaping interventions. These should establish: 1) context cues that trigger the desired habit, 2) incentives to encourage the desired actions, and 3) conditions that promote memory associations between the action and the environment. For example: work with repair business to establish repair shops in recycling centers, distribute repair vouchers to lower the price of repairs (Piringer & Schanda, 2020), and make guarantees force manufacturers prioritize repairs over replacements when products fail.

Design tailored interventions based on consumer profiles. Conduct a market segmentation study to categorize consumers of personal electronics based on their willingness and readiness to engage with repair. Use this typology to develop public policy interventions that caters to their needs and characteristics.

1. Introduction

It is impossible to ignore that the consumption patterns of high-income countries are responsible for a large proportion of today's most pressing environmental challenges (Fauré et al., 2019). In Sweden, consumption-based environmental impacts are higher than production-based ones (Fauré et al., 2019). Given Sweden's heavy reliance on imported goods, more than half of the environmental pressures embedded in the products they consume occur abroad (Fauré et al., 2019). The commonsense strategy to mitigate these environmental pressures is to extend products' lives through repair, since controlling production processes abroad is highly cumbersome and often unrealistic. Therefore repair is of high relevance for the environment and society.

When it comes to unsustainable consumption, cities are the epicenters. Worldwide, cities are responsible for between 60 to 80 percent of global resource use and energy consumption and for up to 70 percent of global greenhouse gas (GHG) emissions (UN Habitat, 2016). To change this unsustainable pattern, governments must understand cities' consumption footprints in detail, including which product groups are the biggest polluters (Prince project, n.d). In Sweden, Lavers Westin et al. (2019) quantified the environmental impacts of Swedish urban consumption. They measured five environmental impacts of 71 product types from cradle to gate and found that electronic products (e-products) are a hotspot product group responsible for between 14 to 58 percent of the total environmental impact on all categories (see Figure 1-1 below) (Lavers Westin et al., 2019).

Figure 1-1. Urban environmental impact of Swedish consumption by product group and environmental category

<div align="right">
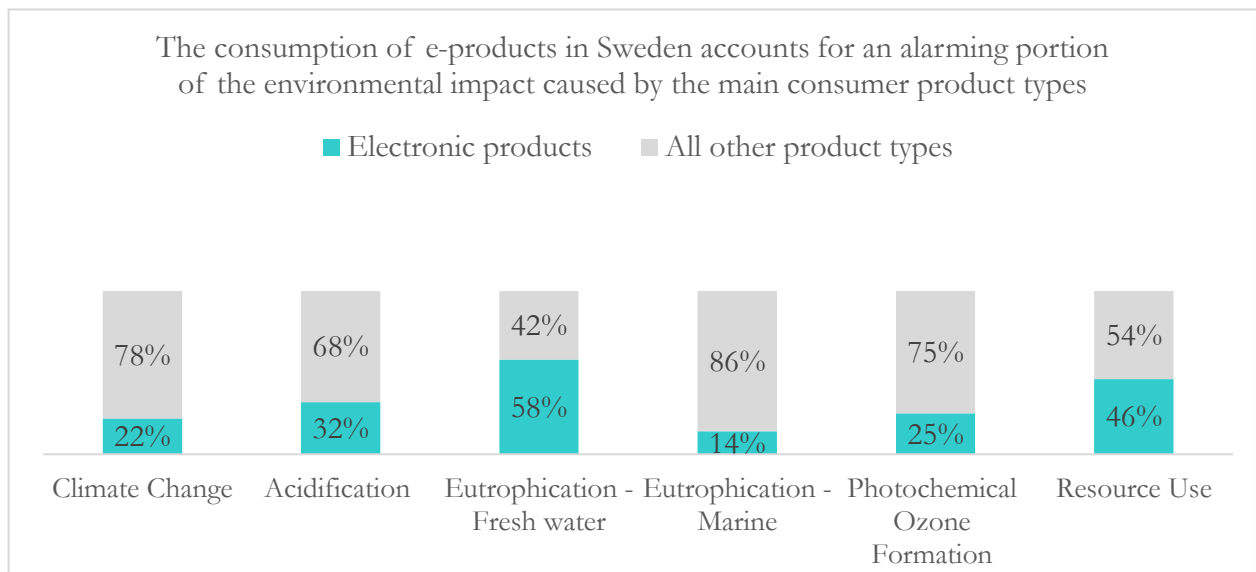
Source: Lavers Westin et al., 2019

</div>

Worryingly, the demand for e-products and the generation of e-waste in Sweden has grown exponentially over the past decades (Forti et al., 2020; Kalmykova et al., 2016). Between 1996 and 2014, the demand per capita for small and large household appliances increased by 100 and 80 percent, respectively (Kalmykova et al., 2016). As of 2018, Sweden was amongst the top six consumers of e-products at over 26 kg per year per capita (Bauer et al., 2018). When it comes to waste generation, e-waste is the biggest growing waste stream in Sweden (Forti et al., 2020). In fact, according to the 2020 Global E-waste Monitor, Sweden ranks second in terms of annual e-waste generation in the world, with an average of 20.1 kg per year per capita.

For most personal electronics, the lion's share of the environmental impact happens during the extraction and manufacturing phases (HOP, 2020; Parajuly et al., 2019). Therefore, one of the fastest and most effective strategies to mitigate their environmental impact is to prolong their use through repair (EEB, 2019). Repair, which is defined as the act of putting something damaged, faulty, or worn back into a good condition, has been a common practice in societies worldwide for millennia (Cambridge University Press, n.d.). However, it has recently received heightened attention as the circular economy (CE) concept gained traction in the European policymaking arena. The CE concept was born as an alternative to the current linear model of consumption which has a "take-make-dispose" nature and assumes access to resources is unlimited (Ackermann, 2020). In contrast, the CE acknowledges that the earth's resources are finite and aims to create *"a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops"* (Geissdoerfer et al., 2017. p.759).

To minimize resource inputs and the generation of waste and emissions, the CE proposes creating a closed-loop system that employs durable design, reuse, sharing, repairing, refurbishment, remanufacturing, and recycling to keep materials in use for longer (Geissdoerfer et al., 2017). The Ellen MacArthur Foundation (EMF) has famously visualized the basic principles of the CE in their butterfly diagram (see Figure 1-2). This diagram shows how biological and technical resources should flow in a CE. There are two CE principles worth highlighting: the power of the inner circle and the power of circling longer. The power of the inner circle explains that the tighter the circle, the more significant the economic, social, and environmental savings (EMF, 2013, p. 30). In order words, the CE prioritizes repair and reuse over refurbishing and recycling. The power of circling longer refers to the gains that stem from avoiding virgin material use by keeping goods circulating for as long as possible (EMF, 2013). These two principles, as well as the basic premise of the CE, are elegantly described by Stahel (2007), who said: *"do not repair what is not broken, do not remanufacture something that can be repaired, do not recycle a product that can be remanufactured"* (p.10, cited in Ackermann, 2020).
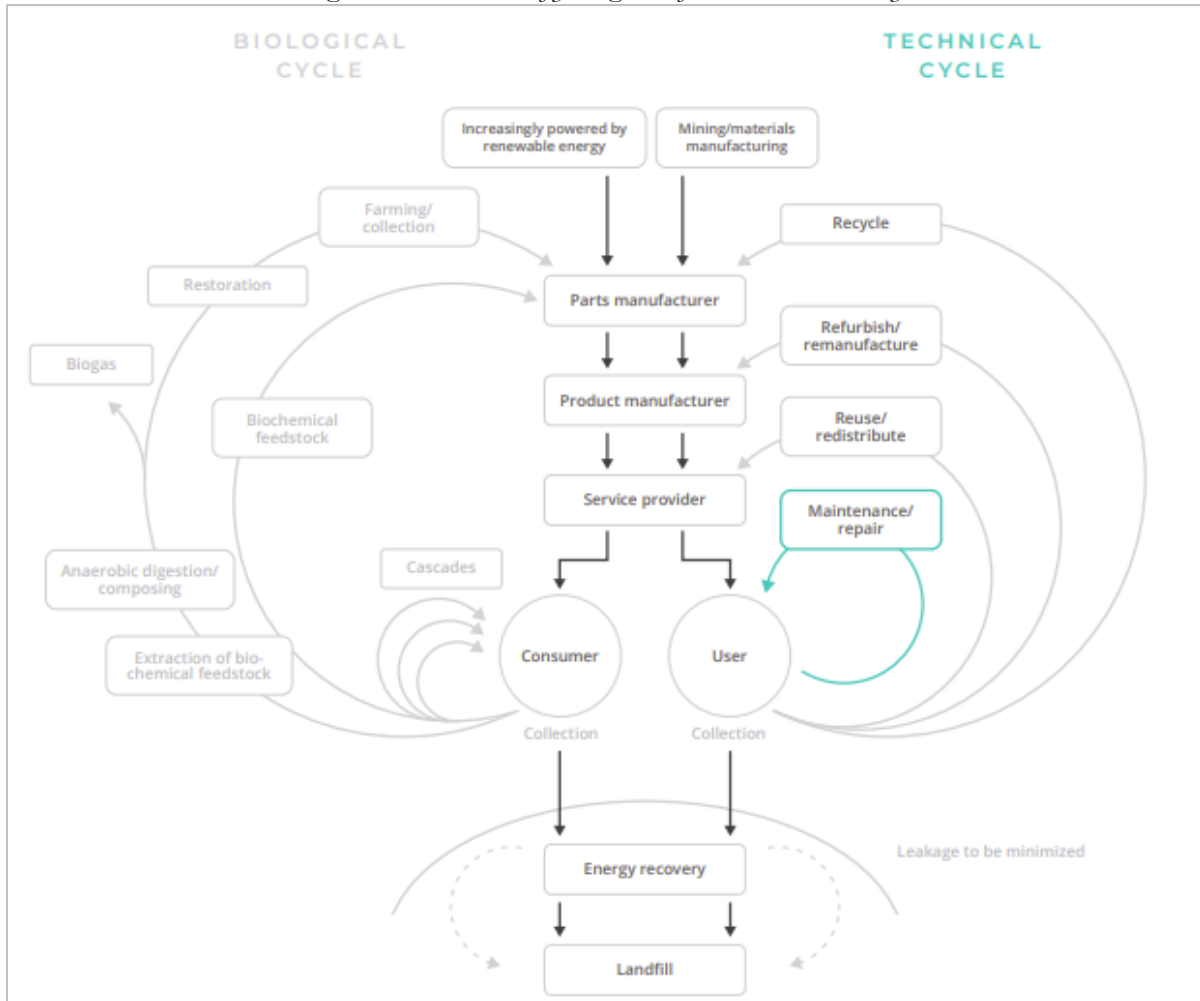
As repair belongs to the innermost circle, it is a crucial strategy for successfully transitioning to a CE and addressing Sweden's environmental challenges. In the 2020 National Strategy to Transition to a CE, Sweden acknowledges the importance of repair and recognizes that consumers play a central role in scaling repair activities. The strategy devotes an entire chapter to calling for "*sustainable ways of consuming and using materials, products and services*" and explains that specific policy measures to incentivize sustainable consumption will be outlined in upcoming action plans (Ministry of the Environment, 2020, p.16). The overall direction the government anticipates taking involves: improving consumer information; creating conditions for a wider demand for and supply of services for repair, reuse, and sharing; promoting business models that increase the lifespan, repairability, and reusability of products; making it profitable to repair, reuse, and share products; and leveraging public procurement to promote all the areas stated above (Ministry of the Environment, 2020, p. 21).

1.1 Problem definition

The demand for e-products and the generation of e-waste in Sweden has grown exponentially over the past decades. In fact, Sweden is one of the largest consumers of e-products and producers of e-waste per capita in the world. From an environmental perspective, it is instrumental to prolong the lifetime of personal electronics, as the largest lifecycle impacts happen in the extraction and production phases. For this reason, stimulating repairs of these products is a key strategy in efforts to realize a CE. In the last couple of years, several new policies to promote consumer repairs have

been adopted or proposed in the European Union (EU) and Sweden. However, the consumer perspective, especially on consumer engagement with e-product repairs, has not received much attention (Ackermann et al., 2018; Cerulli-Harms et al., 2018; Raihanian Mashhadi et al., 2016; Scott & Weaver, 2014; Wieser & Tröger, 2018). Understanding the behavioral factors that shape consumers' decisions to repair faulty personal electronics is necessary for policymakers to design effective policies to incentivize consumer repairs. This is especially relevant for Sweden, where individuals face several barriers when considering whether to invest in repairs. For example, contextual barriers (e.g., cost, time, access), product-related barriers (e.g., legal/commercial guarantee, product design, obsolescence), socio-cultural barriers (e.g., norms, social support), and individual barriers (e.g., attitudes, interest, past experiences with repairs)[2].

To date, much of the existing literature on repair of e-products has focused in understanding contextual and product-related factors while very little is known about the socio-cultural and individual factors that shape people's decision to repair their personal electronics. Only focusing on contextual and product-related factors is important but insufficient since it has been widely acknowledged that behaviors are influenced by more than just external factors (see Jackson, 2005 for a detailed overview of consumer behavior theory). Moreover, consumer behavior theory has very seldomly been applied to understand repair behaviors. In contrast, consumer behavior theory has been widely applied to explain and predict other pro-environmental behaviors such as upcycling (Sung et al., 2019; Terzioğlu, 2021), product care (Ackermann, 2020) sustainable food consumption (Shin & Hancer, 2016; Vermeir & Verbeke, 2008), sustainable farming (Boazar et al., 2019; Vande Velde et al., 2015), waste recycling (K. Chan, 1998; L. Chan & Bishop, 2013) and travel mode choice (Bamberg & Schmidt, 2003; Domarchi et al., 2008).

This study will fill in this research gap by applying consumer behavior theory to study the behavioral factors that influence people's decision to repair their personal electronics. Using behavior theory provides the possibility to explore repair behavior more comprehensively and test the strength of the different factors that influence repair decisions. This knowledge will allow policymakers to rank the factors that influence repair behaviors and identify concrete intervention points to effectively incentivize consumers to engage with this practice. In this way, this study accelerates the implementation of Sweden's CE strategy and supports Sweden's overall environmental goals.

1.2   Objective and research questions

This thesis aims to gain behavioral insights into personal electronics repair in Sweden to provide recommendations for scaling up e-product repairs in order to accelerate Sweden's transition to a CE. Through a mixed-method research design involving semi-structured interviews and an online questionnaire based on Triandis' theory of interpersonal behavior, this thesis will uncover the behavioral factors that shape e-product repairs and explore which factors have the biggest influence on people's decision to repair their personal electronics. Therefore, the research questions (RQs) are as follow:

RQ 1: What are the behavioral factors that shape consumer's decisions to repair their personal electronics?

RQ 2: Which behavioral factors explain the variance in the frequency of repair? Which factors explain the variance in the intention to repair?
2(a): Are there any significant differences based on demographic characteristics?

---

[2] See Chapter 2: Literature Review section 2.1.3 for references on barriers to e-product repairs

Through these research questions, this thesis seeks to address the current lack of understanding of consumer repair behavior and to leverage this knowledge to provide policymakers with recommendations to motivate sustainable consumption practices.

1.3 Scope and delimitations

The geographical scope of the study is in Sweden. The reason for this focus is twofold. On one side, there has been an increased interest in scaling-up repair practices in Sweden, and, as shown in the introduction, e-products represent the highest share of consumption-based emissions in Swedish cities. Therefore, this research topic is very relevant to Sweden. On the other side, Sweden was chosen because the author had good access to data.

Moreover, the population of interest is e-product consumers, which the author defines as an individual currently residing in Sweden that has ever purchased and used personal electronic devices.

Finally, this thesis will exclusively study repair of personal electronic devices, which include: computers, tablets, printers, electronic watches, music equipment, calculators, cellphones, televisions, projectors, digital cameras, electric toys, videogame consoles, and sports machines. This scope delimitation is motivated by research which shows that repair behaviors vary across product type.

1.4 Audience

This study aims to generate knowledge to support policymakers in the implementation of Sweden's National Strategy to Transition to a CE. Moreover, this study also generates insights to support academic research on electronics repair, consumer behavior, and CE transitions.

2 Literature review

2.1 Current knowledge related to e-products and repair

2.1.1 The problems associated with e-products

Demand for and disposal of e-products in Sweden has grown exponentially over the past decades (Bauer et al., 2018; Forti et al., 2020; Kalmykova et al., 2016). When it comes to e-product consumption, it is estimated that between 1994 and 2014, the demand per capita for small household appliances doubled while the demand for large household appliances increased by 80 percent (Kalmykova et al., 2016). As a result, as of 2018, Sweden was amongst the top six consumers of e-products at over 26 kg per year per capita (Bauer et al., 2018). Similarly, e-waste generation in Sweden increased from 19.8 kg per year per capita in 2015 to 20.1 kg per year per capita in 2019, making Sweden one of the top e-waste producers in the world (Forti et al., 2020).

Figure 2-1. Evolution of e-products has been fast and unpredictable

Source: Parajuly et al., 2019

There are several ways in which the literature explains the rising demand for e-products and e-waste generation. From a technological point of view, planned obsolescence, whether because e-products come with a short life expectancy or new technologies make a product obsolete, is described as key reason behind the increase in e-product consumption and e-waste generation (Parajuly et al., 2019). From a business perspective, it is the current paradigm of production, the so-called linear economy, which incentivizes cheap e-products over durable and repairable ones and ignores the associated environmental costs (Parajuly et al., 2019).

From a consumer perspective, individuals' purchasing decisions explain the rising demand for e-products and the generation of e-waste. Whether it is because consumers have adopted a consumerist ideology or because they lack awareness of the issues around e-products and e-waste, consumers tend to replace e-products prematurely and stockpile obsolete (and usually the smaller) e-products at home instead of turning them in for collection and resource recovery (Parajuly et al., 2019).

This rise in consumption and waste generation is worrying as e-products are associated with several environmental and socio-economic issues. When the very first e-products came into use (mainly energy-inefficient household appliances with long lifetimes), the lion's share of the environmental issues happened in the use phase (Parajuly et al., 2019). Today, the bulk of the environmental impacts has shifted to the material extraction and production phases, and in some cases to the end-of-life phase (Miliute-Plepiene & Youhanan, 2019; Parajuly et al., 2019). This change is a consequence of e-products becoming more complex[3], their lifespan and useful lives decreasing over time (C. Bakker et al., 2014), and the increasing decarbonization of electricity mixes of countries like Sweden (Richter et al., 2019).

Figure 2-2. Use of elements from a historical perspective
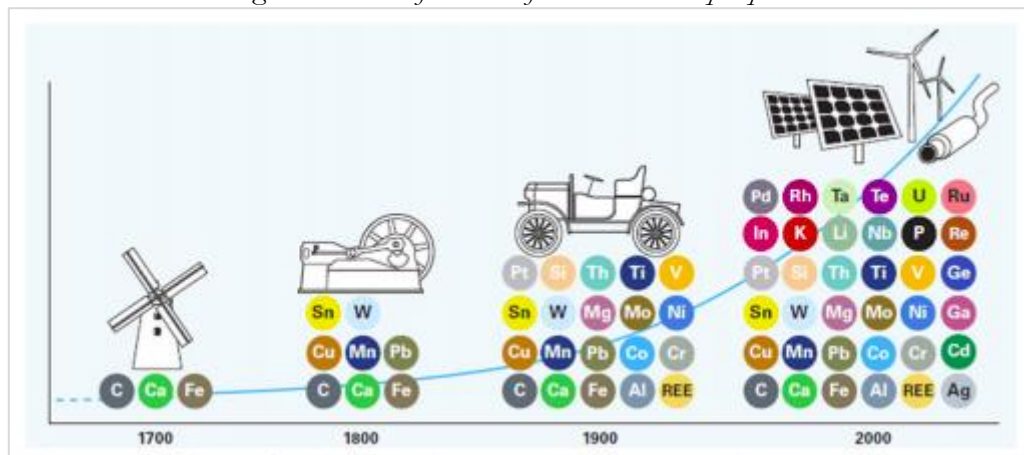
Source: Zepf, Simmons et al., 2014

In the extraction phase, critical materials (i.e., gold, palladium, cobalt, etc.) have the most significant environmental impact. These materials are defined as critical because of their environmental significance or economic importance. They are often used in minimal quantities but provide fundamental properties to e-products such as miniaturization, lightweight, and "smart" functions like touch-screen functionality (Miliute-Plepiene & Youhanan, 2019). Critical materials are a major environmental issue because mining them uses more water, energy, and land per unit than the mining of non-critical materials, which means that their lifecycle impact is higher (Parajuly et al., 2019, p. 13). Gold in mobile phones is a good illustration of this since it accounts for less than 1 percent of the device's weight, but it represents 50 percent of the total material requirement[4] (Miliute-Plepiene & Youhanan, 2019). Moreover, socio-economic issues are also important and more prevalent in critical materials. Extracting and processing critical materials is associated with health hazards, human and labor rights violations, and armed conflict to a much greater extent than other materials found in e-products (Miliute-Plepiene & Youhanan, 2019; Parajuly et al., 2019).

The manufacturing phase also produces significant environmental impacts. One reason is that producing components such as semiconductors and microchips is very material- and energy-intensive. For example, the production and use of a Sony XperiaTM smartphone in Swedish energy

---

[3] an e-product today can contain more than 60 elements from the periodic table

[4] Total Material Requirement (TMR) is a compound indicator that expresses the total mass of primary materials extracted from nature to support human activities (European Environment Agency, 2001). It includes both materials used for further processing and hidden flows, i.e. extractions that are not used further, but have an environmental impact such as overburden and extraction waste. TMR includes extraction both from domestic territory and of the resource requirements associated with imports (European Environment Agency, 2001, p.2).

conditions generate about 45 kg of CO_2e, which equals driving an average European car for 300 km (Miliute-Plepiene & Youhanan, 2019, p. 19). Another reason is that toxicants are used as intermediary inputs during manufacturing, creating long-lasting impacts on the environment. For instance, to manufacture LCD flat screens, producers utilize fluorinated greenhouse gases, which have a global warming potential that is over one thousand times higher than CO_2 (Parajuly et al., 2019).

When it comes to the end-of-life phase, environmental issues occur primarily in countries with weak or no e-waste disposal and processing regulations and their accompanying enforcement mechanisms. Most e-products contain hazardous materials such as mercury, lead, cadmium, and chromium. Their improper disposal can lead to severe air, water, and soil pollution that inevitably enter food chains and endanger human health (Miliute-Plepiene & Youhanan, 2019; Parajuly et al., 2019).

In Sweden, the environmental impacts of the consumption of e-products are significant and alarming. As mentioned in section 1, Lavers Westin et al. (2019) found that e-products are one of the most significant contributors to acidification, climate change, eutrophication, ozone formation, and resource use (see Figure 1-1 in section 1.1). Moreover, the Swedish Environmental Research Institute (2017) found that e-products have the highest waste footprint out of 10 consumer products (see Figure 2-3). As expected, the study found that the very first production stages of mining and beneficiation were the primary sources of large quantities of waste (Laurenti et al., 2017, p. 71). Thus, both studies concluded that e-products should be prioritized for political action.

Figure 2-3. Waste footprint in kilograms of 10 consumer products
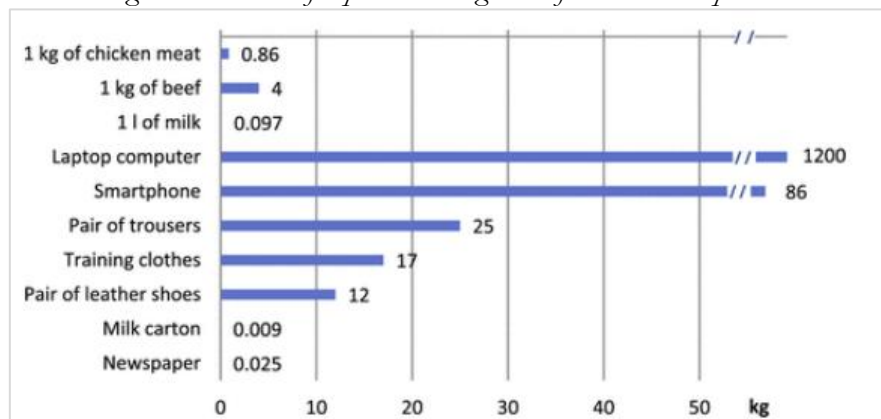
Source: Laurenti et al., 2017

All of the above leads to conclude that rising consumption and disposal of e-products is a significant problem in Sweden. Therefore, it is highly relevant to find strategies to reverse this trend. Here is where repair comes into the picture.

2.1.2 The case for repair

Repair is a practice that has been part of organized society for as far back as we know. However, it has not been a subject of academic inquiry until recently, when in the context of the CE, repair gained attention with the first publication appearing in 2010 and a boom that started in 2018 with over 50 publications (Niskanen et al., 2021).

Most of the existing literature discusses repair as a strategy to achieve circularity. Under this lens, repair brings numerous environmental, economic, and social benefits to society. Environmental

benefits are well documented through several scientific publications that quantify the environmental benefits of extending the life of electronics (Montalvo et al., 2016). For most personal electronics, the biggest environmental impact happens in the extraction and manufacturing phases (see section 2.1.1). Therefore, the literature agrees that extending their lifespan and useful life for as long as possible is beneficial and desired (Bachér et al., 2020; C. A. Bakker & Schuit, 2017; Rudenauer & Prakash, 2020). Promoting repair and repairability are thus coined as essential policies to mitigate the environmental impact of e-products and meet national environmental goals (Almen et al., 2020; C. A. Bakker & Schuit, 2017; EEB, 2019; Wieser & Tröger, 2018).

Moreover, the literature refers to three main economic benefits of repair: job creation (European Commission et al., 2018; King et al., 2006; Llorente-González & Vence, 2020; Mitchell & Morgan, 2015), new profit streams for businesses (Tecchio et al., 2017; Türkeli et al., 2019), and as a cost-savings measure for consumers (European Commission et al., 2018; Rudenauer & Prakash, 2020).

The social benefits of repair are the least researched. However, the literature that addresses this topic agrees that social benefits include skill development and inclusion of vulnerable or disadvantaged populations through low- and medium-skilled jobs (Bovea et al., 2017; Montalvo et al., 2016).

There is also an emerging field of sociology of repair that criticizes the CE utilitarian lens. Sociology of repair proposes a broader understanding of repair as a *"concept or activity evoking and expressing political and cultural values beyond the technocratic and consumerists descriptions which dominate the CE literature"* (Niskanen et al., 2021, p. 2). Repair is seen as *"multi-dimensional relational process"* that, beyond being a market activity undertaken by economic agents, is a tool for people to assert their identities and convey their values, a means to daily survival for those with fewer resources, and a channel for community building (Niskanen et al., 2021, p. 9).

Regardless of the standpoint, repair is overwhelmingly perceived as a practice that mitigates environmental impacts and adds value to society, and that should be prioritized to meet social and environmental goals. Interestingly, whether from a CE or a sociological perspective, the consumer perspective of repair is understudied. As seen in detail in section 2.1.3 below, CE literature Literature from the sociology of repair argues that there is a need for a more inclusive understanding of repair to capture the complexity and diversity of the motivations for repair; however, the literature reviewed does not explore what those motivations are in any depth.

2.1.3 Factors that influence a consumer's decision to repair electronics

The literature has identified several reasons that influence people's decision to repair their personal electronics when they break or malfunction. These reasons can be categorized as contextual, product-related, socio-cultural, or individual. Of the thirteen studies found on the subject, only four examined the Swedish case. Given that not many Sweden-specific studies were found, it was considered appropriate to include studies from Spain, Austria, the Netherlands, Germany, the United Kingdom, and the United States. These studies were designated as relevant because the countries listed above have comparable socio-economic conditions to Sweden. However, there are cultural differences among these countries, so it cannot be assumed that the studies presented here are directly applicable to Sweden. Moreover, although all the studies discuss e-products repairs, some studies take a broader stance and include home appliances. Given the limited number of studies, those studies were also included in this review.

This section summarizes these findings, starting with an overview of the factors reviewed in Figure 2-4. See [Appendix A](#) for the list of the studies reviewed.

Figure 2-4. Overview of the factors that influence e-product repairs found in the literature
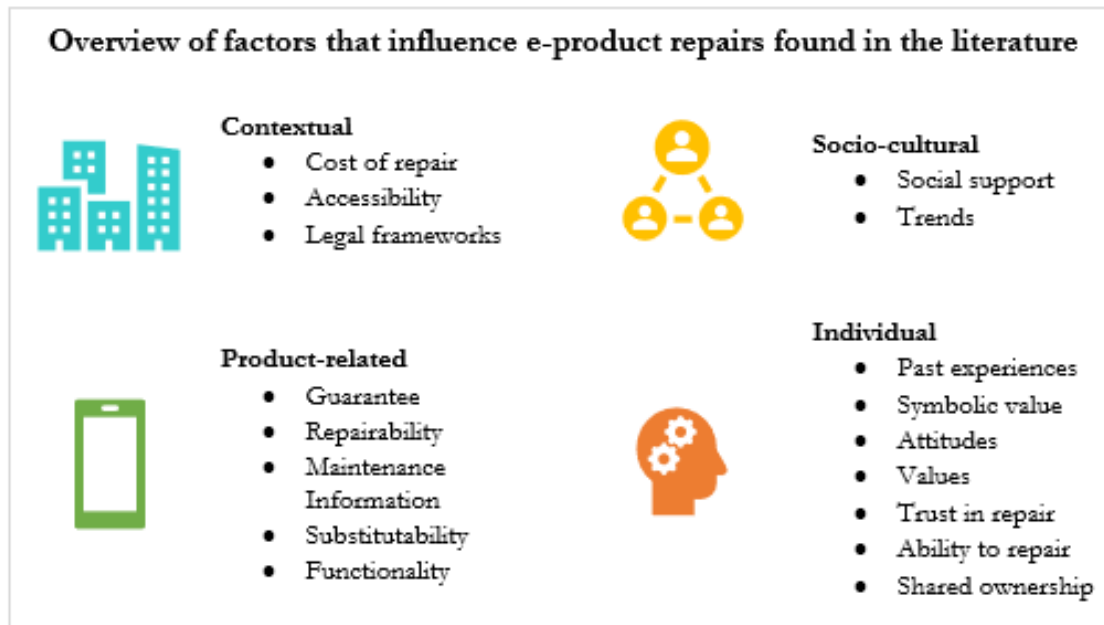
Contextual factors

Cost of repair. Cost is consistently reported as one of the most significant barriers and drivers of repair. Low price is the main reason why people would repair rather than replace a product, while the high cost of repair is the main reason people do not get their items repaired (Ackermann et al., 2018; Almen et al., 2020; Cerulli-Harms et al., 2018; IIIEE, 2018; Jaeger-Erben et al., 2021; Raihanian Mashhadi et al., 2016; Rogers et al., 2021; Sabbaghi et al., 2017; Sabbaghi & Behdad, 2018; Scott & Weaver, 2014; Terzioğlu, 2021; Wieser & Tröger, 2018). This is evidenced in a study by King et al (2006), which found that 68 percent of participants cited cost as the reason they did not repair their small household electronics. In addition to the cost of repair, accessibility and cost of spare parts is also reported as a barrier in the literature (IIIEE, 2018; Raihanian Mashhadi et al., 2016; Sabbaghi et al., 2017).

Accessibility. Convenience and accessibility are often cited as key drivers to scale repair (Ackermann et al., 2018; Almen et al., 2020; Cerulli-Harms et al., 2018; IIIEE, 2018; Lefebvre, 2019; Pérez-Belis et al., 2017; Raihanian Mashhadi et al., 2016; Rogers et al., 2021; Sabbaghi & Behdad, 2018; Scott & Weaver, 2014; Terzioğlu, 2021). Alternatively, lack of accessibility to repair services, implying time and effort to access them, significantly lowers the likelihood of repair (Cerulli-Harms et al., 2018; IIIEE, 2018; Lefebvre, 2019; Pérez-Belis et al., 2017; Rogers et al., 2021). Interestingly, lack of accessibility is not a barrier to product replacement. A behavioral experiment conducted by Cerulli-Harms et al (2018) found that when repairing involved slightly more effort compared to replacing an item, many respondents refrained from repairing and bought replacement products instead. However, when the same level of effort was involved in replacing a product, participants did not refrain from replacing the product (Cerulli-Harms et al., 2018, p. 66).

Legal frameworks. The literature discusses how intellectual property (IP), contract, consumer, tax, and chemical laws disincentivize repair (Svensson-Hoglund et al., 2021). For example, some IP rights, such as patents on spare parts and tools like a specialized screwdriver, hinder repairs by limiting the supply of necessary materials. Moreover, contract law also creates repair barriers by allowing for contract clauses such as forbidding unauthorized repairs in end-user license agreements (Svensson-Hoglund et al., 2021). Finally, under consumer law, original equipment manufacturers can deny repair to consumers by levering guarantee conditions that say that manufacturers may give consumers replacement products when they break or malfunction (Svensson-Hoglund et al., 2021).

Tax laws also affect repair activities. For example, Sweden introduced a chemical tax on flame-retardants in electronics which inadvertently targetted refurbished electronic manufacturers by decreasing their competitiveness against manufacturers of new electronics who can use substitute products (Montalvo et al., 2016; Svensson-Hoglund et al., 2021). Moreover, chemical regulations restricting the use of substances in products unintentionally harm the refurbished e-product market (Svensson-Hoglund et al., 2021).

Product-related factors

Guarantees. Some studies report that after price, a key reason people repair is that the product was still covered under guarantee (Cerulli-Harms et al., 2018; IIIEE, 2018). Fear of losing original guarantee (IIIEE, 2018) and short warranty coverage of repaired products compared to new products (Raihanian Mashhadi et al., 2016) are described in the literature as barriers to repair.

Repairability. The sometimes reality and sometimes perception that electronics are not designed to be repaired is another significant barrier to more engagement in repair activities (Almen et al., 2020; Cerulli-Harms et al., 2018; Lefebvre, 2019; Pérez-Belis et al., 2017; Raihanian Mashhadi et al., 2016; Svensson-Hoglund et al., 2021; Terzioğlu, 2021).

Information about reparability. Information about repairability and maintenance of products has been found to drive consumers to engage with repair (Cerulli-Harms et al., 2018; Lefebvre, 2019; Pérez-Belis et al., 2017; Scott & Weaver, 2014). Information should include whether the product is repairable, how to maintain products, and where to get spare parts (Almen et al., 2020; Cerulli-Harms et al., 2018; Lefebvre, 2019; Pérez-Belis et al., 2017).

Substitutability. Research has identified irreplaceability as an indicator for product maintenance and care. If the consumer believes the product cannot be easily repaired, they will engage in regular care and repair (Ackermann et al., 2018).

Functionality. Research with Dutch consumers uncovered that high product functionality leads to regular product care due to fear of premature breakdown. However, products that become outdated quickly will not be maintained or repaired with the same frequency despite their functionality (Ackermann et al., 2018).

Socio-cultural factors

Social support. Peer pressure can be a driver to more engagement with repair, as research has found that the decision to repair can be influenced by the behaviors of others (Ackermann et al., 2018; Cerulli-Harms et al., 2018). Peer support has been reported to compensate for lack of skills and thus encourage repair (Lefebvre, 2019). In Netherlands, the segment of the population that is characterized as willing to engage in CE practices but needs the motivation to do so grew from 22% in 2014 to 26% in 2017 (Cerulli-Harms et al., 2018). The authors attribute this growth to the

influence of the driver group, which is highly enthusiastic about engaging in CE practices such as repair.

Moreover, 64 percent of participants surveyed by Cerulli-Harms et al (2018) stated that they want their friends to know that they care for the environment. Finally, Raihanian Mashhadi et al (2016) found that consumers who have successfully repaired a product are likely to recommend it to others as they perceive it as high quality.

Trends. According to several stakeholders interviewed in twelve EU countries, a barrier to more engagement with consumer repairs is that society today does not reward consumers who engage in circular economy practices. Instead, society rewards fashion, style, and conspicuous consumption (Cerulli-Harms et al., 2018).

Individual factors

Past experiences. Past repair experiences can motivate or hinder consumers motivations to repair in the future (Ackermann et al., 2018; Cerulli-Harms et al., 2018; Lefebvre, 2019; Raihanian Mashhadi et al., 2016; Wieser & Tröger, 2018). This was evidenced by Wieser and Tröger (2018) who found that participants that successfully repaired their phones were more likely to repair it again.

Symbolic value. Consumers are more willing to repair a product if they feel emotionally connected to it. Products that represent a hobby, a pleasant experience, or that are linked to a consumer's identity – i.e., a kettle used for guests - are most likely to be maintained and repaired (Ackermann et al., 2018; Cerulli-Harms et al., 2018; Lefebvre, 2019; Scott & Weaver, 2014; Terzioğlu, 2021). Conversely, research with Dutch consumers revealed that products that are not emotionally important are not likely to be maintained or repaired (Ackermann et al., 2018).

Attitudes. Those with positive attitudes towards environmental protection and secondhand consumption are more likely to engage in repair behaviors than those who attach high importance to novelty, trends and fashion (Cerulli-Harms et al., 2018; Scott & Weaver, 2014; Terzioğlu, 2021).

Values. Research with English and American consumers on their propensity to repair revealed that stewardship (Scott & Weaver, 2014), innovativeness (Lefebvre, 2019; Scott & Weaver, 2014), and thriftiness (Lefebvre, 2019; Rogers et al., 2021; Scott & Weaver, 2014) are strong predictors of repair behaviors. Stewardship is understood as seeing value and potential in products, while innovativeness is the ability for a consumer to find different uses for existing products (Scott & Weaver, 2014). Thriftiness refers to both the preference to save money and to live a frugal life (Lefebvre, 2019).

Moreover, people with a tendency to challenge themselves are more likely to derive pleasure from maintaining and repairing their belongings: *"Simply to find out if I can do it. And because I put the demand on myself to try it by myself first without seeking help immediately. Because I like to figure out if something will work"* (Ackermann et al., 2018, p. 396; Terzioğlu, 2021).

Trust in repair. Lack of trust in the quality of repair is a key reason why people do not repair. If consumers think that the repaired product will be of lower quality or will not function as well as before, they will opt for replacement over repair (Cerulli-Harms et al., 2018; Dalhammar & Richter, 2020; Raihanian Mashhadi et al., 2016; Pérez-Beliz et al., 2017; Rogers et al., 2021; Sabbaghi & Behdad, 2018; Wieser & Tröger, 2018).

Ability to repair. Consumer knowledge and skills about product repair as well as access to tools can be barriers or drivers to more engagement in repair (Ackermann et al., 2018; Lefebvre, 2019; Pérez-Belis et al., 2017; Terzioğlu, 2021). Consumers that report having the tools and knowledge about how or where to repair their products are more likely to engage in maintenance and repair than those that do not (Ackermann et al., 2018; Pérez-Belis et al., 2017; Terzioğlu, 2021). Not having the skills to repair electrical equipment is perceived as a risk to one's safety, discouraging individuals from engaging in self-repair (Lefebvre, 2019). Interestingly, the study done by the EC found that despite showing the most interest in repair, young consumers do not have repair skills and are not interested in acquiring them (Cerulli-Harms et al., 2018).

Shared ownership. Products with shared ownership are less likely to be cared for and repaired than products with individual ownership. This was found in the particular case of products shared in office buildings or flats in the Netherlands (Ackermann et al., 2018).

2.1.4 Policies to incentivize electronics repair

Policies regarding e-products in the EU and Sweden have historically focused on energy efficiency and waste management, which have had little influence on product life-extension or consumer demand (Kalmykova et al., 2016). However, in recent years both the EU and Sweden have recognized this shortfall and began to acknowledge repair as essential to extend products' lives, decrease waste, and meet environmental goals. This has led to a recent boom in the inclusion of repair in strategies, action plans, and policies, especially at the EU level. The section below outlines the relevant legislation at the EU and national levels.

EU-Level strategic documents

The European Green Deal. Launched in December 2020, the European Green Deal *"resets the Commission's commitment to tackling climate and environmental-related challenges that is this generation's defining task"* (European Commission, 2019b, p. 2). One of the main elements of the European Green Deal is *"Mobilizing industry for a clean and circular economy"* and electronics is mentioned as a sector of focus. The plan mentions that a circular economy action plan will be developed to *"propose measures to encourage businesses to offer, and to allow consumers to choose, reusable, durable and repairable products",* curb built-in obsolescence, and analyze the need for a "right to repair" (European Commission, 2019b, p. 8).

The Circular Economy Action Plan. Released in March 2020 and coined as one of the main building blocks of the European Green Deal, the Circular Economy Action Plan presents measures to: 1) design and produce products that are durable, repairable, reusable and easier to recycle; 2) empower consumers with information about repairability, durability, availability of spare parts, repair instructions and services; and 3) avoid waste (European Commission, 2020a).

The plan talks about developing a Sustainable Product Policy to widen the Ecodesign Directive beyond energy-related products. This legislative initiative is expected to be released in 2021 and will regulate product repairability, durability and upgradability; recycled content in products; high-quality recycling and remanufacturing processes; carbon and environmental footprinting; restrict single-use products; counter premature obsolescence; ban the destruction of unsold goods; encourage circular business models and digitalization; and incentivize sustainability performance (European Commission, 2020b, p. 6).

The action plan also discusses establishing a "right to repair" which would give rights to consumers in regards to the availability of spare parts, access to repair, and in the case of electronics, access to upgrading services (European Commission, 2020b, p. 8). Legislative and non-legislative

measures to establish a new "right to repair" are expected to appear starting in 2021. Moreover, the plan talks about creating a Circular Electronics Initiative which will aim to promote longer product lifetimes by naming electronics a priority sector for implementing the right to repair. This will include the right to update obsolete software; introduce a standard charger for phones and similar devices; and explore options for an EU-wide take-back scheme for phones, tablets, and chargers (European Commission, 2020b, p. 10). The Circular Electronics Initiative is planned for release in 2021.

EU-level legislation

The Ecodesign Directive (2009/125/EC). This Directive lays down rules for improving the environmental performance of energy-related products by requiring minimum product lifespans, availability of spare parts, and product upgradeability and repairability (Šajn, 2019a, p. 5). In addition, the Directive implements regulations by product groups and has historically focused on introducing energy efficiency requirements for energy-related products (Šajn, 2019a).

In 2019, the Commission adopted new ecodesign regulations that support repairability for ten product groups. Among them were electronic displays (including televisions), refrigerators, washing machines, dishwashers, and electric motors (Šajn, 2019a). The regulation ensures that spare parts are available for 7 to 10 years after purchase and mandates manufacturers to share information about maintenance and repair with professional repairers (Šajn, 2019a). For example, the regulation on electronic displays mandates manufactures to make necessary spare parts available for seven years after placing the last unit on the market; to make software and firmware updates available for eight years after placing the last unit on the market; to deliver spare parts to professional repairers on request within 15 working days; to provide repair information to professional repairers; and to publicize information about durability and repair, including addresses and contacts for professional repair in the user instructions (European Commission, 2019c).

Consumer Sales and Guarantees Directive (1999/44/EC) and Sales of Goods Directive (2019/771/EC). This Directive regulates the right of consumers to have products repaired during the legal guarantee period which is two years. The directive makes the seller liable to the consumer for defective products at the time the goods are delivered and gives the consumer the right to get a defective product repaired or replaced free of charge (Šajn, 2019a). The directive stipulates a six-month reversal of burden of proof, which means that the consumer of a defective product does not have to proof that the item was defective during the first six months of the guarantee (Reusch & Wittbrodt, 2019). After the six-month period is over, if an item presents a defect, the consumer must prove the item was defective at the time of purchase (Reusch & Wittbrodt, 2019). Moreover, the directive says that sellers may offer additional commercial guarantees, which obliges the seller to *"reimburse, replace, repair or service the products if they do not meet certain specifications that go beyond the legal conformity requirements"* (Šajn, 2019a, p. 5).

In 2019 the Sales of Goods Directive was introduced which will replace the Consumer Sales and Guarantees Directive in 2022. The new directive extends the reversal burden of proof to one year and encourages Member States to extend it to two years. The directive does not extend the legal guarantee period, but it opens it to Member States to do so (Šajn, 2019a). It also introduces a new article (9a) laying down rules on the repair of goods which delineates that the seller must complete the repair within a reasonable time and has to do it without *"any significant inconvenience to the consumer"* (Šajn, 2019b, p. 10).

The Waste Framework Directives (2008/98/EC and 2018/851/EC). The 2008 Waste Directive requires Member States to promote re-use and prepare for re-use activities through the establishment and encouragement of repair and reuse networks and the use of economic instruments (Šajn, 2019a, p. 5). The new 2018 Waste Directive introduces new requirements for waste prevention which entered into force in July 2020. These requirements include encouraging the design and manufacture of durable and repairable products; promoting repair activities; and encouraging the availability of repair manuals, spare parts, and other equipment that can enable repair (Šajn, 2019a). The Directive includes new minimum requirements for extended producer responsibility, which in some cases includes differentiated financial contributions according to the durability, reparability, reusability, and recyclability of products (Šajn, 2019a).

The Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU). Like the Waste Framework Directive, the WEEE Directive aims to promote repair through product design and manufacturing guidelines (Šajn, 2019a). The Directive also requires producers to provide information on maintenance and preparation for re-use to independent repairers within the first year of placing a product in the market (Šajn, 2019a).

EU Ecolabel. The EU Ecolabel is a voluntary instrument that aims to promote sustainable products. For electronic displays, which covers televisions, computer monitors, and signage displays, the EU Ecolabel includes criteria about repairability. To obtain an EU Ecolabel in this category the producer needs to prove the product design is durable and repairable, that a repair manual is published, and that spare parts are available for at least eight years following the end of the model's production (European Commission, 2019a).

Green Public Procurement (GPP). Green Public Procurement is another voluntary instrument that seeks to stimulate demand for sustainable products and services. In March 2021, the Commission published new voluntary EU GPP criteria for computers, monitors, tablets, and smartphones. The new criteria include a section devoted to repairability, reusability, and upgradeability. The new conditions include language for preventive maintenance and repair service; battery replacement policy; and commitment to repair/upgrade as the first solution (European Commission, 2021).

Swedish strategic documents

National Strategy for Sustainable Consumption. Published in 2016, this strategy identifies seven focus areas to promote sustainable consumption. The strategy talks about developing of measures such as: adding sustainable consumption to school curriculums; developing initiatives to nudge consumers towards sustainable lifestyles; promoting ecolabelling schemes; introducing tax deductions for the repair sector; introducing sustainability requirements for more product groups as well as information about repair opportunities; facilitating the development of the circular economy by introducing instruments to promote reuse, repair and upgrading of products; revising waste prevention efforts for 2018-2023 with a focus on electronics, textiles, food, and construction materials; toughening measures against false green claims; taxing hazardous chemicals on specific e-products; and developing a strategy to combat consumer over-indebtedness (Ministry of Finance Sweden, 2016a).

National Procurement Strategy. Released in 2016, this strategy aims to help contracting authorities develop their public procurement strategies (Ministry of Finance Sweden, 2016b). The strategy talks about public procurement as tool in Swedish's transition to a circular, bio-based

economy, and it tasks the National Agency for Public Procurement with promoting increased environmental consideration in public procurement (Ministry of Finance Sweden, 2016b).

National Strategy for Smart Industry. Also published in 2016, this strategy acknowledges the need for more environmental technologies and increased sustainable production if Sweden is to achieve its ambition to become the world's first fossil-free welfare state (Ministry of Enterprise and Innovation Sweden, 2016). Although it does not directly mention repair or repairability, the strategy makes sustainable production one of its four focus areas. The strategy aims to achieve sustainable production by encouraging circular economy business models and developing new or improving existing technologies, goods, and services *"with considerations given to sharp reductions in emissions … and greater reusability and recyclability"* (Ministry of Enterprise and Innovation Sweden, 2016, p. 33).

National Strategy to Transition to a Circular Economy. In July 2020, the Swedish Ministry of Environment adopted a national strategy for a CE. One of the four focus areas outlined in the strategy is *"Circular economy through sustainable ways of consuming and using materials, products and services"* (Ministry of the Environment, 2020). The strategy explains this can be accomplished by extending the life of products through choosing repair, reuse, sharing or leasing instead of buying new. The strategy announces that specific action plans will be developed to guide the implementation of the strategy.

Swedish legislation

Tax incentives. In 2007 the Government passed a Cleaning, Maintenance, and Laundry (CML or RUT in Swedish) tax deduction on Information Technology (IT) devices. Ten years later and as the first implementing measure of the National Strategy for Sustainable Consumption, a deduction like the 2007 one was passed on repairs of white goods, relieving the consumer of up to 50 percent of the labor cost of repair (Almen et al., 2020). Moreover, also in 2017, the Government lowered the value-added tax for repairing bicycles, clothes, household linen, leather goods, and shoes from 25 percent to 12 percent. In the same year, the Income Tax Act introduced a tax deduction for repairs in the consumer's home for products such as IT and white goods (Dalhammar, 2020, p. 127).

Green Public Procurement. A voluntary instrument to generate demand for sustainable goods and services, the Swedish sustainability procurement criteria for electronics is mostly for computers, monitors, AV (TVs, projectors), and document processing equipment. Of these products, only the criteria for monitors and computers makes a reference to repair by including criteria items such as: access to spare parts for at least five years after product delivery; assurance that spare parts can be replaced using standard tools; ability to upgrade memory and storage capacity; and access to rechargeable batteries (Upphanglings Myndigheten, n.d.).

Hallå Konsument. Hallå Konsument is an informational instrument in the form of a website administered by the Swedish Consumer Agency. This website contains a sea of reader-friendly information about consumer rights and advice on making more sustainable purchases (Dalhammar, 2020). For electronics, the website stresses the importance of extending the lifespan of devices and suggests repair as an alternative to buying new (Hallå Konsument!, n.d.). In addition, this website provides information for consumers to learn about different sustainability labels (Dalhammar, 2020). The improvement Hallå Konsument is one of the activities mentioned in the 2016 National Strategy for Sustainable Consumption as part of Sweden's work to promote eco-smart behavior patterns.

Repair Cafes. Some Swedish Municipalities, such as Lund, have funded the creation of repair cafes for electronic products with the explicit goal to promote and facilitate repair (Lunds Kommun, n.d.).

2.2 Theories of relevance to understanding consumer behavior

2.2.1 Understanding consumer behavior

Using a behavior theory can facilitate studying why people choose to repair personal electronics. Theoretical frameworks are conceptual models that play two roles in understanding motivations and drivers behind behavior and behavior change (Jackson, 2005). The first role is to conceptualize the factors that influence behavior. The second role is to provide a framework to empirically test the strength of the relationships in different contexts. A good conceptual model balances between simplicity that allows for empirical testing and explanatory completeness that provides a complete understanding of the phenomenon it studies (Jackson, 2005).

From all the studies and literature reviewed, only Ackermann et al (2018) leveraged a behavioral model (Fogg's Behavior Model (FBM)) to study repair behaviors. However, the literature review revealed that behavior theories have been widely applied to explain and predict other environmental behaviors such as upcycling (Sung et al., 2019; Terzioğlu, 2021), product care (Ackermann, 2020) sustainable food consumption (Shin & Hancer, 2016; Vermeir & Verbeke, 2008), sustainable farming (Boazar et al., 2019; Vande Velde et al., 2015), waste recycling (K. Chan, 1998; L. Chan & Bishop, 2013), and travel mode choice (Bamberg & Schmidt, 2003; Domarchi et al., 2008). Theory of Planned Behavior (TPB) (or a modified version of it) is the most frequently used theory to study environmental behaviors among economists, psychologists, and business professionals, while FBM is used mainly among product design professionals. Many researchers use a modified version of TPB which often includes elements that are part of the Theory of Interpersonal Behavior (TIB) such as habit, self-concept and affect. TIB has been used to study environmental behaviors but to a much lesser extent.

When looking into the explanatory power of the three models mentioned above, I found that researchers using FBM uncovered strong associations between the model's variables and thus claimed that the model is robust yet sufficient and straightforward to design effective behavior change interventions. Moreover, Bamberg and Schmidt (2003) compared the predicting power of TPB and TIB in the context of car use for university routes in Germany. Their results showed that two variables in the TIB (social roles and habit) significantly increased the explanatory and predictive power of car use. Moreover, in a comprehensive review of consumer behavior and behavior change models, Jackson (2005) found that although TPB is the most widely used model, it has failed to measure actual behavior. Similarly, Bamberg and Schmidt (2003) argue that there is increasing evidence that TPB fails to explain all kinds of social behaviors. In contrast, Jackson (2005) and Bamberg and Schmidt (2003) argue that TIP captures many of TPB's criticisms and thus is a better framework to study social behaviors. Other studies that have applied TIB, such as Sung (2017) in upcycling behavior, Domarchi et al (2008) in travel mode choice, Kupfer et al (2019) in hand hygiene behavior, and Li et al (2020) in ethical decision-making concluded that Triandis' TIB is a suitable model to explain social behaviors.

Given that this thesis seeks to understand repair behaviors to identify intervention points and not design a behavior-change intervention itself, TIB is the most appropriate framework to guide this study. Therefore, the following section describes the key points of TIB, while Appendix B summarizes the FBM and TPB.

2.2.2 Triandis' Theory of Interpersonal Behavior (TIB)

Proposed by Harry Triandis between 1977 and 1980, TIB has its origins in the field of social psychology and attempts to explain all kinds of social behaviors. Under TIB, an individual is not fully deliberative neither fully automatic, fully autonomous, or entirely social. Therefore Triandis proposes that behavior is shaped by three overarching factors: Intentions, the strength of habits, and the facilitating conditions that enable or hinder a behavior (Triandis, 1977). Moreover, he proposes that three factors influence intention: Attitudes, social factors (such as norms, self-image, and roles), and affect (i.e. emotions) associated with the behavior (Triandis, 1977). In other words, TIB proposes that behaviors are a function partly of intentions, partly of our habitual responses, and partly of the facilitating conditions or the geography of the situation (Jackson, 2005). See Figure 2-5 below.

Figure 2-5. Theory of Interpersonal Behavior
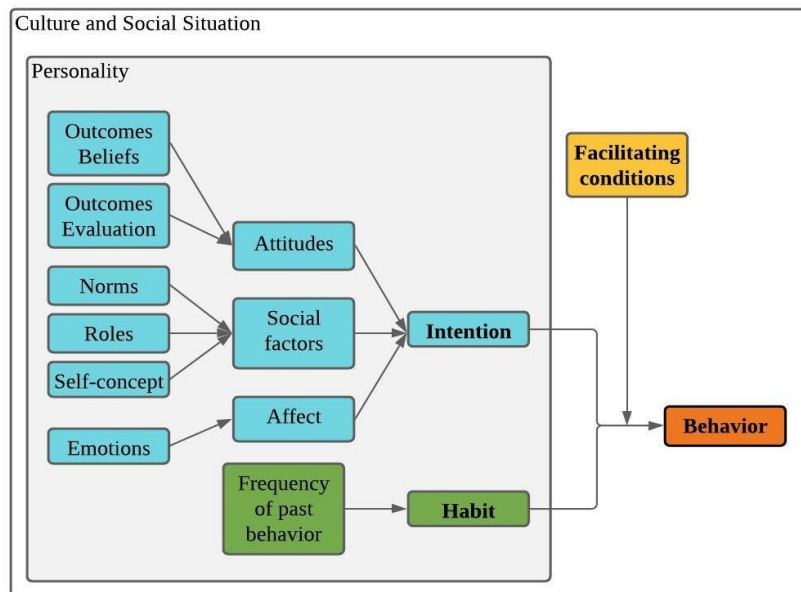
Source: adapted from Jackson, 2005 and Page & Sherif, 1980

Triandis sees behavior as having objective consequences that are interpreted by a person (Page & Sherif, 1980, p. 198). These interpretations generate perceived consequences, which are reinforced or changed once the behavior occurs. Perceived consequences are described as one of the foundations of attitudes. Attitudes, defined as *"ideas, charged with affect, that predispose a class of actions to a particular class of social situations",* are the first determinants of behavioral intention (Triandis, 1971, p. 2). Behavioral intentions are understood as *"instructions that people give to themselves to behave in certain ways"* (Page & Sherif, 1980, p. 203).

In TIB, social factors are *"the individual's internalization of the subjective culture of the group of people with whom the individual interacts most frequently or which she or he uses as a reference groups"* (Page & Sherif, 1980, p. 208). Triandis explains that the norms and roles which are objectively outside of the individual are the basis for the perceptions of the norms and roles that an individual uses to judge the appropriateness of behaviors (Page & Sherif, 1980, p. 218). The individual's internalizations of the norms and roles together with her or his self-concept are the second determinant of behavioral intention (Page & Sherif, 1980).

Affect, or emotion, is the third and final determinant of behavioral intention. Triandis proposes that affective response towards a behavior makes some behaviors more appealing than others and

thus influences people's intention to behave (Page & Sherif, 1980, p. 218). Emotions might be positive, negative, strong, or weak (Triandis, 1977, p. 9). Moreover, habits defined as *"situation-behavior sequences that are or have become automatic"* are described as important determinants of behavior (Page & Sherif, 1980, p. 204). Triandis explains that mental habits or emotional scripts control some acts. These acts will not be influenced by intentional control; hence, it is crucial to consider habits when studying social behavior (Page & Sherif, 1980, p. 216).

However, even if the intention is high, the habit is well established, and the affect optimal, Triandis argues that the behavior might not happen if the environment renders the behavior impossible (Page & Sherif, 1980, p. 198). In this theory, facilitating conditions represent *"the objective conditions of the geographical environment which facilitate the act"* and are the last of the determinants of behavior (Page & Sherif, 1980, p. 217).

Triandis theorizes that depending on the type of behavior, situation, or person, the weights of the components of his model will shift (Triandis, 1977, p. 279). For example, for new, unlearned social behaviors, intentions determine a behavior. However, once the behavior has been repeated multiple times and has been rewarded or punished, the behavior becomes automatic and is determined by habits (Triandis, 1977, p. vii). Furthermore, if an individual is more sensitive to the opinions of others, social norms will have a stronger influence on her or his intention to behave (Triandis, 1977). In sum, TIB is an integrated theoretical framework that acknowledges both the complexities around social behavior and the need for a model that allows for empirical testing. See [Appendix C](#) for a glossary with the definitions of the key concepts of TIB as written by Triandis.

2.2.3 Understanding consumption

Understanding electronics repair behavior begs answering the question of why people consume electronics in the first place. However, answering this question is too big of a task for this thesis as it would require a study of its own. Nevertheless, instead of ignoring the question altogether, I will briefly address it by proposing two complementary theories by anthropologist David Miller: the sacrifice and the peanut-butter theories.

Sacrifice theory

Miller (2012) describes two opposing observations in his years of fieldwork studying shopping. On the one side, he observed that the discourse around shopping is all about spending money in conspicuous consumption. On the other side, he observed that everyday shopping is all about saving money (Miller, 2012). He learned that there are several ways a shopper rationalizes her or his actions as a strategy of saving. A shopper can buy in large quantities because it is cheaper by unit or buy a small quantity to avoid waste. She or he can save by buying an expensive but high-quality piece of furniture because 'it will last forever' or save by buying a cheap one on eBay (Miller, 2012, p. 80). He explains that an overarching morality of thrift shapes the act of shopping: *"If you were to ask a shopper what precisely they are saving towards, it is quite rare that they would be able to come up with anything specific. In general, it is not that they are saving for this car or that computer. Mostly they are just practicing the assumed virtue of thrift itself"* (Miller, 2012, p. 81). Thrift has been a fundamental virtue of the household since the time of Aristotle, and exercising it through shopping (in whatever way the shopper operationalizes it) represents prioritizing one's family, thinking about the household's future resources, and ultimately it symbolizes an act of care (Miller, 2012).

Moreover, Miller describes that he observed what he coined as a contradiction between morality and ethics. Miller learned that most forms of ethical shopping (organic, Fairtrade, etc.) were assumed to be more expensive than their counterparts which meant that *"the purchase of ethical*

commodities would be at the expense of thrift" (Miller, 2012, p. 89). Miller describes how concerns for the planet, which feel more distant, came in direct conflict with concerns for one's family, which feel immediate, leading to less engagement with ethical shopping than we would like to see. Therefore, people do not engage with ethical shopping because they do not care about the planet, but because they care about their families: *"it is because people are thrifty and moral that they fail to be ethical"* (Miller, 2012, p. 89).

Peanut-butter theory

Miller observed that people shop to bridge the gap between who they are and who they think they should be. To exemplify this, he presents the case of Carla, who after leaving her job to go back to school had the need to buy everyday shoes so that she could dress down as a student (Miller, 2012). In her mind, Carla had a clear image of how a student should look, and that image involved wearing everyday shoes. She tried sixteen pairs of everyday shoes before buying a pair that met two criteria: her idea of what type of shoes a student should wear and the pair of shoes within that frame that 'Carla the student' would *actually* wear.

Miller describes that there are two sides to every relationship. One on end, there is what you think a person should be based on what category they represent (i.e., a mother, a bother, a husband). On the other side, there is *"everything you know about how that individual person actually is. Not a wife, but your wife; not a bother, but your brother"* (Miller, 2012, p. 70). In the case of peanut-butter, Miller says that it is something you associate as appropriate for children, but you will only buy it if it is something *your* child actually likes. This is the essence of the peanut-butter theory. That other person is not just anyone; he is Robert, but *"Robert is also a representative of the normative expectations we would have of a middle-class young male cousin"* (Miller, 2012, p. 77). Miller's concluded that people shop to help others conform to what they should be based on who they represent rather than help others be different. This, he argues, is the result of our natural attraction to norms themselves (Miller, 2012, p. 72).

A key takeaway from Miller's fieldwork is that shopping, contrary to the common discourse, is not about being individualistic, hedonistic, and materialistic but instead is an act of sacrifice and love, and how we fulfill our perceived roles in society and build and nurture relationships with those around us.

2.3 Conclusions

Miller's sacrifice and peanut-butter theories reveal how the value of thrift and our attraction towards norms explain why and how we shop. These messages are important to keep in mind while studying repair behaviors since repair is a service we buy and also part of e-product consumption. Therefore thinking about repair through a lens of consumption can help uncover insights about how and why people repair and help design strategies to scale up repair.

Moreover, Triandis' TIB demonstrates that behaviors are a complex act that is partly intentional, party automatic, and partly a result of our emotional reactions and the geography of the environment surrounding us. To understand repair behaviors, we must look for and understand all these factors. When mapping the existing literature on repair drivers and barriers against Triandis' TIB, it becomes crystal clear that the focus has overwhelmingly been in understanding facilitating conditions to repair while very little is known about how attitudes, social factors, affect, and habits influence an individual's decision to repair. This is an important gap that must be filled

for the field to understand the factors that truly shape repair behaviors. Moreover, it was also found that there is very little research that focuses on understanding the Swedish case.

When it comes to e-products, there is sound evidence to assert that they are causing significant environmental and social impacts in our world. Sweden is a main contributor to this issue as it leads the rankings on e-product consumption and e-waste generation, threatening its ambition to become the first carbon-neutral welfare state. Historically, the Government's response to this issue has been to regulate products' energy use and disposal. However, as the CE concept gained traction in Sweden and the EU, there has been a recognition that policy needs to regulate product design beyond energy efficiency, increase consumer rights, promote different business models, and incentivize sustainable consumption (see section 2.1.4).

Both in policy and academia, repair is increasingly referred as an important strategy to extend the life of electronics and achieve circularity. Especially at the EU-level there has been a boom in repair-related policies which include repairability standards for product design; regulations to share repair and repairability information, to make repair parts accessible and available, and to improve legal guarantees; and in the specific case of Sweden tax deductions to promote the repair sector. These regulations align with the main barriers identified by the existing body of literature: cost, access, product design, information, and guarantees.

However, similar to the lack of research on socio-cultural and individual barriers to repair, policies addressing these barriers are lacking. Perhaps the reason is that these barriers are not well understood. Consequently, when analyzing the existing legislation, it appears that repair policies that target consumer behavior are reduced to information provision through manuals and eco-labels. This hints at a classical-economic understanding of the consumer as a rational decision-maker that seeks to maximize utility and thus will correct her or his behavior based on information. However, both Miller and Triandi's research shows that consumer behavior is complex and multidimensional, governed by norms, emotions, habits, attitudes, and context; thus, information provision alone seems unlikely to be effective on its own. A more comprehensive conceptualization and understanding of consumer behavior is needed to design effective behavior-change policies.

In sum, this literature review revealed two important research needs: 1) to understand other-than contextual barriers and drivers to repair, notably socio-cultural and individual factors, and 2) to investigate strategies aimed at incentivizing repair behaviors beyond information provision.

3 Methodology

This thesis aims to gain behavioral insights into personal electronics repair in Sweden to provide recommendations for scaling up e-product repairs in order to accelerate Sweden's transition to a CE. The objective is achieved with a mixed-method design consisting of semi-structured qualitative interviews and an online questionnaire. The following sections explain the philosophical positioning of the author, the research design, and the methods for data collection, sampling, and analysis used to answer the research questions and meet the objective of this thesis. See Figure 3-1 below for an overview of the thesis research design.

Figure 3-1. Research design overview

Worldview:	Pragmatist		
Objective:	To gain behavioral insights into personal electronics repair in Sweden to provide recommendations for scaling up e-product repairs in order to accelerate Sweden's transition to a circular economy		
Theoretical framework:	Triandis' Theory of Interpersonal Behavior		
Research design:	Exploratory sequential design		
Research question (RQ)	**Methods**	**Sources**	**Analysis**
RQ 1: What are the behavioral factors that shape consumer's decisions to repair their personal electronics?	Interviews Questionnaire	Consumers residing in Sweden	Content analysis Descriptive statistics
RQ 2: Which behavioral factors explain the variance in the frequency of repair? Which factors explain the variance in the intention to repair?	Questionnaire	Consumers residing in Sweden	Spearman's rank-order correlation analysis Binomial logistic regression
RQ 2a: Are there any significant differences based on demographic characteristics?	Questionnaire	Consumers residing in Sweden	Mann-Whitney U test Kruskal-Wallis H test

3.1 Philosophical positioning and methodological choices

It would be naïve to carry out this study thinking that it is not guided by the author's assumptions about the world. Every researcher has their conceptions about what is reality (ontology), how we know what we know (epistemology), what values go into it (axiology), how we describe it (rhetoric), and how we study it (methodology) (Creswell, 2003, p. 6). Therefore, any researcher needs to disclose their assumptions so that research is interpreted in the correct context.

When it comes to undertaking research, I subscribe to pragmatism. Pragmatism - developed from the work of Peirce, James, Mead and Dewey - believes in multiple subjective realities but does not favor any particular philosophy of science. Instead, it poses that different theories and methods may be useful for different research problems, and thus, whichever suits a particular problem is considered valid (Creswell, 2003; Leavy, 2017). Therefore, pragmatists see the problem as central and use pluralistic approaches to understanding it (Creswell, 2003, p. 12). In this way, pragmatism is often considered the foundation of mixed methods research (Tashakkori & Teddie, 1998). In short, pragmatism *"supports using both qualitative and quantitative methods, places the research question(s) at the center of inquiry, and links all methodological decisions to the research question(s)"* (Leavy, 2017, p. 168).

The overall ambition of this thesis is to understand how the consumer can be incentivized to extend the life of their personal electronics through repair and in this way contribute to the transition to a CE. Seen through a pragmatist lens, it is assumed that there are many subjective realities that need to be studied to understand how consumers can be incentivized to repair their personal electronics and thus enable a successful transition to the CE. In this case, most of the realities of individuals who repair (or not) their personal electronics are unknown. Since the plural realities of consumers are unknown, the purpose of this research is exploratory, which calls for qualitative methods as the primary method of inquiry. For this study, interviews are a good choice since they are best suited to uncover motivations and attitudes and are a great tool to produce rich, descriptive data (Leavy, 2017, p. 124). Additionally, this thesis seeks to understand how different factors influence repair, a question best answered with explanatory quantitative methods. A questionnaire is a suitable method for this since it allows the researcher to investigate associations, correlations, and casual relationships (Leavy, 2017). Moreover, the literature review revealed that a practical way to explore the reality of consumers, which is plural and unknown, is through the lens of what we already know about behavior by using consumer behavior theory as a guiding framework. All this naturally leads to the choice of a mixed-methods design to deliver the insights needed to meet the objective of this study.

3.2   Research design

The research questions of this study are answered through a mixed-methods exploratory sequential research design which was chosen, as explained in the section above, based on its suitability to address the study's research objective and questions. See Figure 3-2 for an overview of the research process.

Guided by Triandis' TIB (see section 2.2.2) this study started with a qualitative data collection and analysis phase which informed a second phase of quantitative data collection and analysis. Employing a sequential exploratory strategy is adequate since its goal is to explore a phenomenon by using the quantitative findings to assist in the interpretation of the qualitative findings, making this design widely used to gain new insights, test a theory, and generalize qualitative findings (Creswell, 2003).

Qualitative data collection consisted of 19 semi-structured interviews with consumers residing in Sweden. Guided by TIB, the purpose of the interviews was to understand the past experiences, intentions, habits, and situational factors that influence consumers' decisions to repair their personal electronics. Also based on TIB and guided by the findings of the interviews, quantitative data consisted of an online questionnaire answered by 190 consumers residing in Sweden to explore and explain the relationships between the factors that influence intention to repair and repair behavior.

Figure 3-2. Research process overview
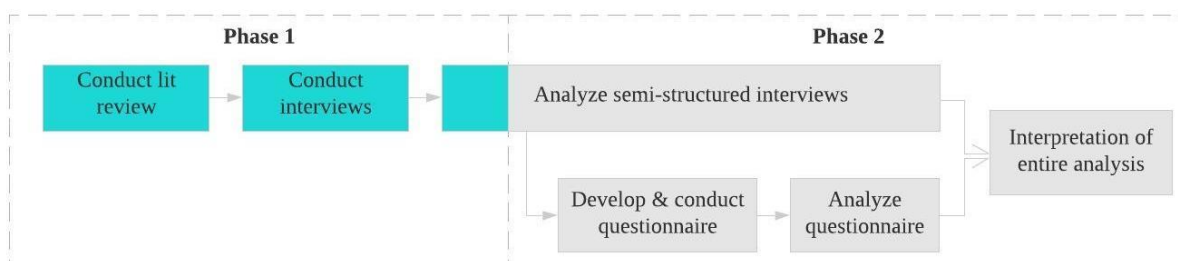
3.3 Data collection methods and sampling

3.3.1 Document review

An exploratory literature review was conducted to examine the current state of knowledge about repair behaviors and barriers and drivers to repairing personal electronics in Sweden. This initial review led to the identification of the research problem, theoretical framework, and the questions that guide this study. The author reviewed 82 documents, including journal articles, book chapters, doctoral dissertations, gray literature, master-level research projects, and studies requested by the European Commission.

The document review was conducted using a multiphase process which involved 1) scanning, 2) screening and 3) synthesizing. The scanning phase consisted of identifying all potentially relevant research through systematic searches for scholarly and other sources such as master theses, doctoral dissertations, and white papers in LubSearch, SCOPUS, Google Search and Google Scholar. Search terms used included: *circular economy, circular economy engagement, circular economy behaviors, consumer behavior, sustainable consumption, repair behaviors, electronics repair, consumer electronics, environmental impacts of consumer electronics, economic impacts of consumer electronics, repair initiatives, right to repair, motivations to repair, incentives to repair, drivers to repair, product care, circular economy policies, repair policies, Sweden, behavioral study, consumer behavior theory, behavior change, theory of planned behavior, theory of interpersonal behavior, Fogg's model of behavior change.* Then, after reviewing the title and abstract, relevant documents were set aside. Relevant documents included any article that referred to consumer electronics, repair practices, behaviors, drivers, barriers, policies, the consumer side of the circular economy, applied a theoretical model to understand environmental behaviors, or reviewed different theories used in sustainable consumption.

During the screening phase, the author skimmed through the selected documents by reading the abstract, findings, and discussion sections. Sudies that discussed factors to encourage or discourage electronics repair, environmental/economic/social impacts of consumer electronics, policies geared towards incentivizing repair or sustainable consumer behavior, and/or used theoretical frameworks to understand and predict pro-environmental behaviors were saved on the author's desktop for further reading. At the end of this phase, the selected articles were read in detail. The literature selected came from a range of disciplines, including product and industrial design, psychology, economics, business and marketing, and environmental studies. The final phase, which consisted of the synthesis and analysis of the documents reviewed, is discussed in section 3.4.1.

3.3.2 Interviews

This study used qualitative interviews as the primary method of inquiry to answer RQ 1. A total of 19 interviews were conducted with consumers residing in Sweden (see more about sampling in section 3.3.4). All interviews were semi-structured which allowed the author to adapt the questioning in whichever way suited the interview best (Lefebvre, 2019). Guided by TIB, all interviews consisted of a series of open-ended "what" and "why" questions and a few closed-ended clarifying questions. The interviews asked questions about repair habits, attitudes, intentions, cultural norms, roles, and conditions that enable or hinder decisions to repair personal electronics. See the interview guides in Appendix D.

All interviews began with a brief overview of the purpose of the study, an introduction of the researcher and the interview's procedure, duration, and data handling (anonymity and confidentiality), and a request to record the interview to facilitate data analysis. See section 3.6 for

more ethical considerations. Only after the participants gave oral consent to participate and be recorded, the recording and interview began. See consent form in Appendix D.

3.3.3 Questionnaire

Informed by the qualitative interviews with consumers and guided by TIB, an online questionnaire was designed to gather consumers' opinions and experiences repairing personal electronics. The questionnaire was created and conducted on SoSci Survey; a free online platform designed for social science research. The online questionnaire was disseminated via Facebook groups and was open between March 15 – April 15, 2021.

The questionnaire consisted of three parts. Part one explained the purpose of the study, defined key terms and presented informed consent information to the reader. Part two consisted of eight short sections, each with two to seven five-point Likert scale items. Together these sections captured respondent's attitudes, habits, feelings, intentions, social factors, facilitating conditions, and past experiences repairing personal electronics. The third and last part consisted of eight socio-demographic questions. See the questionnaire and dissemination materials in Appendix E.

A pilot test was conducted among friends to finetune the questionnaire before launching it. To decrease the nonresponse rate, five 300 sek ICA gift cards were raffled among respondents.

The questions were formulated by adopting measures that have been validated by Ajzen (2013), Bamberg and Schmidt (2003) and Sung et al., (2019). The different constructs in TIB were measured by more than one item. Therefore an overall scale was created by aggregating the median score of the different items for each construct before conducting the analyses to answer research questions. Cronbach α and mean inter-item correlations were used to measure the reliability of each scale (see Table 3-1). In social science research, it is accustomed that the Cronbach α of a scale is above 0.7 (Pallant, 2016). However, it is common to find low Cronbach values (i.e., 0.5) in scales with less than ten items. In these cases, it is considered appropriate to report the mean inter-item correlations (Pallant, 2016; Piedmont, 2014). Briggs and Cheek (1986) recommend an optimal range for the inter-item correlation of 0.2 to 0.4. since an inter-item correlation higher than 0.4 may suggest the scale items are redundant or too narrow. All the items on the scales used dor this study contained less than 10 items, therefore both Cronbach α and mean inter-item correlations are reported.

Table 3-1. Internal consistency statistics

Scale	Cronbach α	Mean inter-item correlations
Beliefs about outcomes	0.692	0.248
Evaluations of outcomes	0.666	0.200
Norms	0.804	0.673
Affect	0.892	0.679
Attitudes	0.548	0.259
Behavioral intention	0.692	0.540
Facilitating conditions	0.749	0.251

3.3.4 Sampling

A mix of quota, convenience, and snowball sampling was used for all methods of data collection during this study. For the interviews, the author sough to identify consumers from different ages, genders, occupational and parental statuses, and time living in Sweden (quota sampling). Participants were then recruited based on accessibility to the author (convenience sampling) and

on recommendations by participants themselves (snowball sampling). Overall, a sample of 19 participants was achieved, see section 4.1.1 for an overview of the demographic characteristics of the interviewees. As mentioned in more detail in section 3.4.2, during data analysis, the author looked for the point of saturation to signal that the sample size was acceptable. This point was reached after interview 13.

The questionnaire targeted consumers residing in Sweden. The questionnaire was posted in several Facebook groups and shared in the personal feed and groups of a few of the author's professors to recruit participants. Overall, a sample of 190 participants was achieved. After cleaning the dataset to ensure that outliers, duplicates, missing data, and other discrepancies, the sample was reduced to 164 valid observations (see more on section 3.4.3).

To determine whether the sample was representative of the Swedish population, a chi-square goodness-of-fit test was conducted for all demographic variables using population data from Sweden's statistical database. The chi-square goodness-of-fit test indicated that the age, gender, educational level and occupation composition of the sample were not similarly distributed to the general population (see results in Table 3-2). The test found that the marital status was similarly distributed in the questionnaire participants as in the general population ($X2(1)=.005$, $p=.945$). It was concluded that the questionnaire sample is not sufficiently representative of the Swedish population. Therefore, this sample is categorized as a non-probability sample which means that the findings of this study cannot be generalized to the Swedish population. However, conclusions drawn from this study are valid and a valuable contribution to policy and academia. Go to section 5.3 for a further discussion on this.

Table 3-2. Chi-square goodness-of-fit test results

Variable	X²	DF	Sig.
Age	87.997	5	.000
Gender	20.103	1	.000
Marital status	.005	1	.945
Educational level	242.095	1	.000
Occupation	12.746	2	.002

Moreover, power analysis was conducted to control for Type I error (when an effect is inferred when in fact there is none) and Type II error (when no effect is inferred when in fact there is one). Since no similar studies were found during the literature review stage, the valid sample achieved (N=164) was used to estimate the power level the sample can theoretically deliver. The analysis revealed that given a 5% significance level in a two-sided hypothesis test, the study's sample (N=164) is capable of detecting: a large effect with a power of 99%, a medium effect with a power of 88%, and a small effect with a power of 24%. This means a 99% chance that statistical analyses performed on the total sample will detect any large effects, 88% chance to detect medium effects, and a 24% chance to detect small effects. Regarding group comparisons, the power level for the different variables based on minimum group sample size varied and thus are shown in Table 3-3 below. The power analysis assumes a 5% significance level in a two-sided hypothesis test.

Table 3-3. Power analysis for variables based on minimum sample size per group

Variable	Total N of groups	N of the smallest group	Power level		
			Large	Medium	Small
Age	4	35	90%	50%	12%
Occupational Status	3	15	55%	25%	7%
Gender	2	50	97%	69%	16%
Time living in Sweden	3	51	97%	70%	16%
Parental status	2	60	99%	77%	20%

3.4 Data analysis

3.4.1 Document review

The documents reviewed were processed via thematic coding. The codes were initially derived from the research questions and further expanded based on emerging themes found in the literature. This process led to 34 codes that were applied to all documents reviewed.

3.4.2 Interviews

The author recorded audio of all the interviews and produced full transcripts to avoid running into validity issues by having inaccurate data descriptions. The transcripts were anonymized and entered into NVivo 10 software. Similar to the coding process of the document review, the codebook was initially derived from TIB and main findings from the document review but was further expanded based on emerging themes during data collection. Although TIB was used as a framework, it was not considered the only explanation to avoid "imposing" meaning instead of allowing it to emerge. This led to the development of over 100 codes which were then consolidated and refined during data analysis. See the list of codes in Appendix F. Interview data was categorized by type of respondent, age group, gender, location, and occupation. NVivo was used to conduct thematic analysis.

To ensure the reliability of the findings, the qualitative data was triangulated between the different respondents' viewpoints and the descriptive statistics obtained from the questionnaire. To ensure the validity of findings, the author looked for the point of saturation, which was reached after interview 13. The remaining interviews served to confirm previous insights and help the author conclude that the sample size was sufficient for this study.

3.4.3 Questionnaire

Once the questionnaire closed, the author cleaned the data ensuring that outliers, duplicates, missing data, and other discrepancies were corrected. This exercise resulted in a reduction of the sample from 190 to 164 observations. 'Not completed' was the number one reason the questionnaire was excluded from the analysis (N=19), followed by participants who were not Sweden's residents (N=5). In addition, two participants were suspects of response biases as they either strongly agreed or disagreed with all questionnaire statements and were therefore removed.

After cleaning the data, the author conducted several non-parametric tests using IBM SPSS 27 to explore relationships among variables and compare responses between groups. Non-parametric tests were deemed appropriate since they do not make assumptions about the shape of the distribution of the population being studied (Pallant, 2016). Moreover, non-parametric tests are

ideal when a study uses ordinal or nominal scales, which is the case of the present study (Pallant, 2016).

As mentioned in section 2.2.2, TIB is used to explore if and how intentions, habits, and facilitating conditions are related to and can explain repair behavior. This was achieved in three phases: 1) exploring relationships, 2) explaining relationships, and 3) comparing groups. To test the concepts under TIB, phases one and two examined intentions to repair before assessing repair behavior. The reason behind this is that Triandis proposes that intentions are formed by several factors (attitudes, social factors, and affect), while this is not the case for habits and facilitating conditions. The testing logic is visualized in Figure 3-3 below, where intentions to repair are labeled as step 1 and repair behavior as step 2.

Figure 3-3. Correlation and regression analysis steps
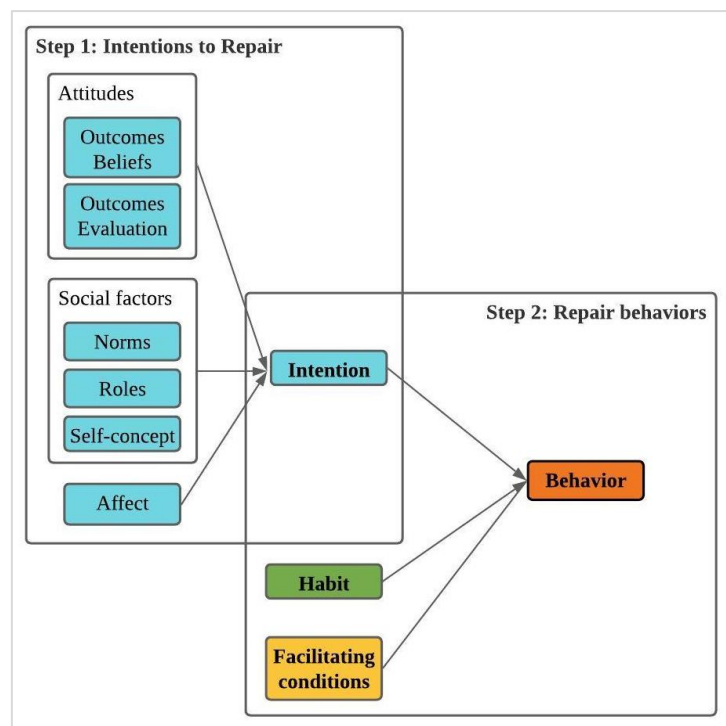
Phase 1: Exploring relationships

The first phase involved exploring relationships between the ordinal variables in this study. For this, a Spearman's rank-order correlation analysis was conducted. Spearman's correlation is a non-parametric test used to measure the strength and direction of association between continuous and/or ordinal variables (Laerd Statistics, 2018). Preliminary analysis was first conducted to examine the reliability of the scales using Cronbach α and mean inter-item correlations analysis (see details on section 3.3.3). Three assumptions were met before conducting a Spearman's correlation test: (1) there was a dependent and an independent variable measured on an ordinal and/or continuous scale, (2) variables represented paired observations, and (3) there was a monotonic relationship between the variables (Laerd Statistics, 2018).

Phase 2: Explaining relationships

The second phase involved explaining how and which factors affect intetion to repair and repair behavior. To achieve this a binomial logistic regression was conducted. A binomial logistic regression tries to predict the probability that the dependent variable will fall in one of two

categories given the independent variables (Laerd Statistics, 2018). Logistic regressions do not make assumptions about the distribution of scores of the independent variables; therefore, it is a suitable test for a non-probability sample such as the one in this study (Pallant, 2016). Six assumptions were met to conduct this analysis: (1) there was one dichotomous dependent variable, (2) there were more than one independent variable measured on a continuous or nominal scale, (3) observations were independent and all categories were mutually exclusive and exhaustive (4) there was a minimum of 15 cases per independent variable (5) there was no multicollinearity, and (6) there were no significant outliers (Laerd Statistics, 2018).

To meet assumptions 1 and 3, all scale ordinal variables were converted into binomial variables (see Appendix G). Moreover, Tolerance and Variance Inflation Factors (VIFs) tests were conducted to ensure there was no violation of the assumption of multicollinearity for both the model that tested repair behavior and the model that tested intention to repair. Tolerance values ranged from 0.752 to 0.862, and VIF values from 1.186 and 1.329 (see Appendix H). These values fall in line with the recommendations that tolerance values should be no lower than 0.10 and VIF values no larger than 10, indicating no violation of the multicollinearity assumption (Glen, 2018).

Additionally, the sample was analyzed for outliers. The model that explained repair behavior revealed one standardized residual with a value of 3.254 standard deviations that was categorized as an outlier and removed from the analysis. Cook's D and DFBeta for the constant were also calculated to ensure values were <1 for every single observation (Glen, 2018). The model to explain intention to repair revealed eight standardized residuals with values between -2.593 and -6.990 standard deviations and one case where Cook's D value was 1.12. These were categorized as outliers and removed from the analysis. Appendix I presents the statistical analysis for dataset including the outliers.

Phase 3: Comparing groups

The last phase involved determining if there are differences between groups (age, gender, occupational status, parental status and time living in Sweden). For this the author conducted Mann-Whitney U and Kruskal-Wallis H tests. The Mann-Whitney U test is a non-parametric ranked-based test used to measure any differences between two groups on a continuous or ordinal dependent variable (Laerd Statistics, 2018). Three assumptions were met to conduct a Mann-Whitney U test: (1) there was one dependent variable measured on an ordinal or continuous scale, (2) the independent variable had two categorical and independent groups, (3) observations were independent (Laerd Statistics, 2018).

The Kruskal-Wallis H test is another non-parametric ranked-based test used to measure differences between two or more groups of independent variables and a continuous or ordinal dependent variable (Laerd Statistics, 2018). Three assumptions were met to conduct a Kruskal-Wallis H test: (1) there was one dependent variable measured on an ordinal or continuous scale, (2) the independent variable had two or more categorical and independent groups, (3) observations were independent (Laerd Statistics, 2018). Pairwise comparisons using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons were conducted for variables that revealed statistical significance under the Kruskal-Wallis H Test.

Continuous variables age and time living in Sweden had skewed distributions, with 74% of the participants being under 40 years old and 60% of the participants having lived in Sweden for seven years or less. Therefore, to increase the power of the group comparisons, both variables were divided into four approximately equal groups. See section 4.3.2 for details on the different groups.

3.4.4 Mixed methods data analysis

Qualitative and quantitative data was integrated using joint display. Joint display is a strategy to *"integrate the data by bringing the data together through a visual means to draw out new insights beyond the information gained from the separate quantitative and qualitative results"* (Fetters et al., 2013, p. 2143). In this way, findings from all methods were captured in a matrix which was organized by research question and the thematic codes captured during data analyzes. This approach allowed for the comparison and integration of quantitative and qualitative findings. In some instances, this comparison led to the confirmation of findings, while in other instances, it led to the expansion of the findings. Overall, linking qualitative and quantitative findings led to a more comprehensive understanding of the factors influencing people's decisions to repair.

3.5 Study biases, limitations, and mitigation strategies

As with any social research study, there are biases and limitations that should be acknowledged and addressed.

Coverage error. This error occurs when the target population does not coincide with the population sampled (Lavrakas, 2008). Coverage error is likely to occur for the questionnaire, given that Facebook was the only distribution channel for the online questionnaire. As a result, the questionnaire sample was overrepresented by people younger than 40 years old. Coverage error was less of a concern for the interview sample since quota sampling allowed for an acceptable population coverage.

Sampling error. This error occurs when the population sampled does not represent the population under study (Lavrakas, 2008). A key limitation of a non-representative (or non-probability) sample is that the findings cannot be generalized to the studied population. Another one is that many statistical analyses cannot be applied to non-probability samples. Therefore, careful interpretation of the findings is needed to avoid mischaracterization of the results.

Response biases. Response bias happens when a participant provides a response that does not reflect her or his true thoughts, feelings, or behavior. For example, response biases can occur as the result the length of the questionnaire or interview, the order and working of the questions or response options, or when the participant distorts an answer based on what they think is a desirable answer (Lavrakas, 2008). The following measures were taken to mitigate response biases: interviews and questionnaires were anonymous, a pilot was conducted to detect any biasing problems, questions were phrased as neutrally as possible, and multiple items were used to measure the same construct with some items worded to "agree" and some to "disagree" with the construct being measured.

Information bias. Recall bias may be present when asking respondents about their past experiences repairing personal electronics as participants may not accurately remember all the details (Blaikie & Priest, 2019). Therefore, probes and multiple question phrasing were integrated into the questionnaire and interview guides to help participants recall and to validate recalled statements.

Self-selection bias. Since the interview and questionnaire were based on volunteer participants there is a probability that only those drawn to the subject participated, biasing the findings. Self-selection bias cannot be easily avoided with voluntary studies based on non-probability samples. However, to mitigate these bias findings were compared with existing academic literature on the subject and responses from consumers were compared with those from repair shops as a way to validate the information provided.

3.6 Ethical considerations

This study has been reviewed against the criteria for research requiring an ethics board review at Lund University and has been found not to require a statement from the ethics committee. However, as with any social science study, there are ethical considerations that the researcher must follow:

Informed consent: all interviewees and questionnaire respondents were informed about the purpose of the study and were able to decide whether to participate or not. Participants were explained that their participation was voluntary and that they were free to withdraw at any time. Their consent to participate was obtained either in writing (questionnaire respondents) or verbally (interviewees) before they participated in the study (see consent forms in Appendixes D for the interview and E for the questionnaire).

Anonymity and confidentiality: The names of the respondents are not revealed or identified during any stage of this research. All interviews/questionnaires received a unique identifier to avoid revealing any identity details.

Data storage: The data is stored in a password-protected folder on my personal computer. The files that match the participant's name with the unique identifier are stored in a separate password-protected folder.

4 Findings and analysis

This section presents an overview of the data collected in subsection 4.1, the findings and analysis for *RQ1* in subsection 4.2, for RQ2 and RQ2a in subsection 4.3, and for *RQ3* in subsection 4.4.

4.1 Overview of data collected

4.1.1 About the interviewees

Nineteen interviews were conducted with consumers residing in Sweden, of which 10 participants were women and nine men. The ages of the interviewees ranged between 22 and 75 years old. Nine participants were single, nine were married or in a domestic partnership, and one was widowed. Eleven participants had children. Eight participants lived in Lund, while the others lived in varied locations such as Malmö, Stockholm, Åhus, Flyinge, Trollhättan, and Forsheda. Eight interviewees had a BA, eight an MA, and three a Ph.D. Participants' time living in Sweden ranged from five years to all their lives. Professional occupations included librarian, teacher, programmer, social worker, researcher, engineer, student, and retiree.

4.1.2 About the questionnaire participants

The questionnaire received 164 valid responses (see more in sections 3.3.4 and 3.4.3). The ages of respondents ranged from 20 to 73 years Md=31 (IQR: 26,42). Time residing in Sweden ranged from 1 to 70 years Md=4 (IQR: 2, 22). Sixty-seven percent of the sample identified as female, 31% as male, and 2% as genderqueer/non-binary. Sixty-two percent of the participants were either married or living with a partner, while 38 % were single. Thirty-eight percent reported having children. Forty-two percent had a master's degree or higher, 41% have a bachelor's degree, 9% vocational training, and 8% a high school diploma. Fifty-three percent of the participants were employed or self-employed, 36% were students, 9% were unemployed, and 2% retired. Thirty-two percent of participants live in Lund, 20% in Malmö, and 48% live in 18 different places across Sweden. See a visual overview of the questionnaire demographics in Figure 4-1 and Figure 4-2 on the following page.

Figure 4-1. Questionnaire sample descriptive statistics
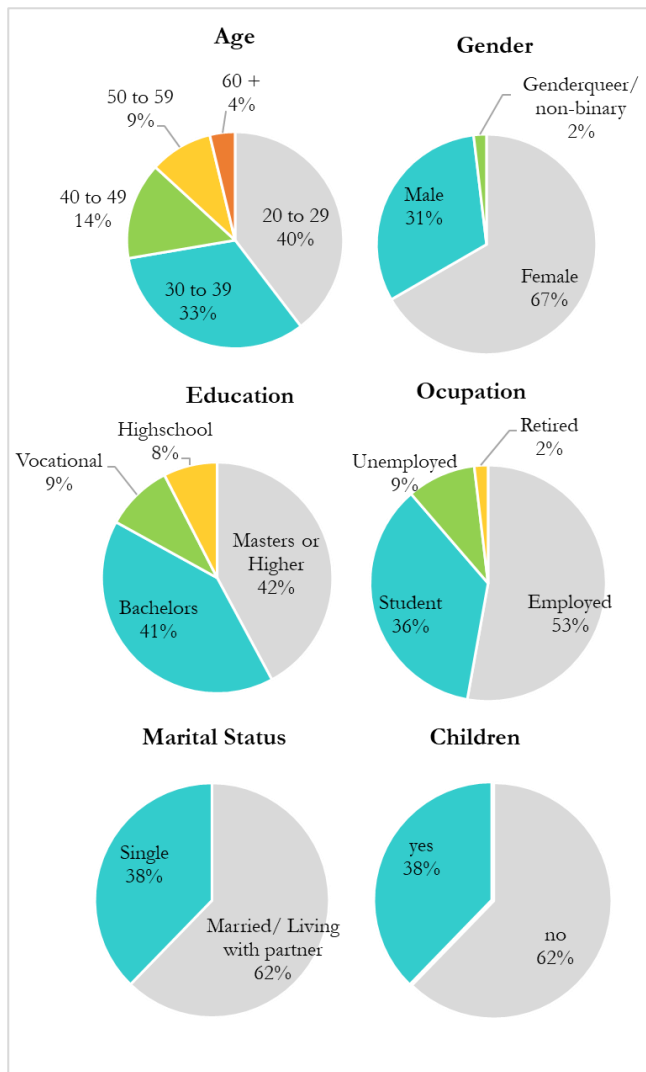
Figure 4-2 Places of residence of current participants
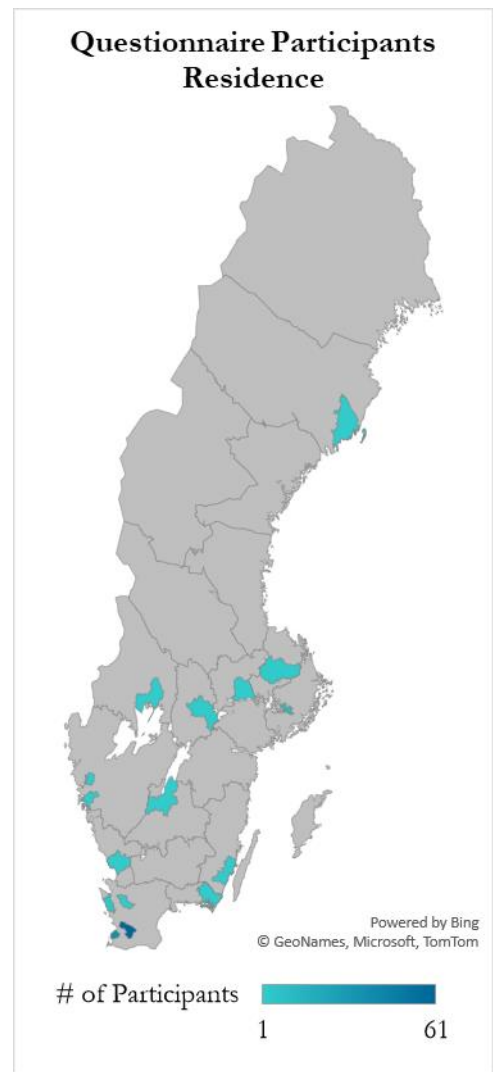
4.2 Factors that shape electronics repair behavior

This subsection presents the findings and analysis for *RQ 1,* which investigated the behavioral factors that shape consumers' decisions to repair their personal electronics. This question was answered through interviews and an online questionnaire with consumers residing in Sweden. Consumers were defined as anyone who has purchased and used personal electronic devices in the past. This subsection begins with a brief overview of the behavioral factors proposed in Triandis' Theory of Interpersonal Behavior (TIB), then presents the interview and questionnaire findings, and ends with the author's analysis of the findings.

4.2.1 Triandis' behavioral factors

Triandis' TIB is leveraged in this study to conceptualize the factors that shape repair behavior. Triandis proposes that behavior is shaped by three factors: intentions, habits, and facilitating conditions. Moreover, he theorizes that intentions are formed by attitudes, social factors, and affect (see Figure 4-3 and section 2.2.2 for more detail on TIB).

Figure 4-3 Triandis' Theory of Interpersonal Behavior
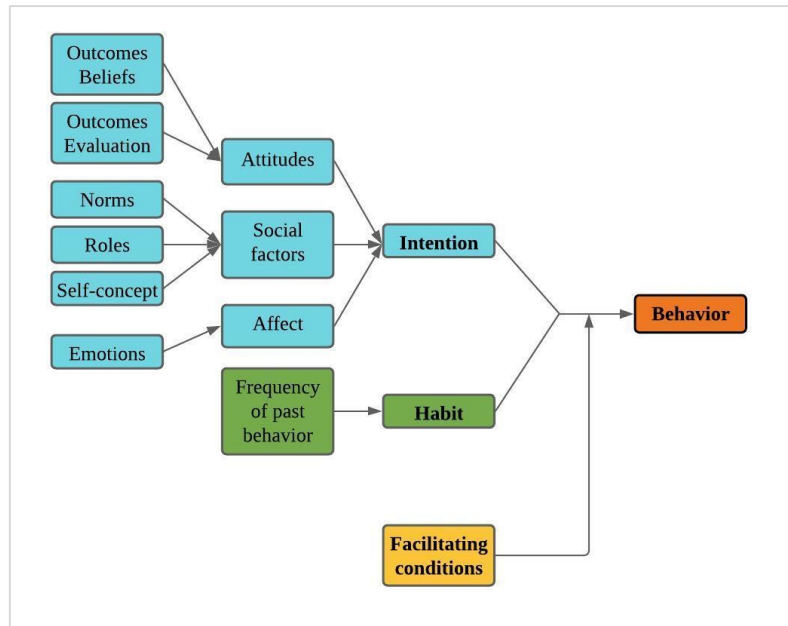
Source: adapted from Jackson, 2005 and Page & Sherif, 1980

4.2.2 Findings

Findings from the interviews and questionnaire are presented following the diagram above, starting with intention and its related factors, then with habits, and finishing with facilitating conditions.

Preamble: What is worth repairing?

As the interviewees began discussing repair, most of them explained their reasoning of what or when electronic devices were worth repairing without questioning or probing. From these conversations, it became apparent that most participants (12/19) believe that old and cheap electronics are generally not worth repairing while expensive and either new or very old (20+ years) products usually are:

> "If it's a new phone that I just bought, then I would make more effort to repair it, but if it's a phone that I've been having for three years and it broke, then it's time to buy a new one" (P16)

> "Chargers, those I just throw out because they have a sense of being things that you usually don't repair and it's just cheaper to buy a new one" (P5)

> "Super old things, as in older than 20 years, those are definitely worth repairing I would say, because they are durable and there's also a personal attachment to them. New products, let's say from 20 to 5 years ago, there it depends, but usually they are not worth repairing" (P19)

Therefore, the products most frequently being repaired by the participants were phones and computers that were not too old and high-quality equipment (both new and vintage) such as sound systems, cameras, headphones, and TVs.

Intentions to repair

The survey revealed that most participants intent to look into repairing their devices next time they break (83%) and are willing to spend time to try to repair their devices (67%) (see Figure 4-4).

Figure 4-4. Respondents' intentions to repair their electronic devices
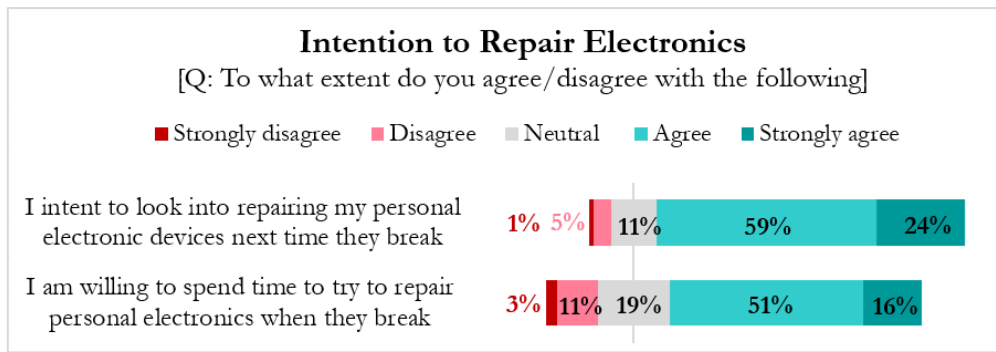
Attitudes towards repair

To capture interviewee's attitudes about repairing personal electronics, they were asked to share their thoughts on the benefits and drawbacks of repairing electronics. Most interviewees mentioned the following benefits and drawbacks.

Perceived benefits

Environmental benefits were consistently mentioned by all interviewees as the biggest advantage of repairing personal electronics. Statements included: *"Repair is very key for not having to keep mining the materials and creating all that waste"* (P18), and *"It is necessary for sustainable development. We are overconsuming and repair helps slow consumption. Also the environmental and social aspects of mining"* (P7).

Economic benefits were mentioned by just under half of the interviewees (8/19) as a benefit of repairing electronics: *"We save some money because [repairing] is not really exactly as expensive as buying a new one"* (P3). A couple of participants also mentioned how repair benefits the local economy since small and medium businesses run most repair shops.

Building emotional connections was mentioned by a few participants (5/19). Some participants referred to repair as the means to develop relationships with their devices (P1) and to *"feel satisfied to see a worn-out device work"* (P13), while others described it as a mindset and lifestyle of caring (3/19).

Perceived drawbacks

Inconvenient and complicated process. Thirteen participants described repair as an inconvenient, complicated, lengthy, and hard thing to do. Statements include: *"It's the opposite of easy but I don't mean just difficult but more like a lengthy process that feels a little bit overwhelming and expensive. I don't really know if it's worth it"* (P3) and: *"Generally when I've repaired stuff, it's been a lot of trouble. You hand it in to the people that are going to repair it and then they charge you and then they say: 'I can't fix it'"* (P12). Some participants (8/19) also described feeling lost and not knowing where to start or where to go if their device were to break or malfunction: *"I don't think we actually have an infrastructure in Sweden, you don't really know where to go with a broken electronic appliance, you know?"* (P10).

Low value of repair. When it came to the cost of repair, twelve participants expressed that repair services were generally expensive in Sweden but that the real problem was that they felt they did not get their money's worth when they repaired their personal electronics. Participants described that when a device broke, they would compare repairing against replacing and often concluded that replacing a device was better value even when it was more expensive. This because they were

confident that a new device would work well or even better than their current one, while the outcome of repair was unknown:

"My big brother broke my keyboard and he really tried to see how much it would cost to repair it, but then the service people said: 'we might try to switch it for this cost, but it maybe won't solve the problem'. We won't pay 2,000 sek so it 'might' get fixed"
(P13)

"Will it be more economic in the long term to buy a new phone? and if I repair, would it last? because repair may be a bit cheaper but then it may not last long. You cannot guarantee a reparation in the same way you can guarantee a new phone" (P16)

<u>Lack of trust in repair</u> was another frequently mentioned drawback of repair (11/19) and one closely tied-in with the perceived low value of repair. Participants mentioned that they did not trust the products were built to be repaired, therefore taking them to the repair service would be a potential waste of time and money: *"If the product were designed in other ways, if I knew that it was built in order for it to be easy to repair, I would have much more trust in handing it to someone and knowing that this would do the trick."* (P1); *"Maybe I would repair it, but how big is the risk that it will break again in another way? I think that the first time it breaks is a sign that maybe it will break again"* (P16).

<u>Time-consuming and time-intensive</u> were among the most frequently mentioned drawbacks of repair (11/19). Participants described repair services as time-consuming in two ways. On the one hand, it takes time to investigate where to go and what is a fair price: *"I think is what economies would label as 'transaction cost' it takes time and effort to find out where to go and how much does it cost"* (P7). On the other hand, the wait time to get a device repaired can be long, which is especially problematic with devices such as computers and phones: *"There is downtime when you have a phone and you have to replace something which is not available immediately and you have to ship it from wherever then you have to wait for three days and three days without a phone in Sweden is really problematic"* (P19).

The survey findings mirrored the interview findings to a great extent except when it came to the perception of the value and the quality of repair. The questionnaire showed that there was overall agreement among participants that repairing electronic devices was good (90%), beneficial (86%), and worthwhile (73%) but also hard (68%), time-consuming (65%), and expensive (50%). Opinions about whether repair was frustrating or satisfying were divided (see Figure 4-5).

Figure 4-5 Respondents' beliefs about the outcomes of repairing electronics
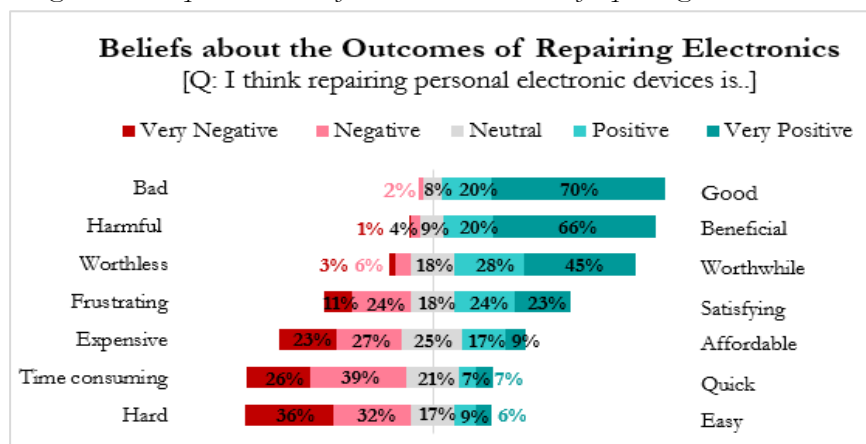
Moreover, most participants strongly agreed or agreed that repairing electronic devices when they break helps protect the environment (87%), makes them feel proud (83%), is *not* a waste of time

(71%) or money (63%), is a good deal (60%), and will result in their device working as well as when it was new (58%). On the other hand, the slight majority of participants strongly disagreed or disagreed that repairing electronics makes them uncomfortable (48%) and that repairing a device signals it will continue to break (42%) (see Figure 4-6).

Figure 4-6 Respondents' evaluations of the outcomes of repairing electronics
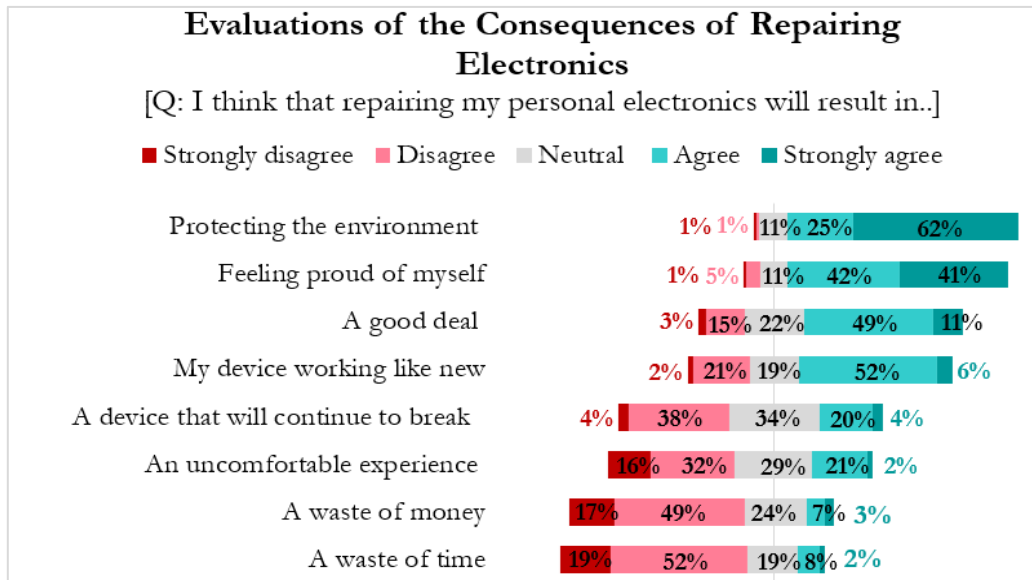
Finally, most respondents strongly agreed or agreed that repairing electronics is good for the environment (96%), a good idea (91%), beneficial for the local economy (79%), and overall important to them (64%). However, unlike the interviews, when it came to the value of repair, only a slight majority of participants (43%) strongly agreed or agreed it is a better deal to buy a new device than to repair a broken or malfunctioning one (see Figure 4-7).

Figure 4-7 Respondents' attitudes about repairing electronics
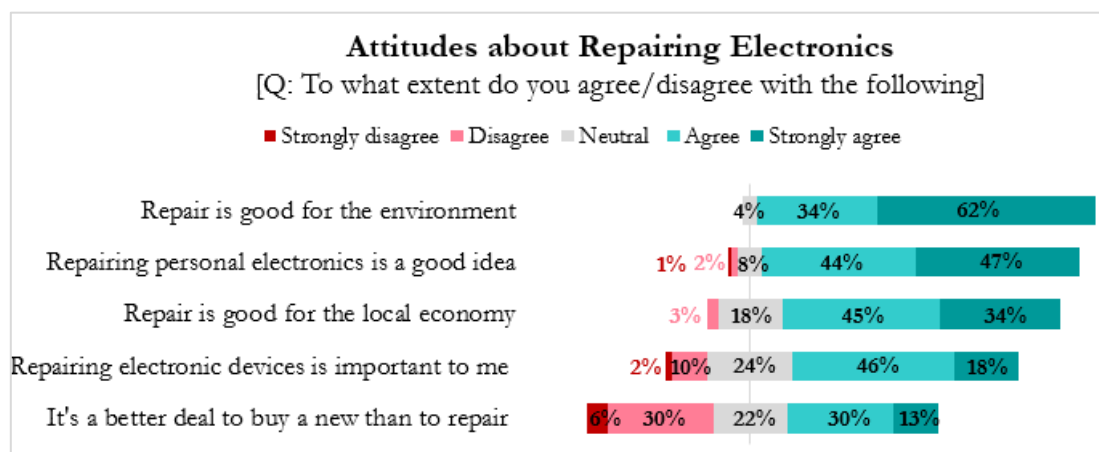
Social factors influencing repair

Norms

To get at norms, the interviews asked participants to share what they considered normal or the norm in Sweden around personal electronics use and repair and why.

In a nutshell, the key finding is that repair is accepted but not expected and hence not really the norm for broken electronic devices in Sweden. Most participants (17/19) perceived that the normal thing to do when an electronic device breaks or malfunction is to replace it. There was some discussion (6/19) about how there is a growing expectation that you donate or recycle old devices; however, many participants (8/19) said they had old devices stored away in drawers at home. In line with this, all but one participant said that they perceived the culture of electronics repair in Sweden as very weak and did not think the average Swede tried to repair broken electronics. There was consensus that repair is more common for high-quality, expensive electronics.

Some participants explained that repairing things, including electronics, was the norm in Sweden for a long time, but it began disappearing at the turn of the century. This change was in part attributed to the government, who back in the 1970s believed consumption needed to be accelerated *"for the health of the country"* (P17), and there was an extensive national campaign promoting consumption called "slit och släng" (use it and throw it away):

> *"I think it was in the 70s, like in 75. It was two very popular ladies in Sweden. One of them said you should always 'slit och släng' and the other one that 'you should always keep everything and save it for the coming generations' so that was a public conversation in the 70s. People thought new things were always better, I think. And that the other lady was a bit oldish"* (P11).

Slit och släng was described as the current paradigm of consumption where Sweden saw a few things happen simultaneously. First, there were nationwide efforts to mainstream "slit och släng" through things such as the televised discussions P11 recalled. At the same time, globalization generated the well-known "race to the bottom" effect, which resulted in increasingly cheaper electronics becoming available in Sweden. Meanwhile, the cost of labor in Sweden kept on rising. All these factors aligned contributed to repair becoming increasingly unpopular and expensive.

In this new paradigm of consumption, the norm became one where *"you should replace your whole living room every year"* (P10), and as gracefully said by one interviewee: *"That's the era we are living in now [slit och släng], it's a lot cheaper to buy new than to repair and it is actually quite cheap to buy new electronics […]. It's the cultural norm and expectation so then it really feels like you're swimming upstream if you want to do something different"* (P18). In line with the slit och släng ideology, all participants agreed that nowadays it is widely accepted to replace electronics while they still work: *"I think it's way too accepted. I think people do that a lot. In all kinds of electronics, I think you change because there is a new model, there is a new color, there is a new function"* (P12). Moreover, participants shared how slit och släng has encouraged a culture with no expectation of taking care of material belongings (4/19): *"People have this view in that they don't invest in what they already have, I think it's more about society's lifestyle, we always want the newest and we get tired of what we have and then we go to another one. It's okay not to care for your things"* (P16).

Another reason mentioned by most participants (15/19) to explain why repair culture is not the norm, was that contrary to buying new, the process and outcome of repair is uncertain, and Swedes prefer certainty over uncertainty: *"Swedes, they say we like safety, we have insurance, security, bells in the cars. We are very much about control and security you know. We really want to know what we're getting so maybe that's part of it as well, you want to be sure. If you go 'there' maybe they won't repair it and it feels really bad not getting what I want or not being sure of what I'm getting"* (P8). Some participants (9/19) highlighted that some Swedes can be conflict-averse, which could explain a preference for replacing over repairing:

"I think people in general in Sweden avoid conflict. So that means that when we buy a product, we don't want to go back and say: 'hey, this is not what I expected I want you to fix it' we don't want that conflict, I think." (P3).

A finding that substantiated that repair is not the norm in Sweden is that most participants (14/19) shared that repair is not a topic of conversation with people that are important to them: *"I feel like at least with the group of people that I hang out with, buying new clothes, for example, is becoming really taboo, you should buy clothes at the second hand store, at Tradera or the marketplace of something like that, but yeah, electronics doesn't have that stamp on it and honestly we don't talk about repair, not that I can recall"* (P6). When a device broke, participants said they have generally not reached out for advice even when they could pinpoint specific people who could help them. When asked whether people in their social circle repair or not, most participants were able to identify both types of people within their social circles. When asked whether they felt encouraged by others to repair, the most common response was that they felt people around them would support their decision regardless of whether they repaired or replaced the product (10/19).

Other explanations mentioned by smaller numbers of participants included that there is a wide-spread false belief that the recycling system in Sweden is excellent (2/19), and that repair is not popular because you go through much trouble to keep the same old device (3/19): *"You don't get that same gratification [of buying a new device] when you have to pay for an expensive repair and you get the same old thing at the end"* (P19).

The questionnaire findings agreed with the interview data by revealing that most participants do not see personal electronics repair as something they are expected to do (49%). Interestingly, the opinion on whether people think they should repair broken personal electronics was somewhat divided with a slight inclination towards thinking that repair is something others think they should do (39% strongly agreed/agreed versus 33% strongly disagreed/disagreed). Also aligned with the interview findings, most participants think it is acceptable to replace a device that still works as long as it is recycled/donated (54%) or replaced with a secondhand device (51%) (see Figure 4-8).

Figure 4-8 Perceived norms around what to do when personal electronic devices break or malfunction
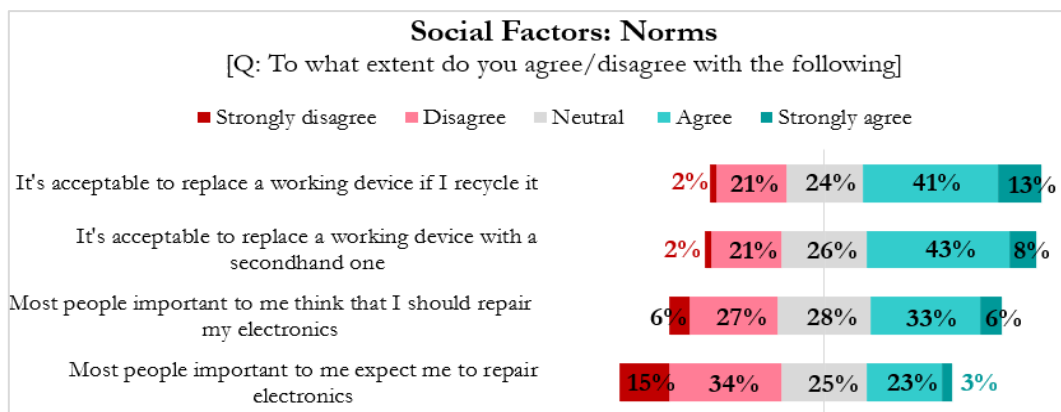
Roles and self-concept

Being a working professional or a parent was consistently described as being *"time poor"* (P11) hence not having time to repair: *"You work all day, then you get home and you have to do a lot of chores, and then on top is: 'oh no! Now I have to fix this device' and so I have to use my lunch break to go to a few shops to show my phone. It's too much"* (P9). In contrast, students identified themselves as perfect candidates for repair as well as for the secondhand market: *"We tend to repair. But also buy second hand. At least in the student world it works like that a lot. Those two things before buying new"* (P14).

Regarding self-concept, the majority of participants (12/19) described themselves as environmentally aware and talked about making intentional choices to live their lives sustainably such as buying second hand, taking bags into the supermaket, and eating less meat-based products. However, during the interview, many (5/19) reflected that repair was not something they had thought about too much: *"I mean when it comes to other aspects of living sustainably, I feel that I go much much longer in other to live right, or do the right thing"* (P1).

The questionnaire found that when it comes to self-concept, about half of the participants (48%) strongly agreed or agreed that not repairing their broken electronics would violate their principles. Regarding roles, the vast majority strongly agreed or agreed that repairing electronics is an appropriate activity for them to do (74%). The opinion on whether their peers repair was divided (40% strongly agree/agree versus 42% strongly disagree/disagree) (see Figure 4-9).

Figure 4-9. Respondents' perceived role and self-concept in relation to repairing personal electronic devices
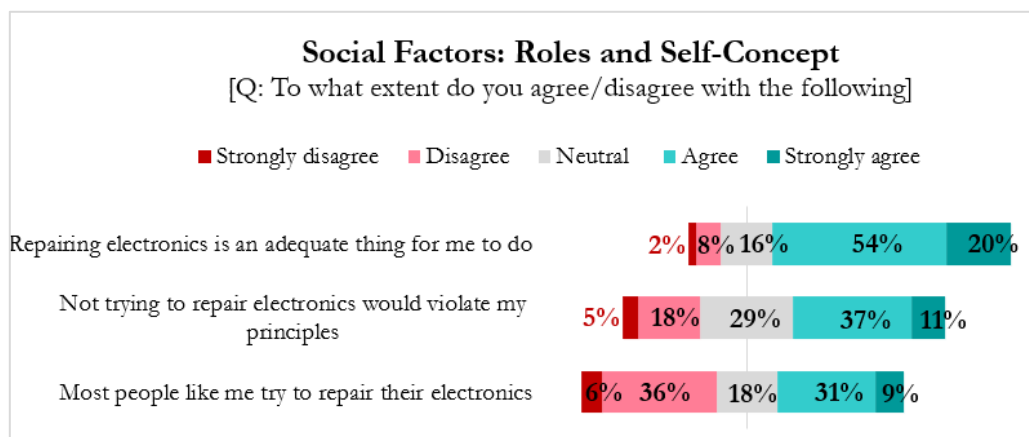
Affect towards repair

The process of getting electronic devices repaired by a professional service seems to be dominated by negative emotions. Interview participants (5/19) reported feeling sad or "bummed out" whenever their device stopped working. This feeling of sadness then transformed into a mix of frustration (4/19): *"There are so many steps that you just get angry"* (P13); discomfort (5/19)*: 'I know that I always get a little bit apprehensive in situations that I'm not really comfortable with and since I don't really know much about electronics I feel like I could be fooled"* (P5); and uncertainty (4/19):*"I feel a bit insecure. In Sweden we have this say: 'you buy a pig in a sack' you pay for something but it's not transparent, you don't really know what you get"* (P8).

Then, while a device is being repaired, participants described feeling stressed (3/19)*: "stressful, because it's something that you can't be without and so you send it for repair and it takes a few days or a week, so it's always like 'ok what do I do, now I have to get another phone?'"* (P14), and anxious (4/19): *"I do get anxious and wonder: 'Will it really be functioning like its new again? or now that I had to repair it, will it come back with some other thing that won't work?'"* (P12). Finally, things turn bright once participants received their devices as they described feeling happy and satisfied (4/19): *"After you repair something you feel this kind of happiness or that you did good. You feel the satisfaction both in an environmental perspective but also because I felt like I saved a lot of money, so that's kind of the best feeling of repair"* (P6).

The experience of repair was described differently by four participants that engaged in self-repair activities. They also felt sad, disappointed, and annoyed when a device stopped working but

feelings of excitement quicky replaced those emotions as they investigated how to repair their device. This feeling of excitement ended up in feeling happy and proud:

> *"When it breaks obviously I feel disappointed, but pretty soon, I mean I always start to think 'is there a way to repair it?' and then the problem solving mechanisms go on and that's the fun part, trying to understand how it works … and when I find it is a really good feeling because both I learned something new, and if I manage it repair it, it brings extra value to the thing I repaired that wasn't there before"* (P17).

Unlike in the interviews, the reported feelings about repairing electronics in the questionnaire were mixed between positive and negative emotions, with no clear trend. Participants reported feeling pleased (50%), unsure (45%), nervous (43%), comfortable (38%), confident (35%), relaxed (29%), annoyed (29%), and uncomfortable (27%) (see Figure 4-10).

Figure 4-10. Respondents' feelings about repairing electronics
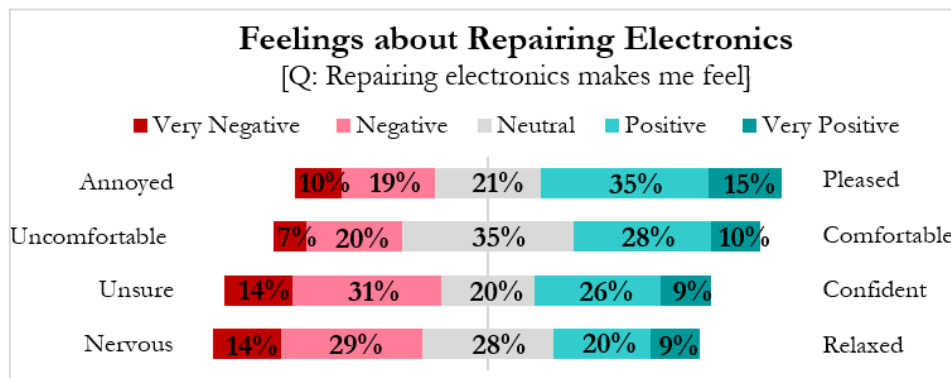
Repair habits

Habits here refer to participants' repair activities in the present and the past. The present being defined as repair activities in the last five years, and the past as repair activities in their childhood.

Childhood repair activities

Participants born in the 80s or earlier revealed that they did not grow up with many electronic devices, and the devices they had rarely broke or malfunctioned (7/19): *"We never replaced things until they broke, and things didn't break. And I can't say we had that much. I mean we had a radio in the kitchen, we had a stereo, a really good quality stereo from the 60s, and my father still has the loudspeakers, we sent them for repair"* (P12).

For sixteen of the participants interviewed, repair was a commonplace activity while growing up, and for many, fathers were frequently mentioned as the home repairers:

> *"I'm used to thinking of my Dad being down in the basement fixing some product"* (P1)

> *"My mom would definitely repair, she'd take devices apart and see if there is anything she could do. She would even probably ask a friend, like a neighbor, 'do you want to have a look at this?' she would go to some lengths to fix something before thinking about replacing it"* (P4)

> *"For them it was repair, but they grew up in the 1920-30s and in that time you really had to take care of anything you had, so they never threw away and always repaired"* (P7)

When asked about whether their childhood experiences had changed over time, there was general agreement that there still was a culture of repair at home, however consumption of electronic devices had increased together with a tendency to replace more often than to repair:

"I would say the consumption increased generally, there is more buying new than repairing but also technology changes much faster. It's a mixture of both, the increase on consumption made it more tending towards replacing with something new than repairing but there is still consciousness of repair, for example my mother recently repaired her oven" (P19)

Only three participants described experiencing no repair activities while growing up: *"My mother would say 'don't put too much effort and buy a new one instead'"* (P5), and *"I don't recall repairing but most things we owned were secondhand, that's maybe why"* (P15).

Current repair activities

Quite the opposite from when participants grew up, today, most participants (11/19) are not repairing their broken electronics. When personal electronics were broken or malfunctioned, participants' actions could be placed into three categories: replaced, repaired, or did nothing. The most frequently cited reasons for replacing a device instead of repairing it were that the device was at the end of its useful life and hence not worth repairing (4/19): *"When those phones reached three years and started malfunctioning, you don't even consider repair, you just go for replacing"* (P12); that the device couldn't be repaired (3/19): *"Actually it has been so broken that it can't be repaired. The repairer told me that its more costly to repair than to buy new"* (P15); or simply that they did not think about repair (8/19): *"We ended up buying a new one. There wasn't even a question of trying to repair it"* (P6).

Of those who repaired their electronics (8/19), only a minority talked about using guarantees to pay for repairs (3/19); the rest repaired their devices outside of the guarantee period. The participants that reported "doing nothing" usually cited doing so because their device was functioning well enough (5/19): *"I recently dropped it so the screen crashed a little, but it works still so I can continue to use it for a while"* (P1).

The past and present repair experiences of the questionnaire participants disagreed with the interviewees. Most respondents reported that their parents used to repair electronics when they were young (58%) and that today they try to repair electronics when they break (57%). Conversely, most participants disagreed with the statement that replacing a broken device is something they do without thinking (58%) (see Figure 4-11).

Figure 4-11 Respondents' past and present repair habits
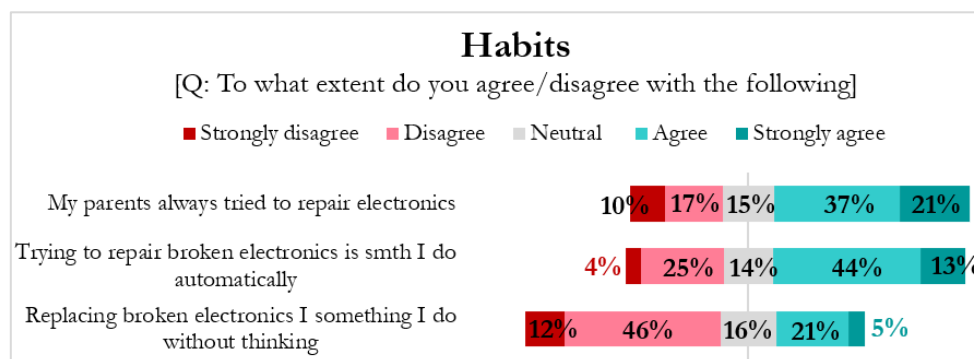
When asked how frequently they have tried to repair broken devices in the past five years, 45% reported having done it always or most of the time. When asked whether they tried to repair the

last device that broke, 65% said they had. Of those who tried to repair, 35% repaired it themselves while 65% took it to a repair shop. Of those that took it to a repair shop, 62% had a successful experience, 23% could not repair it, and 15% chose not to repair it because of the cost (see Figures 4-12 & 13).

Figure 4-12 Respondents' reported frequency of electronics repair behavior
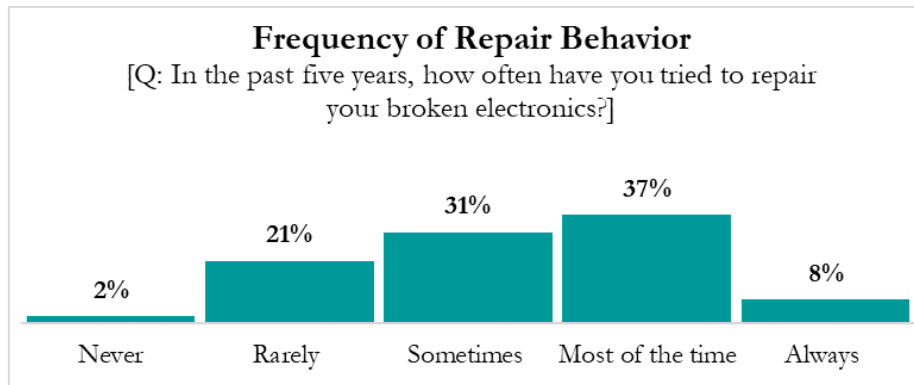
Figure 4-13 Respondents' experience with last personal device that broke or malfunctioned
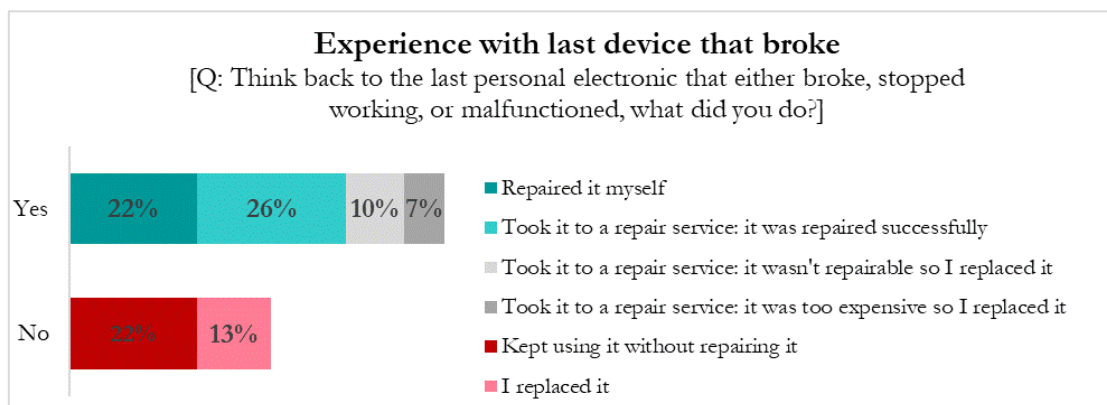
Conditions that facilitate or hinder repair

Participants reported six facilitating conditions that would make repair their first option when a device breaks or malfunctions. These conditions are presented starting with the one that was mentioned by the largest number of interviewees.

Improving the value of repairs. As mentioned earlier, many participants described the value of repair as a key drawback. Consequently, many (11/19) mentioned that they would repair if they got better value for their money. To improve the value of repairs, participants talked about having repairability labels (2/19): *"I think just this label would make you more aware and confident that is possible to repair things"* (P19); and comprehensive guarantees (5/19): *"If you buy something new or second hand, then you get this guarantee, and then you're more safe, you pay money and you know what you get and its more safe to have the guarantee. But if you bring your device for repair and then you have no sort of guarantee"* (P9).

Hearing more about repair: Many participants (8/19) discussed how they would repair if it got more attention in the media or if it had a higher profile in the Government's agenda: *"The Swedish government should encourage people, like when they promoted the pant scheme"* (P3). In addition, many mentioned how Swedes like to do "the right thing", so if the consequences of not repairing

electronics were discussed more openly, many Swedes would start making an effort to repair their devices:

> *"I just think it has to get the attention and become commonly known. A great example is with plastic bags, like it's incredible that you would skip go to ICA if you don't have your plastic bag rather than just buy a new one for 6 sek. Like 6 sek is nothing compared to what you're getting at the store but you still, sometimes I say, 'oh I didn't bring my plastic bag, I'll just go shopping some other time'"* (P6).

<u>Better level of service.</u> Participants want simplified repair experiences (8/19) and experts that encourage repair (5/19). Simplified experiences were described as *"A place to approach which is there in an instant where I can ask for help like: what can I do with this?"* (P19), and *"If I could go to somewhere where it felt like it was the right place to be, regardless of what the outcome would be of my situation. Regardless of whether they would take it and repair it, or if they can say that 'maybe you can do this instead'"* (P1), and *"By making it possible to do the whole process online because then you won't have to do that whole confrontation step"* (P5). Moreover (and again), extended guarantees (5/19) were mentioned as key to improving the level of service, while some participants (2/19) said they would want data security to be part of the repair service so that they did not have to worry about backing up their devices in order to send them for repair.

Participants also described wanting repair services to be friendlier and to be a place where people are encouraged to repair their devices: *"I think one big part of the solution is having experts and specialists that are excited about doing it and positive and encouraging people to do it because it is really discouraging to try to do it and just feel like you're fighting a battle in every turn and people are just like 'oh just buy a new one'"* (P18).

<u>Clearer information about repair options</u>. Participants discussed how they wanted better information on where to go repair (5/19) and about the cost of repair (7/19):*"There may be some infrastructure for repair already but I'm not aware of it, and I'm not aware of what kind of products can I leave there, and what result I can expect"* (P10). Some participants (4/19) wished there was a website *"like price runner"* (P8) to compare repair shops and make it easier to choose where to repair electronics:*"If there was a big website where you would see the prices and you would see that the price you pay, everyone pays, and not that someone's friend comes in and gets half the price"* (P6).

<u>Knowing people that repair.</u> Five participants discussed how they would repair if they knew people that did it and saw more people talking about it: *"Honestly I think that if more people will do it in my social network and I will also do it"* (P16).

<u>Improving the status of repair.</u> Some participants (4/19) mentioned that they would repair if repair were trendy: *"If it was more of a trend to be repairing your stuff, I would repair more, I'm definitely a trend follower, and probably other people as well"* (P5); or had a higher status:

> *"If you buy a plate from the XVI century that was broken and then repaired, it is valued a lot higher because we can see the craftmanship going into repairing these stuffs. Imagine if we could feed the same status to modern stuff"* (P10).

> *"It's very popular nowadays to have clothes that are old, people go and buy these old clothes. Maybe you can do the same with the computers and the iPhone and so on, you can go and buy an old one that is 'high class'"* (P11).

When it came to the questionnaire, participants were asked to report their perceived barriers to repair. The majority reported that the following factors have impeded them from repairing their broken electronics to a considerable or a great extent: the cost of repair being higher than the cost

of buying a new item (72%), not having a way to easily compare repair prices (66%), not knowing the cost of repair up-front (56%), not having access to instructions on how to maintain and repair electronics (55%), not having a device covered by a guarantee (55%), and not knowing where to go to repair their electronic devices (54%). Slightly less than half of the participants reported that not having the time to figure it out (43%) was a factor that prevented them from repairing their devices either to a considerable or great extent. In addition, about one-third of the respondents reported not trusting the repair service will do the job right (37%) and not trusting that the repair service is being transparent (31%) as considerable or great barriers (see Figure 4-14).

Figure 4-14. Factors that impede repair

Factors that Impede Repair
[Q: To what extend do you think the following factors have impeded you from repairing your personal electronic devices?]

Legend: Not at all | Slightly | Moderately | Considerably | To a great extent

Factor	Not at all	Slightly	Moderately	Considerably	To a great extent
Cost of repair	5%	9%	14%	32%	40%
Ability to easily compare repair prices	9%	9%	16%	45%	21%
Not knowing the cost of repair up-front	7%	14%	23%	30%	26%
Not having maintenance instructions	9%	17%	19%	38%	17%
Not knowing where repair shops are	9%	20%	17%	32%	22%
The guarantee being over	12%	17%	16%	35%	20%
Lack ot time to figure it out	12%	18%	27%	27%	16%
Trust in the quality of the repair	25%	17%	21%	26%	11%
Trust in the transparency of the repair service	27%	21%	21%	21%	10%

Additional findings: consumption and culture of personal electronic devices

Interviews often drifted away from the topic of repair and into the topic of personal electronics consumption. Participants shared their thoughts on the reasons behind consuming electronics:

<u>Drive to have something new.</u> Many participants (6/19) expressed that they consumed electronics because they enjoyed technology and liked having 'smart things'. Others said (3/19) they were 'victims' of commercial advertising, making them feel like they had to have the newest things. Two participants mentioned they buy new electronics because they get bored of the ones they have and want to try something new. Overall, it seemed like excitement about new technology was a common theme that explained personal electronics consumption:

> *"There is always an excitement about new things. I mean in Sweden people are very interested in technology and I think the drive may be more to try the newest thing of everything rather than keeping what you have"* (P17).

> *"I can get the feeling of 'oh my television broke down but uuu there is a cool technology maybe I can see if I can buy a new one'. I can see how it can be fun to buy new products"*
> (P13).

<u>Status</u>. Most participants (16/19) agreed with the thought that electronic devices are a status symbol and a way of showing others how well they are doing: *"It is status, they want to be seen as*

successful and you're successful if you have the latest iPhone and you're not if you have another phone, a cheap one" (P3). However most also noted that this was not true in every circle: "*There is always two sides to it but generally I would say it's totally accepted to brag with your electronics. It's an easy way and it's also not the most expensive way, when you look at electronics, you can have a good smartphone, the newest smartphone, very easily"* (P19).

<u>Peer pressure</u>. Those with children or grandchildren mentioned that teenagers are more susceptible to marketing campaigns and social pressure that pushes them to want the newest models to 'fit in': "*Both my daughters were really impressed with the new phone, they were like 'oh I want that thing because I can tell my friends that I have this galaxy S20'. And where do they get these ideas from? I guess they hear it from fellow students in school and watching things in YouTube and they believe that this is an important part of their life"* (P10).

Moreover, participants shared that although replacing devices is widely accepted, wanting a new device is not an acceptable reason to replace it. Thus, people find other ways to justify replacing their devices: "*It's not socially accepted to be flashy, so I think that many people rationalize it, they say: 'oh I need to replace it because the processor on my computer is too slow' or 'I need a better camera' but they would never say 'oh I want that cell phone because it's a new model and its cool to have the latest model'"* (P8).

4.2.3 Analysis

The factors that shape people's decision to repair their personal electronic devices are nuanced and diverse. Altogether the findings suggest that repair has an unfavorable imagine. Attitudes and feelings about repair are both positive and negative, with a slight inclination towards being negative. Social norms around broken electronics favor replacing devices over repairing them. Habits are still existing although they seem to have declined over the past decades. Lastly, the physical environment of repair is filled with barriers and disincentives.

The following subsection reflects on the key findings for *RQ1* and presents some possible explanations for some of the most interesting insights.

Attitudes and Intentions

Triandis' defines attitudes as *"an idea, charged with affect, that predisposes a class of actions to a particular class of social situations"* (Triandis, 1977, p. 208). The findings revealed two contrasting ideas that dominate attitudes about repairing personal electronics. On the one hand, most participants agreed that repairing personal electronics is a good practice that protects the environment, helps the local economy, and can save them money by extending their devices' lives. Repair also enables them to care for their devices and supports a lifestyle of caring. On the other hand, most think that repairing is complicated, time-consuming, and expensive. In general, people do not know where to repair their devices, which makes the process feel harder. When it comes to the value of repair, attitudes are divided, with some thinking that replacing broken devices is a better deal and others thinking they get more for their buck by repairing. Despite having mixed attitudes about repair, most participants said they do intend to try to repair the next device that breaks.

The apparent dichotomy surrounding repair where participants perceived it to be beneficial for the environment and the economy, and thus an important activity, but at the same time not the most beneficial activity to them as individuals, suggests a red flag for scaling repair. This is explained in Miller's (2012) theory of sacrifice, which describes a contradiction between morality and ethics (see section 2.2.3). In a nutshell, Miller found that most ethical shopping (i.e. buying organic, Fairtrade, etc.) is often assumed to be more expensive than its counterparts, creating a

direct conflict between the value of thrift and the purchase of ethical commodities (Miller, 2012). Thrift symbolizes concern for one's resources, and thus, being thrifty while shopping means prioritizing one's family, which is a very immediate concern to the average consumer. On the other hand, ethical shopping demonstrates concern for the planet, which is a more distant concern. Thus, Miller argues that people will often prioritize immediate concerns, which means less involvement in ethical shopping. This dilemma is clearly reflected in the case of repair, which is seen as the right thing to do for the environment but also as the more expensive alternative in most cases surrounding broken personal electronics. Following Miller's logic, one could infer that the attitudes toward repair revealed in this study do not favor actual repair behavior.

Social factors

Triandis defines norms as *"self-instructions to do what is perceived to be correct and appropriate by members of culture in certain situations"*, roles as *"behaviors that are considered correct or appropriate for persons holding a particular position in a group, society, or social system",* and self-concept as *"behaviors that people consider appropriate for themselves"* (Triandis, 1977, p. 206). Based on these definitions, this study found that repair is not the norm for broken personal electronics in Sweden. Although many people think they should repair their electronics when they break, most think they are *not* expected to do it. In other words, people think it is adequate and appropriate to repair electronics, but they also think it is appropriate *not* to do it.

There are a few possible explanations of why repair is a "you should" but not a "you must" practice. First, the fact that it is not reinforced within social circles and not talked about at a societal level may make repair seem unimportant and not "a must". Participants revealed they do not hear much about repair in the media or through their networks and consequently it is not a topic of conversation. Many also said they do not know people who have repaired. There is the general perception that whether people choose to repair or replace will not be questioned by their peers. Suggesting that repair is 'invisible' and easy to skip even when you think you should not. Repair is not shaping people's perceptions of what they should do to fit in society. This claim that repair is somewhat 'invisible' can be further substantiated by looking at the survey responses. Between 10% to 30% of the questionnaire responses were neutral for all questions, indicating that repair is not an area where people have well-defined opinions.

A second possible explanation is that 'slit och släng' (use and throw away) is the norm that dominates consumption of personal electronics, and thus influences people's decision to repair. Whether it is because people believe it is a better deal to buy new, feel peer pressured into having the newest model, or appreciate new technology, there is a strong perception that replacing working devices is correct and appropriate for everyone in Sweden. The interviews revealed that craving a new device is not an acceptable reason for replacing a functioning device; however, having a broken or malfunctioning device is a perfectly acceptable reason. Therefore, having a broken device might turn into the opportunity to justify getting a new one, and getting a new device is a behavior that is accepted and justified by the prevalent slit och släng norm.

Affect

Moreover, the interviews brought to light that many believe that buying new is exciting while most said repairing is associated with negative feelings. For those that seek instant gratification after feeling bummed about their device breaking, it seems rather evident that they would choose to replace over repair. If both practices are socially appropriate and the expectation of repairing is not strong, why would anyone choose an option that makes them feel anxious, confused, and

stressed over one that brings instant joy and excitement when the cost is not an issue and buying new is generally easier?

Habits

When it came to habits, there were disagreements between the interview and the survey responses. On the one hand, the interviews uncovered that most participants lived in households where repair was a norm. However, fast forward to their current lives, and less than half of them claimed they consistently try to repair broken devices. On the other hand, the survey revealed that most participants used to repair while growing up and still try to repair today. All that can be confidently concluded from these findings is that the repair culture is still out there.

Facilitating conditions

Conditions that facilitate repair could be categorized in two groups: contextual and cultural conditions. Contextual conditions refer to things like improving the level of service of repair shops and increasing flow of information about repair, etc., while cultural conditions refer to the social expectations built around repair.

Contextual conditions. Participants overwhelmingly agreed that they want repair to be easier. Repair shops should be more visible, the entire process should be able to happen online, and repair technicians should be excited about extending the life of your devices. The cost should be transparent, lower than the cost of replacing, and the guarantees should be as good as those of new devices. Participants want to know what to expect upfront, and have access to information about repairability and maintenance. In a nutshell, participants want repair to be as easy, exciting, and convenient as buying new or secondhand.

Cultural conditions. To increase their engagement with repairing personal electronics, participants want others to be doing it. They want society to tell them it is very important to repair and encourage them to engage in it in the same way they have been encouraged to buy secondhand, eat less meat-based products, bring their bags to the supermarket, and take the train instead of the plane. They want to know their friends and colleagues are repairing to hear about their experiences and get their recommendations about the good repair shops. In other words, repair should become more visible, more normal. Repair should be seen as something that increases your status, something that allows you to fulfill your vision of who you want to be in the world.

Repair understood through theory of shopping

While Triandis' TIB is a useful framework to dive deep into repair behavior, theory of shopping can provide complementary insights into to why people choose to repair their electronic devices. To achieve this, we need to take a step back and think about repair as an integral part of consuming personal electronic devices.

According to Miller (see section 2.2.3), our attraction towards norms combined with the value of thrift explain how and why we shop. In Miller's peanut-butter theory, he proposes that we shop to diminish the gap between who we are and who we think we should be (Miller, 2012). Using Triandis' terms, this means that our self-concept (or our conception of who we are and whether we should engage in a particular behavior in a particular situation) is shaped by what we perceive to be the norms and how we think they apply to us. Shopping helps us achieve this vision of ourselves. In addition, in Miller's sacrifice theory, the value of thrift dominates much of the shopping we do. He observed that people are always looking to save money, for example, by buying expensive things that are high quality because they will last. He argues that thrift has been

48

a fundamental virtue of the household for a long time and that exercising it in shopping represents safeguarding the household's future resources, and ultimately an act of care (Miller, 2012).

To relate this to personal electronics and repair, I will use the story of one of the interviewees; let us imagine her name is Anna. Anna is a university student. She told me how once she dropped her three-year-old smartphone completely shattering her screen. Her phone had already started to slow down, so she went to a repair shop to fix both issues. She was told to leave her phone, so they could investigate the "slow problem" and tell her how much it will cost to fix it. They gave her a cost estimate of around 2,000 sek. Her heart sank to her stomach, and she told them she would think about it and maybe come back. Once at home, she remembered some of her friends had purchased refurbished phones on a website called Swappie, so she decided to investigate. She learned that she could buy a newer model for 3,500 sek with a 12-month guarantee and free shipping. She did not have the latest model, but she was a student, so it made sense that she could not afford the newest, yet she thought it would be nice to get an upgrade. She began to get very excited with the idea of having a better camera and all the other features, which suddenly seemed essential to her. She also began thinking that her three-year-old phone was near the end of its useful life and was not confident that repairing it will make it last for much longer. It was okay to replace an old phone like hers. Although repairing was cheaper, she decided it was more economical to buy a refurbished phone, so she did.

This story illustrates how thrift and norms influenced Anna's behavior and discouraged her from repairing her phone. First, she exercised thrift by looking for the best deal and concluded that buying a refurbished phone was the best way to save money. This was rationalized by her implicit belief that a newer phone was better than a repaired 'old' phone. This implicit belief that new is better than used can be understood as the successful result of the slit och släng campaign, which many in this study claimed is the dominating consumption norm in Sweden. Second, she considered a refurbished phone because that was something her peers were doing. This study found that it is normal for students to buy secondhand; therefore, one could say that Anna was doing what she thought was appropriate based on her role as a student. Her story also resonates with other findings in this study, such as the overwhelming agreement that it is acceptable to replace devices that still work, that is not expected to repair broken devices, and that Swedes are interested in technology which drives the desire to replace over keeping what you already have.

Anna's story highlights how people's decision to repair electronic devices is inevitably intertwined with and heavily influenced by societal norms that shape why and how people consume personal electronic devices. Suppose the dominant consumption norms dictated that the average Swede does not throw things away, or that average Swedes used their phones for 7 years. Then Anna might not have felt that it was okay to replace her 3-year-old phone and instead would have thought the right thing for her to do was repairing her device.

This last thought about the influence of norms in repair behavior creates the perfect segue into the following research question, which investigates the behavioral factors that have the biggest influence on people's decision to repair their broken electronics.

4.3   Factors that explain electronics repair behavior

The following subsection presents the findings from *RQ2* and *RQ2a* which investigated which behavioral factors explain the variance in frequency of repair and the variance in intention to repair and looked for any significant response differences based on demographic characteristics. This

question was also guided by Triandis' TIB and was answered with the data collected via the online questionnaire (see section 4.1.2 for details on the questionnaire sample).

This subsection begins by reviewing the theoretical underpinnings that motivate the statistical analyses presented right afterward. The statistical analyses in this subsection will be presented in two formats: 1) in plain language and 2) in statistical language. The goal behind presenting the findings in these two formats is to increase this section's readability for those who are not interested in statistical methodology.

4.3.1 Using TIB to explain repair behavior

As mentioned in section 2.2.2, Triandis theorizes that depending on the type of behavior, situation, or person, the weights of the factors of his model will shift (Triandis, 1977, p. 279). In order words, he does not assert how the different factors influence any specific behavior but instead says that all factors are important, and how influential they are is determined by the behavior itself. The following section explores *if* and *how* intentions, habits, and facilitating conditions are related to and can explain frequency of repair behavior. As mentioned in section 3.4.3, to gain a more comprehensive understanding of whether intentions are related and could potentially explain frequency of repair behavior, we first have to examine how attitudes, social factors, and affect are related to intention to repair. This is better explained in the diagram below as the logic follows TIB itself. Therefore, both the correlation and regression tests will begin by looking at the intention to repair (step one on Figure 4-15 below) and then at frequency of repair behavior (step two).

Figure 4-15. Correlation and regression analysis steps
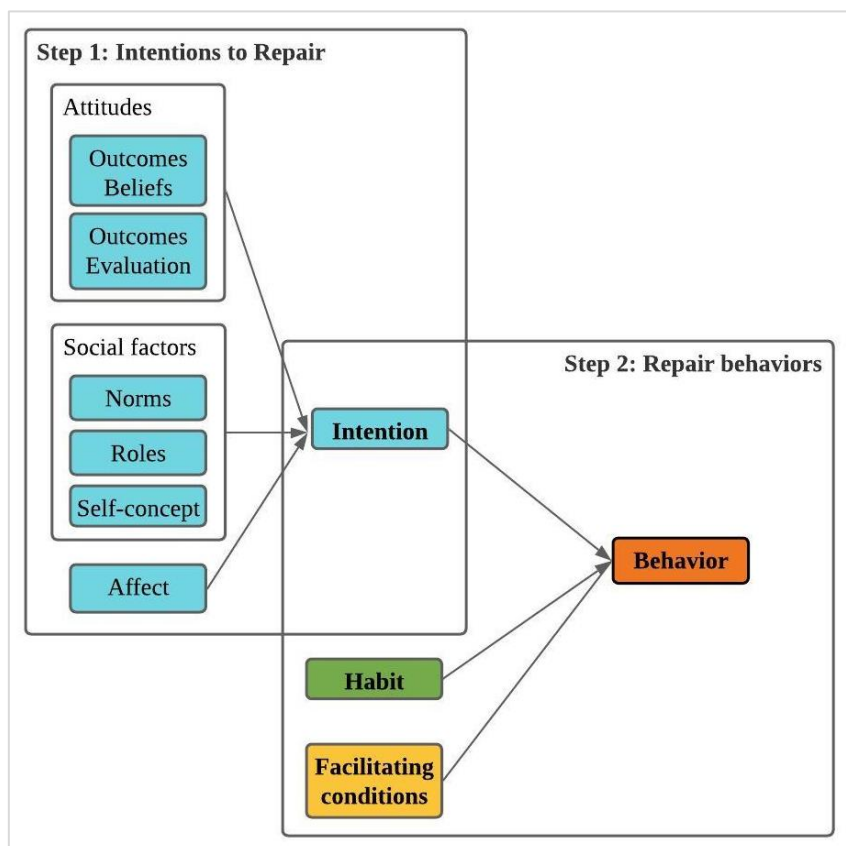
4.3.2 Findings

Phase 1: Exploring relationships

Step 1: Exploring intention to repair

Version 1 – in plain language

The first step was to investigate if and how attitudes, social factors, and affect are related to intention to repair (see step 1 in Figure 4-15). To achieve this, a Spearman's Rank Order Correlation was conducted (see section 3.3.3 for details on methodology). The results revealed that all factors were positively associated with intention to repair (see Table 4-1). This means that on average, the more positive a participant response was on all items of the questionnaire (attitudes, affect, norms, etc.), the higher the intention to repair broken electronics they reported. In addition, the test revealed that attitudes, roles, self-concept, and beliefs about the outcomes of repair were more closely associated with intention to repair than participants' evaluations of the outcomes of repair, affect, and norms. In other words, a change in attitudes, roles, self-concept, or beliefs is accompanied by a change in intention to repair more consistently (they move together in the same direction and similar magnitude) than for evaluations, affect, and norms.

Version 2 – in statistical language

Spearman's Rank Order Correlation was conducted to investigate whether the determinants of intention are correlated with intention to repair (see step 1 in Figure 4-15). Cohen's standard was used to evaluate the strength of the relationships, where coefficients between .10 and .29 represent a small effect size, coefficients between .30 and .49 represent a moderate effect size, and coefficients above .50 indicate a large effect size (Cohen, 1988). The analysis revealed that all the determinants of intention are positively correlated with intention to repair with a moderate-size effect. The analysis also revealed that beliefs about repair outcomes help explain 23% of the variance in respondent's reported intention to repair while roles help explain 22% of this variance. See results in Table 4-1.

Table 4-1. Spearman's rho between determinants of intention to repair and intention

Variable	Correlation coefficient	Determination coefficient
Beliefs about outcomes	.477**	23%
Evaluations of outcomes	.374**	14%
Attitudes	.421**	18%
Norms	.300**	9%
Roles	.470**	22%
Self-Concept	.357**	13%
Affect	.345**	12%

**. Correlation is significant at the 0.01 level (2-tailed).

Step 2: Exploring frequency of repair behavior

Version 1 – in plain language

The second step was to investigate how intention, habits, and facilitating conditions were related to frequency of repair behavior (see step 2 in Figure 4-15). To achieve this a Spearman's Rank Order Correlation was conducted. The results revealed that habits and intention were positively associated with repair frequency (see Table 4-2). This means that the stronger the intention to repair, the more frequently participants reported repairing broken devices on the questionnaire.

The same logic applied to repair habits. The test found that there was no association between facilitating conditions and repair behavior. The results also showed that both intentions to repair and repair habits are strongly associated with repair frequency. This means that an increase in intention to repair or in habits (i.e., answering 4 instead of 3) is accompanied by a somewhat consistent increase in repair frequency (i.e., not a change that mirrors the change in intention to repair or habits, but one that is close, such as an increase on intention to repair from 3 to 3.4).

<u>Version 2 – in statistical language</u>

Spearman's Rank Order Correlation was conducted to investigate if intentions, habits, and facilitating conditions correlate with frequency of repair behavior (see step 2 in Figure 4-15). Correlation analysis revealed that frequency of repair is positively and strongly associated with both repair habits (r=.585, p<.001) and intention to repair (r=.501, p<.001). No significant association was found between frequency of repair and facilitating conditions. The analysis also revealed that repair habits help explain 34% of the variance in the respondent's reported frequency of repair while intention to repair help explain 25% of this variance. See results in Table 4-2.

Table 4-2. Spearman's rho between determinants of behavior and behavior frequency

Variable	Correlation coefficient	Determination coefficient
Repair habit	.585**	34%
Intention to repair	.501**	25%
Facilitating conditions	.085	-

**. Correlation is significant at the 0.01 level (2-tailed).

Phase 2: Explaining relationships

<u>Version 1 – in plain language</u>

Now that we understand whether and how TIB factors are associated with intention to repair and repair frequency, we can explore whether any of these factors can predict intention to repair and frequency of repair. This is done through binomial logistic regression, which is a test that allows you to guess (or predict) the probability of an event occurring. In this case, we investigate if any of our determinants can predict intention to repair (model 1) or repair frequency (model 2).

<u>Version 2 – in statistical language</u>

Two models were tested through logistic regression to explain intention to repair and frequency of repair behavior (see Figure 4-15, where step 1 is model 1, and step 2 is model 2).

Step 1: Explaining intention to repair

<u>Version 1 – in plain language</u>

The binomial logistic regression was able to predict participants' intention to repair their broken electronics. Of the six variables that could predict intention to repair (see Figure 4-15, step1), three made a statistically significant contribution: norms, evaluation about repair outcomes, and affect.

The strongest predictor was norms since the test found that participants that reported positive repair norms were 82 times more likely to report that they intent to repair their electronics next time they break. The second strongest predictor was affect. For this determinant, the test found that those who reported positive emotions about repair were 34 times less likely to report intention to repair than those that reported neutral or negative emotions. Finally, the model revealed that participants that reported positive evaluations of the outcomes of repair (i.e., I strongly agree that

repairing my electronics will result in protecting the environment) were 29 times more likely to report intention to repair than those who reported neutral or negative evaluations of the outcomes of repair.

Version 2 – in statistical language

The model to explain intention to repair had six predictors and was statistically significant x^2 (6, N=158)= 81.699, p< .001, indicating that the model was able to distinguish between respondents that reported positive intention to repair and those that did not. The model explained between 40.4% (Cox & Snell R2) and 72.9% (Nagelkerke R2) of the variance in intention to repair and classified correctly 93% of the cases. Sensitivity, or true positives, was 95.6% and specificity, or true negatives, was 77.3%. Positive predictive value, or the percent of true positives predicted was 96.29%, and negative predictive value, or the percent of true negatives predicted was 73.91%.

Three predictors made a unique statistically significant contribution to the model: norms, affect, and outcomes evaluation. The strongest predictor was norms with an odds ratio of 82.48 followed by affect with an odds ratio of 0.03, and by outcomes evaluation with an odds ratio of 28.86. This means that participants who believed that they were expected to repair were 82 times more likely to report that they intended to repair their electronics. Participants who had positive beliefs about the consequences of repair were 29 times more likely to report intention to repair than those who did not. Conversely, those that reported positive emotions were 34[5] times less likely to report intention to repair than those that reported neutral or negative emotions (see Table 4-3).

Table 4-3. Logistic regression explaining the likelihood of reporting intention to repair electronics with beliefs about outcomes, evaluation about outcomes, norms, roles, self-concept, and affect variables.

Predictor	ß	SE B	Wald's x^2	df	p	Odds ratio
Beliefs about outcomes	20.160	3729.37	.000	1	.996	569322802.7
Evaluation of outcomes	3.363	.955	12.392	1	.000	28.862
Norms	4.413	1.423	9.620	1	.002	82.487
Roles	.941	.820	1.318	1	.251	2.563
Self-Concept	1.586	.913	3.014	1	.083	4.883
Affect	-3.530	1.096	10.364	1	.001	.029
Constant	-1.675	.675	6.157	1	.013	.187
Test			x^2	df	p	
Omnibus tests of model coefficients			81.699	6	.000	
Hosmer and Lemeshow test			2.352	7	.729	
Model summary and classification						
Pseudo R square statistics			.404 (Cox & Snell R²)			.729 (Nagelkerke R²)
Overall percentage correct						93.0

Step 2: Explaining frequency of repair behavior

Version 1 – in plain language

The second regression model was able to predict participants' frequency of repair behavior. Of the three tested variables (see Figure 4-15, step 2), repair and habits made a statistically significant contribution while facilitating conditions did not. This means that only repair intentions and habits were able to predict repair behavior.

The strongest predictor was intention to repair since the test found that participants that reported positive intention to repair were 9 times more likely to report high frequencies of repair behavior

---

[5] To aid interpretation the odd ratio for Affect was inverted (dividing 1 by .029)

than those who did not. The test also found that those that reported strong habits were 6 times more likely to report high frequency of repair behavior than those with weaker habits.

Version 2 – in statistical language

The model to explain frequency of repair included three predictors and was statistically significant x^2 (3, N=160)= 46.787, p< .001, indicating that the model was able to predict which respondents reported repairing frequently and those who did not. The model explained between 25.4% (Cox & Snell R2) and 33.9% (Nagelkerke R^2) of the variance in frequency of repair and classified correctly 73.1% of the cases. Sensitivity was 79.2%, specificity 68.8%, positive predictive value 67.06%, and negative predictive value 80%.

As shown in Table 4-4 below, only intention to repair and habit were statistically significant. The strongest predictor is intention with an odds ratio of 8.85 followed by habits with an odds ratio of 6.02. This means that participants that reported intent to repair electronics were 9 times more likely to report high frequencies of repair behavior, while participants that reported strong habits were 6 times more likely to report high frequency of repair behavior than those who did not.

Table 4-4. Logistic regression explaining the likelihood of reporting relatively more frequent electronics repair with intention, habit, and facilitating conditions variables.

Predictor	ß	SE B	Wald's x^2	df	p	Odds ratio
Intention to repair	2.181	.789	7.633	1	.006	8.855
Habits	1.795	.395	20.619	1	.000	6.020
Facilitating conditions	.304	.501	0.368	1	.544	1.355
Constant	-3.284	.800	16.830	1	.000	0.037
Test			X^2	df	p	
Omnibus tests of model coefficients			46.787	3	.000	
Hosmer and Lemeshow test			1.620	4	.805	
Model summary and classification						
Pseudo R square statistics		.254 (Cox & Snell R²)			.339 (Nagelkerke R²)	
Overall percentage correct						73.1

Phase 3: Group comparisons

Version 1 – in plain language

As a final step, this study explored if there were any differences in responses between participants that differ in age, gender, marital status, occupational status, time living in Sweden, and parental status. Response differences were explored on all the different determinants of repair as well as on repair behavior itself. This study found statistically significant differences between the following groups in the following variables:

Differences in perceived roles

The study found that underlined unemployed participants reported that repair was a proper activity for them to engage in (4/5),[6] while participants that were employed on average had a neutral response (3/5).

Differences in affect

Moreover, there was a difference in affective appraisal between the youngest and the oldest participants. Participants over the age of 42 reported having positive emotions towards repair

---

[6] The questionnaire used a 5-point Likert scale where 1 was the most negative response, 3 was neutral, and 5 was the most positive response. The first number in the parenthesis represents the most common response each group.

(4/5), while those under 26 years old on average reported negative emotions (2.5/5). Furthermore, male participants reported neutral and positive emotions (3.5) while female participants reported negative, neutral, and positive emotions (3/5). Finally, parents overall reported more positive emotions (3.5/5) than those without children, who on average reported more negative emotions (3/5).

Differences in habits

Finally, when asked if trying to repair electronics when they broke was something participants automatically did, participants that have lived in Sweden for less than 3 years or more than 14 years generally agreed (4/5 and 3/5, respectively), while those that have lived in Sweden between 4 and 13 years on average gave a neutral response (3/5).

Version 2 – in statistical language

Mann-Whitney U and Kruskal-Wallis H tests were conducted to look for response differences across groups on all variables. Mann-Whitney U test was used to compare variables with two independent groups (marital and parental status). Kruskal-Wallis H test was used to compare variables with three or more independent groups (age, gender, education, occupational status, and time residing in Sweden). Pairwise comparisons using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons was conducted for variables that revealed statistical significance under the Kruskal-Wallis H Test. Eta square (n^2) was used to compute the effect size, where coefficients between .010 and .059 represent a small effect size, coefficients between .060 and .139 represent a moderate effect size, and coefficients above .140 indicate a large effect size (Cohen, 1988). Only the statistically significant findings are reported below.

Differences between age groups

The Kruskal-Wallis was conducted to look for statistically significant differences between four age groups: under 26 (N=46), between 27 and 31 (N=35), between 32 and 42 (N=38), and over 43 (N=40). The test revealed statistically significant differences between age group in their affect towards repair ($x^2(3)$= 9.351, p=.025). See results in Table 4-5.

Table 4-5. Kruskal-Wallis H Test and median scores of the significantly different variables across age groups

Variable	x²	Sig.	n²	Md.			
				<=26	27-31	32-42	43+
Affect	9.351	.025**	.418	2.5	3.0	3.0	4.0

**Significance level is 0.05

Subsequently, pairwise comparisons using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons were performed. Adjusted p-values revealed statistically significant differences in affect between the under 26 age group (Md: 2.5) and the over 43 age group (Md: 4.0) (p=.030).

Differences between occupational statuses

There were statistically significant differences in repair behavior and roles between three occupational statuses: students (N=57), employed (N=87), and unemployed (N=15). See Table 4-6.

Variable	x^2	Sig.	n^2	Md		
				Student	Employed	Unemployed
Repair behavior	6.296	.046**	.028	4.0	3.0	4.0
Roles	8.672	.013**	.043	3.0	3.0	4.0

**Significance level is 0.05

Subsequently, pairwise comparisons using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons were performed. Adjusted p-values revealed statistically significant differences only in <u>roles</u> scores between those employed (Md: 3.00) and those unemployed (Md: 4.00) (p=.011).

Differences between time lived in Sweden

There were statistically significant differences in habit scores between groups that differ in the time they have resided in Sweden: 3 years or less (N=55), 4 – 13 years (N=51), and more than 14 years (N=53). Median habit scores were statistically significantly different between groups (x^2(2)= 8.446, p=.015). See results in Table 4-7.

Table 4-7. Kruskal-Wallis H Test and median scores of the significantly different variables across time in Sweden

Variable	x^2	Sig.	n^2	Md		
				<=3	4 – 13	>14
Habits	8.446	.015**	.041	4.0	3.0	3.0

**Significance level is 0.05

Pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Adjusted p-values are presented. This post hoc analysis revealed statistically significant differences in <u>habit</u> scores between:

- the 4 -13 years group (Md: 3.0) and the <=3 years group (Md: 4.00) (p=.036), and
- the 4 -13 years group and the >14 years group (Md: 3.0) (p=.032).

Differences between gender groups

When it came to gender, a Mann-Whitney U Test was performed, which found statistically significant differences in <u>affect</u> scores between females (Md=3.0; N=106) and males (Md=3.5; N=50). See results in Table 4-8.

Table 4-8. Mann-Whitney U Test and median scores of the significantly different variables across gender groups

Variable	U	Z	Sig.	r	Md	
					Female	Male
Affect	3476	3.177	.001**	0.25	3.00	3.5

**Significance level is 0.05

Differences between parental statuses

Finally, there was a statistically significant difference in <u>affect</u> towards repair between those with children (Md= 3.5, n=60) and those without (Md= 3.0, n=98), indicating that participants with children reported overall more positive emotions towards repair. See Table 4-9.

Table 4-9. Kruskal-Wallis H Test and median scores of the significantly different variables across parental statuses

Variable	U	Z	Sig.	r	Md	
					Children	No children
Affect	211	-2.995	.003**	0.24	3.5	3.0

**Significance level is 0.05

4.3.3 Analysis

The findings uncovered that intention and habits shaped participants' repair behavior, while facilitating conditions were not a determining factor. Moreover, it showed that there is a positive association between repair behavior and intention, and between repair behavior and habits, meaning that the stronger participants' repair intentions and habits were, the more frequently they repaired.

Data revealed norms, outcomes evaluation, and affective appraisal as the key determinants of intentions to repair. Interestingly, while the correlation analysis detected that all determinants as positively associated with intention to repair, the regression analysis showed that affect is negatively associated while the rest of the factors have a positive association. In other words, correlation analysis revealed that the more positive the participants' attitudes, affect, and perceived social expectations towards repair were, the stronger their intention to repair was. Regression analysis uncovered that intention to repair is significantly associated with positive norms and positive evaluations about repair outcomes. In contrast, it is significantly associated with neutral and negative emotions about repair. The author was unable to uncover plausible explanations for this contradictory finding. Section 5.1 discusses this case in more depth.

When it comes to differences among groups across the different determinants of repair behavior, statistical analysis revealed differences between age groups, gender, occupational status, parental status, and time living in Sweden for four determinants of repair. The oldest participants (43+) overall reported positive feelings about repair, while the youngest participants (under 26) generally reported negative feelings about repair. Males generally reported more positive emotions, while females tended to report negative or neutral emotions. Similarly, parents reported more positive emotions than those without children. Moreover, this study found that unemployed participants think repair is a more adequate behavior for them than those that are employed. Finally, the data revealed that habits of participants that have lived in Sweden for less than 3 years and over 14 years differed from those that have lived in Sweden between 4 and 13 years, with the former groups reporting stronger repair habits than the latter.

It is important to note that the magnitude of all statistically significant differences found between groups, except those between age groups, was small (n^2 <.06 and r <.3) (see section 3.3.4). The small effects and the unrepresentativeness of the sample suggest that these findings should be interpreted carefully since type II error[7] is possibly present. Given that most comparisons had small effects, many group differences were likely not detected in this study. Therefore further research is needed to uncover what is likely to be rich group differences in repair behavior.

On the contrary, the effect of the differences found between age groups in affect was large (n^2 = .418), suggesting a robust finding and a high confidence level that the older participants in this sample have more positive feelings about repair than the youngest. Unfortunately, this finding is hard to interpret since the correlation analysis suggests that improving the affect toward repair of

---

[7] When no effect is inferred when in fact there is one

the younger generations would increase their intention to repair, while the regression analysis suggests the opposite.

Overall, the statistical analysis aligns with the qualitative findings, suggesting that norms are fundamental in the decision-making equation. The findings revealed that norms indirectly yet strongly influencing repair since participants with strong positive norms about repair were 82 times more likely to report high intention to repair. Consequently, participants who reported high intention to repair were 8 times more likely to report high repair frequencies.

5 Discussion

This thesis aimed to gain behavioral insights into personal electronics repair in Sweden in order to provide recommendations for scaling this behavior to accelerate Sweden's transition to a CE. This was achieved through a mixed-method research design involving semi-structured interviews and an online questionnaire based on Triandis' theory of interpersonal behavior.

The following section discusses the study's key findings, relates them to the existing literature, and highlights the contributions of the findings to the state of knowledge. Moreover, the methodological choices leading to the findings of this study are reflected upon.

5.1 Overview of findings and their significance

RQ 1 – What are the behavioral factors that shape consumers' decisions to repair their personal electronics?

The decision to repair a broken personal electronic device in Sweden is shaped by intricate individual, social, and contextual factors. Key findings are described in Table 5-1 below.

Table 5-1. RQ 1 findings overview

Determinant	Key Findings
Attitudes	Repair has a tainted image. Although people think repair is beneficial for the environment, the economy, and society as a whole, they think it is complicated, time-consuming, and expensive.
Social Factors	Repairing broken electronics is seen as something people "should" do but not as something they "must" do. The prevalent norm is to replace broken electronics without trying to repair them.
Affect	Professional repairs are associated with negative emotions such as frustration, uncertainty, and stress, especially for participants under 26 years old who reported more negative feelings than other groups. Conversely, emotions for those who self-repair are more optimistic, including excitement, fun, and satisfaction.
Habits	About half of the study participants claimed to try to repair their personal electronics when they break. Most participants also said they remember growing up in households that repaired personal electronics when they broke.
Facilitating conditions	To create the optimal conditions to repair electronic devices, the study revealed that participants would want the following to be in place: • Contextual. Repair should be as easy and convenient as buying new. Repair shops should be more visible, the entire repair process should happen online, and repair technicians should be more encouraging. The cost should be transparent, lower than the cost of replacing, and the guarantees should be as good as those of new devices. Consumers should know what to expect upfront and have access to information about repairability and maintenance • Cultural. To increase their engagement with repairing personal electronics, participants want others to be doing it. They want society to tell them it is important to repair and encourage them in the same way they have been encouraged to buy secondhand, eat less meat-based products, bring their bags to the supermarket, and take the train instead of the plane. They want to know their friends and colleagues are repairing to hear about their experiences and get their recommendations about the good repair shops.

Attitudes towards repairing electronics revealed an interesting dichotomy where participants perceived repair to be beneficial for the environment and the economy, and thus an important activity, but overall not the most beneficial activity to them as individuals. This finding suggests that current attitudes do not favor repair behavior. As described in detail in section 4.2.3, Miller's theory of sacrifice explains how the concern that most frequently governs people's lives is the wellbeing of their families, which is represented in shopping by saving or being thrifty. This concern provides a potential explanation as to why people do not engage in more expensive ethical shopping (such as repair) to the extent that we would want to see. This finding suggests that for repair to be scaled up, attitudes about the individual benefits of repair need to be improved.

Moreover, the findings suggest that social norms and expectations about the consumption of personal electronic devices may be influencing people's decision to repair their personal electronics to a greater extent than norms and expectations about repairing. And unfortunately, repair is not favored by the current norms and expectations of electronic device consumption. This indicates that strengthening norms and social expectations of repair cannot happen without addressing existing consumption norms. Repair needs to be understood not as a standalone practice but as part of electronic device consumption. Some organizations such as iFixit[8] have understood the importance of placing electronics repair in the context of consumption and are actively working on inviting people to reflect on their consumption levels and use their community and repair resources to fix their products and 'hang on to last year's model' (Wiens, 2010). This study suggests that iFixit is on the right track, and their approach should be studied and supported by actors that wish to scale repairs.

When repair is understood as part of electronic device consumption, it becomes clear that when a device breaks, to continue consuming electronics, individuals face the choice to repair or replace. Although understanding consumption of electronic devices was outside of the scope of this work, the qualitative findings did hint that the overall attitudes, social factors, and emotions associated with buying new may be more favorable than those associated with repair. Findings also revealed that people find buying new is easy and convenient while repair is complicated and inconvenient. Therefore, practitioners and policymakers looking to promote repair should study and leverage existing knowledge and practices associated with promoting electronic device consumption to identify and develop interventions to scale repair.

The facilitating conditions revealed in this study are aligned with what a growing body of research has found (see section 2.1.3). Overall, it can be concluded that the conditions needed to promote repair are generally missing. Fortunately, relevant actors have identified contextual barriers to repair, and this is the area where most of the work is happening when it comes to promoting repair. In fact, the literature review revealed that there is a boom in both publications and legislation that aim to understand and lower environmental barriers to repair.

RQ2 & 2a –Which behavioral factors explain the variance in frequency of repair and in the intention to repair? Are there any significant differences based on demographic characteristics?

The results from logistic regression indicated that intention to repair and habits exert a strong and significant influence on frequency of repair behavior while facilitating conditions exert a very weak

---

[8] iFixit is a wiki-based website that compiles and creates open-source repair manuals for electronic devices. They also have a store that sells precision tools and spare parts, and is an active member of the "right to repair" movement.

and nonsignificant influence. Moreover, norms, outcomes of evaluation, and affect strongly and significantly influence intention to repair, while the other factors exert a weak and nonsignificant influence. All the determinants of frequency of repair behavior and intention to repair except affect have a positive relationship meaning that an increase in any of the determinants increases intention or frequency of repair behavior. When it comes to affect, findings revealed that positive affect decreases intention to repair. Moreover, correlation analysis uncovered medium and strong positive associations between determinants of intention and intention and between determinants of repair and frequency of repair behavior, except for facilitating conditions that revealed no significant association with repair frequency. Figure 5-1 below visualizes repair behavior based on regression analysis results.

Figure 5-1. Logistic regression findings
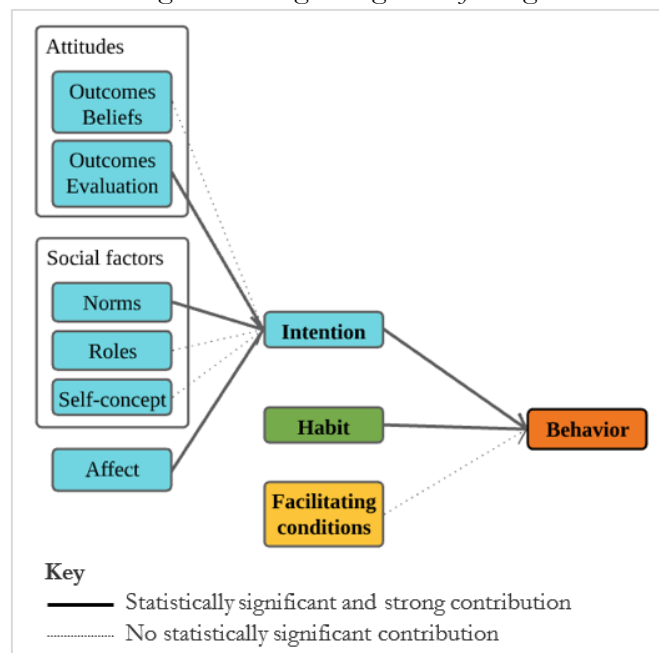
The results that intention is a direct predictor of behavior have been corroborated by studies on upcycling (Sung, 2019), travel mode choice (Bamberg et al., 2003), and recycling (Chan & Bishop, 2013). However, the intention-behavior gap in pro-environmental behaviors has been highly debated in academic literature, with studies finding no link between the two (Carrington et al., 2010; Hassan et al., 2014). This study contributes to this debate by confirming Triandis' position that behavior is party determined by controlled processes and suggesting that repair is partly an intention-driven behavior.

The finding that habits are a direct predictor of behavior has been documented in two studies on travel mode choice (Bamberg et al., 2003; Dormachi et al., 2008). Triandis position is that for new, unlearned social behaviors, intentions determine a behavior. However, once the behavior has been repeated multiple times and has been rewarded or punished, the behavior becomes automatic and is determined by habits. This position is confirmed by this study and suggests that repair is partly a habitual behavior. In hindsight, it would have been important to explore what makes repair habitual to provide further insights to promote this habit. Verplanken and Roy (2018) explain that habits have three pillars: repetition, automaticity, and context cues. Using these pillars as a framework to understand behavior could help study and design effective habit-shaping interventions.

Moreover, the considerate influence of norms in forming intention coincides with findings from existing studies on upcycling (Sung, 2019), sustainable food consumption (Shin & Hancer, 2016; Vermeir & Verbeke, 2008), sustainable farming (Velde et al., 2015; Boazar et al., 2019), waste recycling (Chan, 1998; Chan & Bishop, 2013) and travel mode choice (Bamberg et al., 2003). This result also confirms Triandis' position that norms are critical to the intention-building process and indicates that repair behavior is indirectly yet strongly influenced by norms through intentions.

The result that affective appraisal is a direct predictor of intention to repair has also been found in sustainable farming (Boazar et al., 2019), travel mode choice (Domarchi et al., 2008), and ethical decision-making in the health sector (Li et al., 2020). Triandis' position is that affective response towards a behavior makes some behaviors more appealing than others and thus influence people's intention to behave. The correlation analysis confirmed this position but not by the regression analysis, which revealed that neutral and negative emotions towards repair increase the repair odds and not the other way around. Given that the author identified no other studies of this nature on repair behavior, it is difficult to compare and propose a potential explanation. However, a plausible explanation generated through discussions with thesis advisor Carl Dalhammar is that people who reported repairing frequently while reporting neutral or negative emotions about the repair process may have limited means and therefore see repair as the most viable alternative to continuing consuming personal electronics. This idea is only an educated guess, and further research on the role of affective appraisal on repair is necessary to solve this mystery.

The finding that facilitating conditions are not a predictor of repair behavior was documented in an upcycling study (Sung, 2019). This lack of association and predictive value is not surprising given that the literature review and interview findings revealed that there are more substantial barriers than drivers to electronics repair. Therefore, it could be the case that those repairing are not doing it because "it is easy". The questionnaire revealed that 65% of the participants tried to repair the last device that broke. This suggests the study sample is overrepresented by those who choose to repair in today's barrier-ridden context and indicates that it is norms and attitudes, and not facilitating conditions, that influence the decision to repair for this group of people. However, this finding does not imply that lowering the barriers to repair would not increase the number of people who chose to repair; instead, it suggests that mainstreaming and improving the image of repair would. This last thought is supported by Triandis' TIB, which posits that *"even if the intention is high, the habit well established, and the affect optimal, the behavior might not happen if the environment renders the behavior impossible"* (Page & Sherif, 1980, p. 198).

Regarding differences identified by comparing demographic groups, there was only one robust finding which revealed that people ages 43 and older reported more positive emotions towards repair while those ages 26 and younger reported more negative emotions. Although this result is not known to be corroborated in other studies, it reveals an interesting subtlety of repair behavior which should be leveraged by interventions that aim to scale it.

Finally, as mentioned in , this study found several small effect differences across groups with low power levels (between 7% and 20%, see Table 3-3). This means a 20% or smaller chance for statistical analyses to detect any small effects, indicating a high probability that many small effect differences were missed in this study. Therefore, a larger and more representative sample is needed to comprehensively explore any group differences in repair behavior.

5.2 Implications

Triandis' theory of interpersonal behavior proved to be a powerful model to understand and explain repair behavior that can be useful for guiding interventions for scaling up repair of personal electronic devices. The results suggest that any actor that seeks to scale up repair activities should pay attention to intention- and habit-shaping interventions. To shape positive repair intention, actors need to focus on improving the perceived individual benefits (attitudes), emotions (affect), and on establishing repair as the expected behavior for broken electronic devices (norms). For example, inspirational campaigns mainstreamed in social media, TV shows, and community-based events to promote repair (i.e., repair cafes) could improve attitudes, norms, and affective appraisal (Sung, 2017). Moreover, regulating advertising by including an obligation to promote longer use of electronics and ban the promotion of early renewals, introducing mandatory repairability and durability labels in electronics, and creating a European durability day, could contribute to establishing repair as the expected behavior for broken electronic devices (HOP, 2020). Lastly, introducing repair funds in anti-waste laws could reduce the cost of repair and thus improve the perceived individual benefits of repairing electronics (HOP, 2020).

Habit shaping interventions for complex behaviors such as repair of personal electronic devices are more challenging. As mentioned above, more research is needed to understand repair as a habitual behavior better. Existing research suggests that interventions that can succeed in establishing and maintaining new habits should aim to achieve three things: *"change the context cues that trigger existing habits, establish incentives and intentions that encourage new actions, and promote repetitions of new action in stable circumstances so that associations form in memory between features of the environment and the response"* (Verplanken & Wood., 2006, p. 100).

Regarding contributions to the state of knowledge, this study expands on our understanding of the behavioral factors shaping and explaining consumers' decisions to repair personal electronics in Sweden. This study is the first to explore consumer repair behavior using Triandis' theory of interpersonal behavior which demonstrated that norms, affect, and evaluations of the outcomes play a considerable role in shaping intentions to repair, and that intention and habits shape frequency of repair behavior. It also highlights context-specific issues which help in developing a more nuanced understanding of Swedish repair behavior. In addition, this study further contributes by suggesting how this new knowledge can be used to scale repair behavior in Sweden.

5.3 Methodological reflections

A major strength of this study is that it explored repair behavior systematically using constructs and a theoretical framework validated by previous pro-environmental behavior studies. It also used a mixed-method design that yielded both depth and breadth and served to triangulate the findings and increase the study's internal validity.

The sampling methods have both advantages and disadvantages. The advantage of using quota sampling for the interviews is that it provided a diversity of respondents. The advantage of the total sample achieved through the online questionnaire is that it was capable of detecting large and medium effects with high power levels (99% and 88% respectively) as well as large effects in group differences with high power levels (90% to 99%). The disadvantage is that findings cannot be generalized to the Swedish population. This is particularly important to highlight in the case of the questionnaire since the sample is primarily composed of students and young professionals. However, it can be argued that this segment of the population will be more affected by environmental degradation, and thus, increasing repair activities in this group is most important.

Therefore, it can be concluded that although not generalizable, the findings of this study are relevant and valuable in guiding the design of policies and interventions to scale up repair behavior.

Another limitation of the study is self-selection bias. It can be assumed that those with pro-environmental values could have been more motivated to participate in the study than those without, leading to an over-representation of these groups in the sample (Hage et al., 2009). This is likely the case for the questionnaire since 65% of respondents reported repairing broken electronics. Self-selection is also a possibility for the interviews; however, although there may be an overrepresentation of interviewees with pro-environmental values, there is a balanced representation of other demographic characteristics thanks to quota sampling.

Finally, a third limitation refers to potential measurement error. The study relied on self-reported data, which can lead to different results if observation or objectives measures had been used instead (Armitage & Conner, 2001). Although it is impossible to avoid this, measurement error was mitigated by carefully interpreting the findings, using multiple items per construct to ensure the validity and reliability of the instruments, and conducting diagnostic statistics and sensitivity analysis to minimize internal validity threats.

6 Conclusion

This final section consolidates the major findings and conclusions gained through this study and provides policy and research recommendations.

6.1 Objective and questions

This thesis aimed to gain behavioral insights into personal electronics repair in Sweden in order to provide recommendations for scaling this behavior to accelerate Sweden's transition to a CE. This was achieved through a mixed-method research design involving semi-structured interviews and an online questionnaire based on Triandis' theory of interpersonal behavior. The research questions that guided this study are the following:

> RQ 1 – What are the behavioral factors that shape consumers' decisions to repair their personal electronics?

> RQ2 - Which behavioral factors explain the variance in the frequency of repair? Which factors explain the variance in the intention to repair?
> > RQ 2a - Are there any significant differences based on demographic characteristics?

6.2 Key findings

The key findings of this study are the following:

1. Norms are the strongest predictor of intention to repair, which is the strongest predictor of repair behavior. The dominant norm for broken electronics in Sweden is not to repair them but to replace them.

2. Positive evaluation of the outcomes of repair (i.e., you think repair will result in your device working as well as new) is another key predictor of intention to repair, which is the strongest predictor of repair behavior. Outcomes evaluation are mixed. Most people agree that repair results in societal and environmental benefits. However, there are mixed thoughts about the individual benefits of repair, with people thinking it could be a good deal but also that it is complicated, time-consuming, and expensive. While social and environmental benefits are important, they are perceived as far away concerns. In contrast, individual benefits are perceived as immediate concerns and most likely influence people's ultimate decision-making process.

3. Habits are the second strongest predictor of repair behavior. Most study participants reported that their automatic response when electronics break is to try to repair them.

4. Facilitating conditions did not predict repair behavior. At the same time, the study found that the conditions needed to facilitate repair are severely lacking. Therefore, it could be assumed that those who participated in this study have strong pro-environmental values that could explain why the lack of facilitating conditions was not a barrier.

5. People ages 46 and older have more favorable feelings about repair than those ages 26 and younger.

6.3 Conclusions

The major conclusions of this study are thus the following:

1. **The prevalent norms for broken personal electronics do not favor repair behavior.** Therefore, to scale up personal electronic repairs it is key to change the social norms for broken electronic devices to favor repair over buying new.

2. **The existing perception that repair is complicated, time-consuming, and expensive does not encourage repair behavior.** This is important because attitudes are key in shaping people's repair intention and behavior. Therefore, to encourage repair it is key to improve the perception of the individual benefits of repairing personal electronics.

3. **Repair is a habitual behavior.** Therefore, understanding how to encourage and shape repair habits is essential to scale up repair activities of personal electronic devices.

4. **Facilitating conditions of repair should not be dismissed.** The overrepresentation of people with pro-environmental values in this study could explain why facilitating conditions did not explain repair behavior. Facilitating conditions should be improved since it can be assumed that other types of consumers who were not captured in this study would engage in repair if there were no significant contextual barriers.

6.4 Recommendations

6.4.1 Policy recommendations

Based on this research, policymakers should consider the following measures:

1. **Make repair the norm for broken personal electronics.** Efforts to promote repair need to focus on normalizing repair activities. Examples of interventions that could contribute to establish repair as an expected behavior include:

   - Fund and develop media campaigns to increase awareness of the social and environmental consequences of the throw-away economy and promote both the circular economy and a lifestyle based on caring for our devices. Emphasize and calculate the benefits of extending electronic devices' lives. Make repair seem as desirable and as the right thing to do.
   - Revive the 'slit och släng' campaign but change the narrative to favor a culture of caring, repairing, and maintaining material belongings. The Ministry of Environment should turn electronics repair into a national conversation that could start by introducing a new slogan that references 'slit och släng' such as 'Vägra slit och släng!' (refuse slit och släng).
   - Introduce principles of electronics repair to the Home Economics course at the high school level. Teaching young students how to troubleshoot issues with their phones, computers, and other devices will not only promote a culture of self-repairs but will make them more comfortable to use repair services and lower the barrier associated with feeling lost when something breaks that was revealed in this study.
   - Regulate advertising by including an obligation to promote longer use of electronics and ban promotion of early renewals (HOP, 2020). This will increase the visibility of repair and make it a topic of conversation within social groups in Sweden.

- Introduce mandatory repairability and durability labels in electronics (HOP, 2020). This will make repair more visible but also increase the consumer's confidence that their device can be successfully repaired.
- Engage social media influencers and Swedish celebrities to promote extending the life of electronics and heighten the status of owning an older or repaired device.
- Adopt the repairability criteria proposed by the EU green public procurement guidelines and encourage the business sector to follow suit. This would help normalize repairs and elevate the subject to a public debate.

2. **Adopt regulations to increase the value of personal electronic repairs.** Policymakers need to step in to create a conducive environment for repair services to flourish and thus change the current perception that there are not many individual benefits to repairing electronics. Some recommendations include:

- Require producers to create repair funds as part of anti-waste laws (HOP, 2020). This would increase the access to and lower the cost of repair services, and incentivize producers to adopt more durable and repairable designs.
- Push for adopting and implementing right to repair legislation that seeks to enforce spare part availability, and access to software updates and repair manuals.
- Extend Ecodesign regulations to cover personal electronic devices and include criteria to limit software obsolescence (HOP, 2020).

3. **Introduce habit-shaping interventions.** These should establish: 1) context cues that trigger the desired habit, 2) incentives to encourage the desired actions, and 3) conditions that promote memory associations between the action and the environment. Some recommendations of habit-shaping interventions include:

- Leverage existing recycling habits and infrastructure to establish context cues. Many people in Sweden have the habit to take unwanted electronics to the recycling centers even if these could be repaired. City governments should work with repair businesses to establish repair shops in recycling centers. The city of Goteborg has successfully implemented a similar policy in the [Alelyckan Recycling Park](#) which is located next to three resale points.
- Incentivize people by distributing repair vouchers which lower the cost of repairs. This intervention has successfully been implemented in [Austria](#) (Piringer & Schanda, 2020).
- Create a Swedish durability campaign where people are encouraged to bring their broken or malfunctioning electronics for repair once a quarter. This would allow people to create associations by knowing that there is a day when they fix their devices four times a year.
- Make guarantees prioritize repairs or replacements when products fail. This is a way to make repair the default option and help shape repair habits.

4. **Design tailored interventions based on consumer profiles.** Policy makers should conduct a market segmentation study to categorize the Swedish population in order to facilitate policy design to scale repair of electronics. This is important since this study hinted that there are different types of consumers, and actions to incentivize them to repair should be differentiated according to their characteristics. Borrowing Finisterra do Paço et al. (2009) typology of the green consumer, a classification system could look like this:

Table 6-1. Illustrative market segmentation of repairers in Sweden

Consumer type	Key characteristics	Illustrative tailored strategy
The green activist	Has favorable positions concerning the environment but has not identified electronics repair as an important issue	• Make electronics central to the environmental debate
The undefined	The environment is not a prominent concern but is receptive and somewhat aware of the environmental agenda	• Highlight both the social and the environmental benefits of repair
The uncommitted	Has negative positions about the environment and is mainly concerned about the economy	• Talk about the social and economic benefits of repair

6.4.2 Further research

The results of this study should encourage researchers to join in a more intensive investigation of the behavioral factors of repair using Triandis' theory of interpersonal behavior. A study with a larger and more representative sample could strengthen the validity and expand the generalizability of the results found in this study. A follow-on study could also delve into affective appraisal, measure habits using other scales, and get more robust findings on the differences across groups.

Furthermore, there is the need to develop a deeper understanding of what makes repair habitual. According to Verplanken and Roy (2018), habits have three pillars: repetition, automaticity, and context cues. Further research could use these three pillars as a framework to understand the links between habits and repair.

Another avenue of research is to investigate intention-shaping and habit-shaping policies further to scale personal electronics repair. As mentioned in the last recommendation, a market segmentation study to categorize the Swedish population in order to facilitate policy design to scale repair of electronics should be key in investigating effective policy interventions.

Finally, research should be conducted to further understand how electronic device consumption influences repair behavior and draw lessons from successful campaigns promoting e-products consumption to develop strategies and interventions to scale up repair activities.

Bibliography

Ackermann, L. (2020). *Design for Product Care*. 210. https://doi.org/10.4233/uuid:9fe0a3cd-a7f7-4d29-bb44-6dc78575a2e8

Ackermann, L., Mugge, R., & Schoormans, J. (2018). Consumer's perspective on product care: An exploratory study of motivators, ability factors, and triggers. *Journal of Cleaner Production*, *183*, 380–391.

Almen, J., Anehagen, M., Enstrom, E., Hartman, C., Jonsson, C., Lindbladh, F., & Ohlsson, J. (2020). *Promoting the Repair Sector in Sweden*. 56.

Armitage, C. J., & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: A Meta-Analytic Review. *British Journal of Social Psychology*, *40*(4), 471–499. https://doi.org/10.1348/014466601164939

Bachér, J., Dams, Y., Duhoux, T., Deng, Y., & Teittinen, T. (2020). *Electronics and Obsolescence in a Circular Economy*. https://www.eionet.europa.eu/etcs/etc-wmge/products/electronics-and-obsolescence-in-a-circular-economy

Bakker, C. A., & Schuit, C. S. C. (2017). *The Long View: Exploring Product Lifetime Extension*. United Nations Environment Programme.

Bakker, C., Wang, F., Huisman, J., & den Hollander, M. (2014). Products that go round: Exploring Product Life Extension Through Design. *Journal of Cleaner Production*, *69*, 10–16. https://doi.org/10.1016/j.jclepro.2014.01.028

Bamberg, S., & Schmidt, P. (2003). Incentives, Morality, Or Habit? Predicting Students' Car Use for University Routes With the Models of Ajzen, Schwartz, and Triandis. *Environment and Behavior*, *35*(2), 264–285. https://doi.org/10.1177/0013916502250134

Bauer, B., Watson, D., & Gylling, A. C. (2018). *Sustainable Consumption and Production*. Nordic Council of Ministers. https://doi.org/10.6027/ANP2018-798

Blaikie, N., & Priest, J. (2019). *Designing Social Research: The Logic of Anticipation*. /z-wcorg/. https://ebookcentral.proquest.com/lib/qut/detail.action?docID=5638724

Boazar, M., Yazdanpanah, M., & Abdeshahi, A. (2019). Response to Water Crisis: How Do Iranian Farmers Think About and Intent in Relation to Switching from Rice to Less Water-dependent Crops? *Journal of Hydrology*, *570*, 523–530. https://doi.org/10.1016/j.jhydrol.2019.01.021

Bovea, M. D., Pérez-Belis, V., & Quemades-Beltrán, P. (2017). Attitude of the Stakeholders Involved in the Repair and Second-hand Sale of Small Household Electrical and Electronic Equipment: Case Study in Spain. *Journal of Environmental Management*, *196*, 91–99. https://doi.org/10.1016/j.jenvman.2017.02.069

Cerulli-Harms, A., Suter, J., Landzaat, W., Duke, C., Rodriguez Diaz, A., Porsch, L., Peroz, T., Kettner, S., Thorun, C., Svatikova, K., Vermeulen, J., Smit, T., Dekeulenaer, F., & Lucica, E. (2018). *Behavioural Study on Consumers' Engagement in the Circular Economy: Final Report*. Publications Office. https://data.europa.eu/doi/10.2818/956512

Chan, K. (1998). Mass Communication and Pro-Environmental Behaviour: Waste Recycling in Hong Kong. *Journal of Environmental Management*, *52*(4), 317–325. https://doi.org/10.1006/jema.1998.0189

Chan, L., & Bishop, B. (2013). A Moral Basis for Recycling: Extending the Theory of Planned Behaviour. *Journal of Environmental Psychology*, *36*, 96–102. https://doi.org/10.1016/j.jenvp.2013.07.010

Cohen, J. (1988). Set Correlation and Contingency Tables. *Applied Psychological Measurement*, *12*(4), 425–434. https://doi.org/10.1177/014662168801200410

Creswell, J. W. (2003). *Research Design: Qualitative, Quantitative, and Mixed Method Approaches*. Thousand Oaks, Calif: Sage Publications.

Dalhammar, C. (2020). Sustainability, the Circular Economy and Consumer Law in Sweden. *Journal of European Consumer and Market Law*, *3*, 125–128.

Domarchi, C., Tudela, A., & González, A. (2008). Effect of Attitudes, Habit and Affective Appraisal on Mode Choice: An Application to University Workers. *Transportation*, *35*(5), 585–599. https://doi.org/10.1007/s11116-008-9168-6

EEB. (2019). *Cool Products Don't Cost the Earth—Full Report*. www.eeb.org/coolproducts-report

EMF. (2013). *Towards the Circular Economy: Economic and Business Rationale for an Accelerated Transition*.

European Commission. (2019a). *Commission Regulation (EU) 2019/2021 of 1 October 2019 laying down ecodesign requirements for electronic displays pursuant to Directive 2009/125/EC of the European Parliament and of the Council, amending Commission Regulation (EC) No 1275/2008 and repealing Commission Regulation (EC) No 642/2009*.

European Commission. (2019b). *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: The European Green Deal. COM/2019/640 final*.

European Commission. (2019c). *Laying down ecodesign requirements for electronic displays pursuant to Directive 2009/125/EC of the European Parliament and of the Council, amending Commission Regulation (EC) No 1275/2008 and repealing Commission Regulation (EC) No 642/2009*.

European Commission. (2020a). *Circular Economy Action Plan*.

European Commission. (2020b). *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: A new Circular Economy Action Plan for a cleaner and more competitive Europe COM/2020/98final*.

European Commission. (2021). *Green Public Procurement*.

European Commission, Cambridge Econometrics., Trinomics., & ICF. (2018). *Impacts of circular economy policies on the labour market: Final report and annexes*. Publications Office. https://data.europa.eu/doi/10.2779/574719

Fauré, E., Dawkins, E., Wood, R., Finnveden, G., Palm, V., Persson, L., & Schmidt, S. (2019). Environmental Pressure from Swedish Consumption: The Largest Contributing Producer

Countries, Products and Services. *Journal of Cleaner Production*, *231*, 698–713. https://doi.org/10.1016/j.jclepro.2019.05.148

Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving Integration in Mixed Methods Designs-Principles and Practices. *Health Services Research*, *48*(6pt2), 2134–2156. https://doi.org/10.1111/1475-6773.12117

Finisterra do Paço, A. M., Barata Raposo, M. L., & Filho, W. L. (2009). Identifying the Green Consumer: A Segmentation Study. *Journal of Targeting, Measurement and Analysis for Marketing*, *17*(1), 17–25. https://doi.org/10.1057/jt.2008.28

Forti, V., Baldé, C. P., Kuehr, R., & Bel, G. (2020). *The Global E-waste Monitor 2020*. 120.

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy: A New Sustainability Paradigm? *Journal of Cleaner Production*, *143*, 757–768. https://doi.org/10.1016/j.jclepro.2016.12.048

Glen, S. (2018). *Tolerance Level / Tolerance Statistics: Definition, Examples*. StatisticsHowTo.Com: Elementary Statistics for the Rest of Us! https://www.statisticshowto.com/tolerance-level-statistics/

Hage, O., Söderholm, P., & Berglund, C. (2009). Norms and Economic Motivation in Household Recycling: Empirical Evidence from Sweden. *Resources, Conservation and Recycling*, *53*(3), 155–165. https://doi.org/10.1016/j.resconrec.2008.11.003

Hallå Konsument! (n.d.). *Miljöpåverkan från elektronikprodukter*. Retrieved May 13, 2021, from https://www.hallakonsument.se/miljo-och-hallbarhet/miljopaverkan-fran-elektronikprodukter/

HOP. (2020). *White Paper Durable and Repairable Products 20 Steps to a Sustainable Europe*.

IIIEE. (2018). *Dare to Repair: Exploring Open Repair to Keep Critical Materials in the Loop*.

Jackson, T. (2005). *Motivating Sustainable Consumption: A Review of Evidence on Consumer Behaviour and Behaviour Change*. Sustainable Development Research Network.

Jaeger-Erben, M., Frick, V., & Hipp, T. (2021). Why Do Users (Not) Repair Their Devices? A Study of the Predictors of Repair Practices. *Journal of Cleaner Production*, *286*, 125382. https://doi.org/10.1016/j.jclepro.2020.125382

Kalmykova, Y., Rosado, L., & Patrício, J. (2016). Resource Consumption Drivers and Pathways to Reduction: Economy, Policy and Lifestyle Impact on Material Flows at the National and Urban Scale. *Journal of Cleaner Production*, *132*, 70–80. https://doi.org/10.1016/j.jclepro.2015.02.027

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. https://doi.org/10.1002/sd.271

Laerd Statistics. (2018). *Statistical Tutorials and Software Guides*. Laerd Statistics. https://statistics.laerd.com/premium/spss/sroc/spearmans-rank-order-correlation-in-spss-15.php

Laurenti, R., Moberg, Å., & Stenmarck, Å. (2017). Calculating the Pre-Consumer Waste Footprint: A Screening Study of 10 Selected Products. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, *35*(1), 65–78. https://doi.org/10.1177/0734242X16675686

Lavers Westin, A., Kalmykova, Y., Rosado, L., Oliveira, F., Laurenti, R., & Rydberg, T. (2019). Combining Material Flow Analysis with Life Cycle Assessment to Identify Environmental Hotspots of Urban Consumption. *Journal of Cleaner Production*, *226*, 526–539. https://doi.org/10.1016/j.jclepro.2019.04.036

Lavrakas, P. (2008). *Encyclopedia of Survey Research Methods* (Vols. 1–0). Sage Publications, Inc. https://methods.sagepub.com/reference/encyclopedia-of-survey-research-methods

Leavy, P. (2017). *Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches*. Guilford Publications.

Lefebvre, M. (2019). *To Repair or Not to Repair: An Investigation of the Factors Influencing Prosumer Repair Propensity* [Loughborough University]. https://repository.lboro.ac.uk/articles/To_repair_or_not_to_repair_an_investigation_of_the_factors_influencing_prosumer_repair_propensity/11365325/1

Llorente-González, L. J., & Vence, X. (2020). How Labour-Intensive is the Circular Economy? A Policy-Orientated Structural Analysis of the Repair, Reuse and Recycling Activities in the European Union. *Resources, Conservation and Recycling*, *162*, 105033. https://doi.org/10.1016/j.resconrec.2020.105033

Lunds Kommun. (n.d.). *FixaTill återbruk*. Retrieved May 13, 2021, from https://www.lund.se/bygga-bo--miljo/lunds-renhallningsverk/framtid-nu/forebygga-avfall/fixatill-aterbruksbutik/

Miliute-Plepiene, J., & Youhanan, L. (2019). *E-waste and Raw Materials: From Environmental Issues to Business Models* (B 2355; p. 44). IVL Swedish Environmental Research Institute.

Miller, D. (2012). *Consumption and Its Consequences*. Polity Press.

Ministry of Enterprise and Innovation Sweden. (2016). *Smart Industry: A strategy for New Industrialization for Sweden*.

Ministry of Finance Sweden. (2016b). *National Public Procurement Strategy*.

Ministry of Finance Sweden. (2016a). *Strategy for Sustainable Consumption*.

Ministry of the Environment. (2020). *Circular Economy: Strategy for the transition in Sweden*.

Mitchell, P., & Morgan, J. (2015). *Employment and the circular economy Job creation in a more resource efficient Britain*. https://doi.org/10.13140/RG.2.1.1026.5049

Montalvo, C., Peck, D., & Rietveld, E. (2016). *A Longer Lifetime for Products: Benefits for Consumers and Companies*.

Niskanen, J., McLaren, D., & Anshelm, J. (2021). Repair for a Broken Economy: Lessons for Circular Economy from an International Interview Study of Repairers. *Sustainability*, *13*(4), 2316. https://doi.org/10.3390/su13042316

Page, M. M., & Sherif, C. W. (1980). *Beliefs, Attitudes, and Values: Nebraska Symposium on Motivation, 1979.* University of Nebraska Press. https://books.google.com.mx/books?id=THtKAQAAIAAJ

Pallant, J. (2016). *SPSS Survival Manual: A Step by Step Guide to Data Analysis using IBM SPSS* (6th ed.). Open University Press/McGraw-Hill.

Parajuly, K., Kuehr, R., Awasthi, A. K., Fitzpatrick, C., Lepawsky, J., Smith, E., Wildmer, R., & Zeng, X. (2019). *Future E-Waste Scenarios.* StEP, UNE ViE-SCYCLE & UNEP IETC.

Pérez-Belis, V., Braulio-Gonzalo, M., Juan, P., & Bovea, M. D. (2017). Consumer Attitude Towards the Repair and the Second-Hand Purchase of Small Household Electrical and Electronic Equipment. A Spanish Case Study. *Journal of Cleaner Production*, *158*, 261–275. https://doi.org/10.1016/j.jclepro.2017.04.143

Piedmont, R. L. (2014). Inter-item Correlations. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 3303–3304). Springer Netherlands. https://doi.org/10.1007/978-94-007-0753-5_1493

Piringer, M., & Schanda, I. (2020, September). *Austria Makes Repair More Affordable.* Right to Repair. https://repair.eu/news/austria-makes-repair-more-affordable/

Raihanian Mashhadi, A., Esmaeilian, B., Cade, W., Wiens, K., & Behdad, S. (2016). Mining Consumer Experiences of Repairing Electronics: Product Design Insights and Business Lessons Learned. *Journal of Cleaner Production*, *137*, 716–727. https://doi.org/10.1016/j.jclepro.2016.07.144

Repair. (n.d.). In *Cambridge Dictionary.* Cambridge University Press. Retrieved May 8, 2021, from https://dictionary.cambridge.org/dictionary/english/repair

Reusch, P., & Wittbrodt, S. (2019). *Reversal of the Burden of Proof Extended: What Sellers Should Know.* https://www.reuschlaw.de/en/news/reversal-of-the-burden-of-proof-extended-what-sellers-should-know/#:~:text=The%20reversal%20of%20the%20burden%20of%20proof&text=This%20means%20that%20the%20buyer,principle%20rebut%20this%20legal%20presumption.

Richter, J. L., Tähkämö, L., & Dalhammar, C. (2019). Trade-offs with Longer Lifetimes? The Case of LED Lamps Considering Product Development and Energy Contexts. *Journal of Cleaner Production*, *226*, 195–209. https://doi.org/10.1016/j.jclepro.2019.03.331

Rogers, H. A., Deutz, P., & Ramos, T. B. (2021). Repairing the circular economy: Public perception and participant profile of the repair economy in Hull, UK. *Resources, Conservation and Recycling*, *168*, 105447. https://doi.org/10.1016/j.resconrec.2021.105447

Rudenauer, I., & Prakash, S. (2020). *Economic and Environmental Impacts of Extending the Durability of Electrical and Electronic Equipment.*

Sabbaghi, M., & Behdad, S. (2018). Consumer Decisions to Repair Mobile Phones and Manufacturer Pricing Policies: The Concept of Value Leakage. *Journal of Resources, Conversation and Recycling*, *133*, 11.

Sabbaghi, M., Cade, W., Behdad, S., & Bisantz, A. M. (2017). The Current Status of the Consumer Electronics Repair Industry in the U.S.: A Survey-Based Study. *Resources, Conservation and Recycling*, *116*, 137–151. https://doi.org/10.1016/j.resconrec.2016.09.013

Šajn, N. (2019b). *Consumer Sale of Goods*. European Parliamentary Research Service.

Šajn, N. (2019a). *Consumers and Repair of Products*. European Parliamentary Research Service.

Scott, K. A., & Weaver, T. (2014). To Repair or Not to Repair What is the Motivation? *Journal of Research for Consumers*, *26*.

Shin, Y. H., & Hancer, M. (2016). The Role of Attitude, Subjective Norm, Perceived Behavioral Control, and Moral Norm in the Intention to Purchase Local Food Products. *Journal of Foodservice Business Research*, *19*(4), 338–351. https://doi.org/10.1080/15378020.2016.1181506

Sung, K., Cooper, T., & Kettley, S. (2019). Factors Influencing Upcycling for UK Makers. *Sustainability*, *11*(3), 870. https://doi.org/10.3390/su11030870

Svensson-Hoglund, S., Richter, J. L., Maitre-Ekern, E., Russell, J. D., Pihlajarinne, T., & Dalhammar, C. (2021). Barriers, Enablers and Market Governance: A Review of the Policy Landscape for Repair of Consumer Electronics in the EU and the U.S. *Journal of Cleaner Production*, *288*, 125488. https://doi.org/10.1016/j.jclepro.2020.125488

Tashakkori, A., & Teddie, C. (1998). *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. (Vol. 46). Sage Publications, Inc.

Tecchio, P., McAlister, C., Mathieux, F., & Ardente, F. (2017). In Search of Standards to Support Circularity in Product Policies: A Systematic Approach. *Journal of Cleaner Production*, *168*, 1533–1546. https://doi.org/10.1016/j.jclepro.2017.05.198

Terzioğlu, N. (2021). Repair Motivation and Barriers Model: Investigating User Perspectives Related to Product Repair Towards a Circular Economy. *Journal of Cleaner Production*, *289*, 125644. https://doi.org/10.1016/j.jclepro.2020.125644

Triandis, H. C. (1971). *Attitude and Attitude Change (Foundations of Social Psychology)*. John Wileys & Sons Inc.

Triandis, H. C. (1977). *Interpersonal Behavior*. Brooke/Cole.

Türkeli, S., Huang, B., Stasik, A., & Kemp, R. (2019). Circular Economy as a Glocal Business Activity: Mobile Phone Repair in the Netherlands, Poland and China. *Energies, 12*, 498. https://doi.org/10.3390/en12030498

UN Habitat. (2016). *World Cities Report 2016*.

Upphanglings Myndigheten. (n.d.). *Sustainability criteria for computers and monitors*. https://www.upphandlingsmyndigheten.se/kriterier/it-och-telekom/datorer-och-bildskarmar/

Vande Velde, F., Claerebout, E., Cauberghe, V., Hudders, L., Van Loo, H., Vercruysse, J., & Charlier, J. (2015). Diagnosis before treatment: Identifying dairy farmers' determinants for the adoption of sustainable practices in gastrointestinal nematode control. *Veterinary Parasitology*, *212*(3–4), 308–317. https://doi.org/10.1016/j.vetpar.2015.07.013

Vermeir, I., & Verbeke, W. (2008). Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values. *Ecological Economics*, *64*(3), 542–553. https://doi.org/10.1016/j.ecolecon.2007.03.007

Wiens, K. (2010). *Self-Repair Manifesto*. IFixit. https://www.ifixit.com/News/14266/self-repair-manifesto

74

Wieser, H., & Tröger, N. (2018). Exploring the Inner Loops of the Circular Economy: Replacement, Repair, and Reuse of Mobile Phones in Austria. *Journal of Cleaner Production*, *172*, 3042–3055. https://doi.org/10.1016/j.jclepro.2017.11.106

Appendix A: Overview of factors that influence repair

Appendix Figure 1. Overview of factors that influence repair

Category	Factor	# of studies	Geographic scope of studies	Source
Contextual	Cost of repair	11	• EU-wide *(Austria, Czech Republic, France, Germany, Hungary, Ireland, Latvia, Netherlands, Portugal, Romania, Spain, **Sweden**)* • Germany • Global • Netherlands • **Sweden** (x3) • United Kingdom (x2) • United States (x3)	Ackermann et al., 2018 Cerulli-Harms et al., 2018 Dalhammar & Richter, 2020 IIIEE, 2018 Jeager-Erben et al., 2021 King et al., 2006 Nazli, 2021 Raihanian M. et al., 2016 Rogers et al., 2021 Sabbaghi & Behdad, 2018 Sabbaghi et al., 2017 Scott & Weaver, 2014 Weiser et al., 2018
	Accessibility	10	• EU-wide • Global • Netherlands • Spain • **Sweden** (x3) • United Kingdom (x2) • United States (x2)	Ackermann et al., 2018 Cerulli-Harms et al., 2018 Dalhammar & Richter, 2020 IIIEE, 2018 Lefebvre, 2019 Nazli, 2021 Perez-Beliz et al., 2017 Rogers et al. 2021 Raihanian M. et al., 2016 Sabbaghi & Behdad, 2018 Scott & Weaver, 2014
	Legal frameworks		• EU-wide	Montalvo et al., 2016 Svensson-Hoglund et al., 2021

| Product-related	Guarantee	3	• EU-wide • Global • **Sweden**	Cerulli-Harms et al., 2018 IIIEE, 2018 Raihanian M. et al., 2016
	Repairability	5	• EU-wide • Global • Spain • **Sweden (x2)** • United Kingdom	Cerulli-Harms et al., 2018 Dalhammar & Richter, 2020 Lefebvre, 2019 Nazli, 2021 Pérez-Beliz et al., 2017 Raihanian M. et al., 2016 Svensson-Hoglund et al., 2021
	Information about repairability	4	• EU-wide • Netherlands • Spain • **Sweden**	Cerulli-Harms et al., 2018 Dalhammar & Richter, 2020 Lefebvre, 2019 Pérez-Beliz et al., 2017
	Substitutability	1	• Netherlands	Ackermann et al., 2018
	Functionality	2	• Netherlands • Sweden	Ackermann et al., 2018 Nazli, 2021
Socio-Cultural	Social support	3	• EU-wide • Germany • Netherlands	Ackermann et al., 2018 Cerulli-Harms et al., 2018 Jeager-Erben et al., 2021
	Trends	3	• EU-wide • **Sweden**	Cerulli-Harms et al., 2018 Nazli, 2021
Individual	Past experiences	6	• Austria • EU-wide • Global • Netherlands • **Sweden** • United Kingdom	Ackermann et al., 2018 Cerulli-Harms et al., 2018 Dalhammar & Richter, 2020 Lefebvre, 2019 Raihanian M. et al., 2016 Weiser et al., 2018

	Symbolic value	3	- EU-wide - Netherlands **Sweden** - United States	Ackermann et al., 2018 Cerulli-Harms et al., 2018 Nazli, 2021 Scott & Weaver, 2014
	Attitudes	2	- EU-wide - Germany - United States	Cerulli-Harms et al., 2018 Jeager-Erben et al., 2021 Scott & Weaver, 2014
	Values	4	- Netherlands **Sweden** - United Kingdom (x2) - United States	Ackermann et al., 2018 Lefebvre, 2019 Nazli, 2021 Rogers et al. 2021 Scott & Weaver, 2014
	Trust in repair	6	- Austria - EU-wide - Global - Spain **Sweden** - United States	Cerulli-Harms et al., 2018 Dalhammar & Richter, 2020 Perez-Beliz et al., 2017 Raihanian M. et al., 2016 Sabbaghi & Behdad, 2018 Weiser et al., 2018
	Ability to repair	3	- Netherlands - Spain **Sweden**	Ackermann et al., 2018 Nazli, 2021 Perez-Beliz et al., 2017
	Shared ownership	1	Netherlands	Ackermann et al., 2018

Appendix B: Overview of FBM and TPB

Fogg's Behavior Model (FBM)

FBM (2009) has its origins in the field of persuasion technologies. It states that for a behavior to occur, three factors need to align: "motivation (if people want to do it), ability (if people can do it), and triggers (a stimulus that provokes people to do it)" (Ackermann et al., 2018, p. 2) (see Figure 1). FBM posits that both motivation and ability need to be present for a trigger to have an effect. However, both motivation and ability do not need to be high as they can compensate for each other. I.e., if motivation is very high, people will put the energy to realize the action when triggered. All three factors must be present for an action to take place. Fogg identifies six motivations, six abilities, and three triggers: sparks, facilitators, and signals (see Appendix Figure 2).

Appendix Figure 2. Fogg's Behavior Model from Ackermann et al (2018)
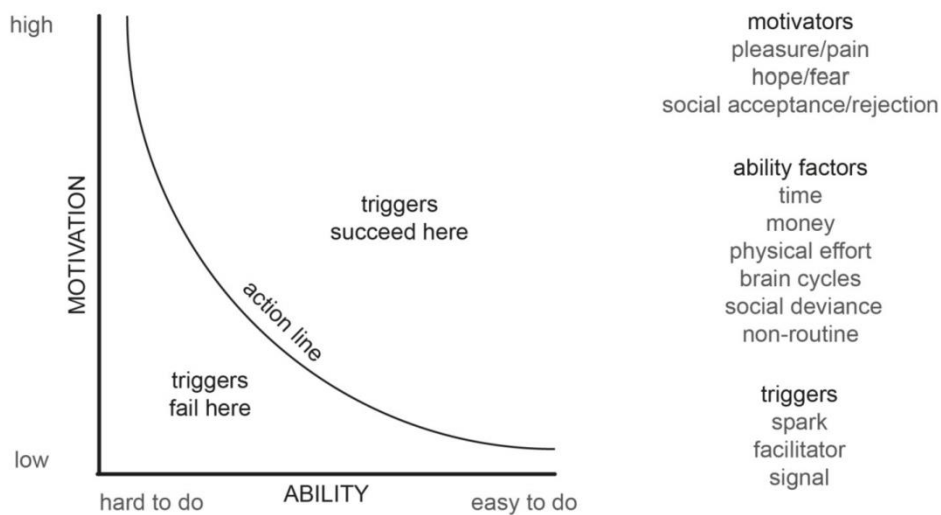
Theory of Planned Behavior (TPB)

With its origins in social psychology, TPB (1991) claims to explain all kinds of intentional social behaviors. It posits that behaviors are determined by behavioral intentions and perceived behavioral control (see Appendix Figure 3). Behavioral intentions are formed based on an individual's attitude towards the behavior, subjective norms, and perceived behavioral control. Perceived behavioral control is understood as the individual's perception of their ability to perform a task (Jackson, 2005).

Appendix Figure 3. Theory of Planned Behavior
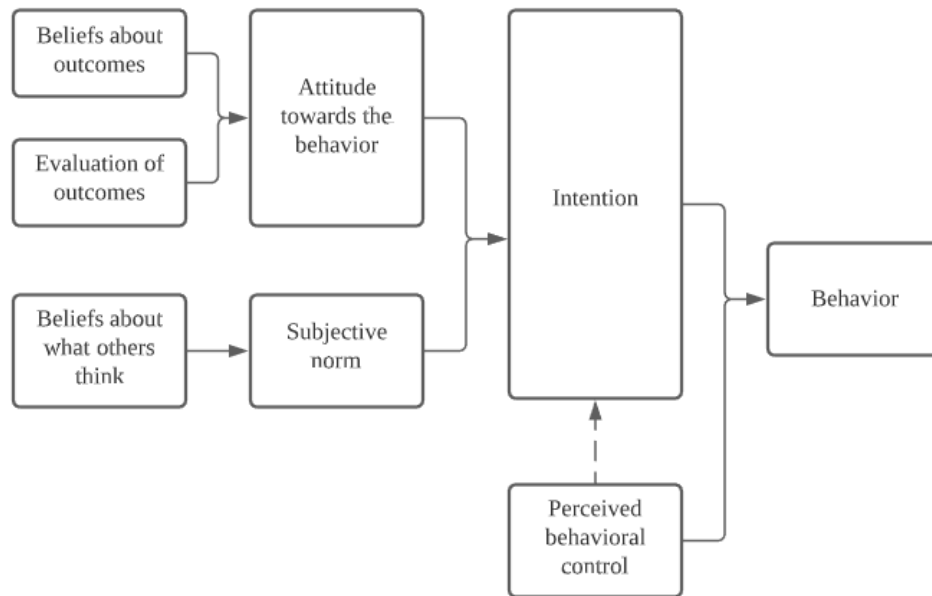
Appendix C: Triandis' TIB Definitions

The following list provides the definitions of Triandis' theory of interpersonal behavior. The definitions are directly quoted from his 1977 book (see bibliography).

Affect	Refers to the emotional system of an individual. It is the feelings of joy, elation, pleasure, depressions, disgust, displeasure, or hate associated by an individual with a particular act.
Attitude	An idea, charged with affect, that predisposes a class of actions to a particular class of social situations.
Behavior	Broad class of reaction by an organism to any stimuli.
Behavioral intentions	Instructions that people give to themselves to behave in certain ways. They involve ideas such as "I must do X" "I will do X" and "I am going to do X".
Beliefs about outcomes	The affect attached to a consequence. For example, the act of saving is connected with a positive value. Then this value is likely connected to the broader and more abstract values, such as the value of "comfortable life".
Evaluations of the outcomes	The perceived consequence of an act. For example, being healthy might be perceived as a consequence of exercising daily.
Facilitating conditions	Objective factors, "out there" in the environment that several observers can agree make an act easy to do. A person may intend to do something but be unable to do it; the geography of the environment may prevent the act.
Habits	Situation-behavior sequences that are or have become automatic so that they occur without self-instruction. The individual is usually not "conscious" of these sequences.
Norms	Self-instructions to do what is perceived to be correct and appropriate by members of culture in certain situations.
Roles[1]	Concerned with behavior that is considered correct or appropriate for persons holding a particular position in a group, society, or social system.
Self-concept	Behaviors that people consider appropriate for themselves. Self-instructions to behave in particular ways.

Appendix D: Consent Form and Interview Guide

Consent form for interviews with consumers

Before we start, I would like to share a few points about the nature of this study:

Purpose

As I mentioned via email, my name is Mariana Lopez Davila, and I am a MSc student of Environmental Management and Policy at Lund University. I am writing my masters' thesis on the behavioral barriers and drivers that occur when people's personal electronics break and they are faced with the choice to repair or replace. The purpose in talking with you today is to understand your experiences with broken electronics and with repair services.

Procedures

If you agree to participate, I will ask you a series of questions taking about 45 mins to 1 hour of your time. I would like to record this discussion so that I can more easily remember what was said, so, with your permission, your answers will be audio recorded. I can stop the recording at any time if there is something you would like to share off the record. Your name will not be included or attached to the recording in any way to protect your privacy.

Risks/Benefits

There is minimal risk involved in your participation in this interview. The questions will not involve sensitive or personal information, and you can refuse to answer any question. Although this study may not benefit you personally, we hope that the results will add to the knowledge about how to scale repair practices to transition to a circular economy in Sweden.

Voluntary Participation

Participation in this interview is completely voluntary. You do not have to agree to participate in this interview and you may change your mind and stop at any time.

Confidentiality

Anything you tell me is confidential and the records of this study will be kept private. I may share your name with my supervisor as a person who was consulted, but nothing you say will be personally attributed to you in any documentation or reports that result from this interview.

Do you have any questions before we begin?

Is it okay for me to start recording and begin my questions?

Interview Guide

Before we start, please know that there are no right or wrong responses. I am interested in your personal opinions and experiences.

Also, during this interview, whenever I say electronics or personal electronics, I am referring to the following items: computers, tablets, electronic watches, speakers, headphones, cellphones, televisions, projectors, cameras, musical equipment, electric toys, sports machines

Attitudes

1. What comes to your mind when you think about repairing your electronics?
    a. *Probes*
        i. Do you think repair is good/bad/easy/hard?

Habits/Affect

2. Have you had any personal electronics break or malfunction in the past 5 years?
    a. If yes, can you tell me about the last two products? Describe what happened, whether you replaced or repaired them, and why you choose that action.
        i. *Probes:*
            1. What was wrong with the product?
            2. Did you get the item repair or replaced?
            3. What motivated you to repair/replace the product?
            4. What challenges did you encountered in trying to repair/replace the item?
            5. Where you successful in repairing/replacing the item?
    b. If not, move to question 3.
3. Can you describe the emotions you felt during the process of getting your item repaired/replaced *and* after it was repaired/replaced?
4. From what you remember, as you were growing up, would your parents try to repair electronics whenever they broke?
    a. Did that change over time?

Norms, roles and self-concept

5. From the people you surround yourself with, is there anyone who would suggest that you repair electronics when broken?
6. From the people you surround yourself with, is there anyone who would suggest that you to replace electronics when broken?
7. How would you describe the culture of repair in Sweden?
    a. In your opinion, do you think it is accepted for people in Sweden to replace electronics when they still work? Why or why not?
    b. Do you think the average Swede is used to repairing personal electronics? Why or why not?

Behavioral beliefs and outcomes

8. In your opinion, what are the advantages of repairing electronics?
9. What are the disadvantages of repairing electronics?

Facilitating conditions

10. What factors or circumstances would make it easy or enable you to repair your broken electronics?
11. What factors would make it difficult or prevent you from repairing your broken electronics?

Demographics

12. Where do you currently live?
13. For how long have you lived in Sweden?
14. What year were you born?
15. What is your education level?
16. What is your profession?
17. What is your marital status?
18. Do you have children?
19. Gender

Appendix E: Questionnaire

This appendix has two parts to it. First, a table that organizes the questionnaire into the different variables and indicates which items were used in the scales for the statistical analysis. The second part provides the questionnaire dissemination materials and a screenshot of the questionnaire.

Appendix Figure 4. Questions asked in the questionnaire

TIB Factor	Question and answer options
Beliefs about the outcomes of repairing electronics	I think that repairing personal electronic devices is: (1: hard – 5: easy*, 1: worthless – 5: worthwhile*; 1: frustrating – 5: satisfying*; 1: harmful – 5: beneficial*; 1: bad – 5: good*; 1: expensive – 5: affordable*; 1: time consuming – 5: quick*)
Evaluations of the outcomes of repairing electronics	I think that repairing my personal electronics will result in: 1) my device working as well as when it was new*; 2) a sign that my device will continue to break or malfunction*; 3) feeling proud of myself*; 4) an uncomfortable experience*; 5) a waste of time*; 6) a good deal*; 7) protecting the environment*; 8) a waste of money*. (1: strongly disagree – 5: strongly agree)
Norms	To what extent do you agree or disagree with the following statements? 1) Most people important to me think that I should repair my personal electronic devices when they break*; 2) Most people important to me expect me to repair my personal electronic devices when they break*. (1: strongly disagree – 5: strongly agree)
Perceived roles	To what extent do you agree or disagree with the following statements? 1) Most people like me try to repair their personal electronic devices before replacing them; 2) I believe repairing electronics is an adequate thing for me to do. (1: strongly disagree – 5: strongly agree)
Self-concept	To what extent do you agree or disagree with the following statements? 1) Not trying to repair electronics when they break would violate my principles. (1: strongly disagree – 5: strongly agree)
Affect	Repairing my personal electronic devices makes me feel: (1: nervous – 5: relaxed*; 1: unsure – 5: confident*; 1: annoyed – 5: pleased*; 1: uncomfortable – 5: comfortable*)
Attitudes	To what extent do you agree or disagree with the following statements? 1) Repairing personal electronics when they break is a good idea*; 2) Repairing electronic devices is important to me*; 3) Repair is bad for my economy*; 4) Repair is good for the environment*; 5) Repair is good for the local economy*; 6) It is often a better deal to buy a new electronic device than to repair an old one; 7) I think it's acceptable to replace an electronic device that could be repaired as long as I recycle or donate the device I'm replacing; 8) I think it's acceptable to replace an electronic device that could be repaired if it's replaced with a secondhand device. (1: strongly disagree – 5: strongly agree)
Behavioral intention	To what extent do you agree or disagree with the following statements? 1) I intent to look into repairing my personal electronic devices next time they break*; 2) I am willing to spend time to try to repair personal electronics when they break*. (1: strongly disagree – 5: strongly agree)
Habits	To what extent do you agree or disagree with the following statements? 1) Trying to repair a personal electronic that has broken is something I automatically do (2) Growing up my parents always tried to repair electronic devices before replacing them. (1: strongly disagree – 5: strongly agree)

Facilitating conditions	To what extend do you think the following factors have impeded you from repairing your personal electronic devices in the past? (1) Not having access to instructions on how to maintain and repair my electronics*; (2) Not having my device covered by guarantee*; (3) The cost of repair being higher than the cost of buying a new item*; (4) Not knowing where to go to repair my electronic device*; (5) Not trusting the repair service will do the job right*; (6) Not trusting that the repair service is being transparent*; (7) Not knowing the cost of repair up-front*; (8) Not having a way to easily compare repair prices*; (9) Not having the time to figure it out*; (10) Having personal data on my device*. (1: Not at all – 5: To a great extent)
Repair behavior	In the past five years, how often have you tried to repair your broken electronics? (1: Never – 5: Always) Think back to the last personal electronic that either broke, stopped working, or malfunctioned; what did you do? 1) Kept using it without repairing it; 2) Repaired it myself; 3) Took it to a repair service – it was repaired successfully; 4) Took it to a repair service – it wasn't repairable, so I replaced it; 5) Took it to a repair service – it was too expensive, so I replaced it; 6) I replaced it; 7) I can't remember having an electronic device break of malfunction.

*These items were included in the scale for each of the concepts they measure

Dissemination example

Mariana Lopez Davila
March 15 · 🌐

Dear Alumni network,

As part of my master thesis, I'm looking to survey residents of Sweden about their experiences repairing electronics. If you reside in Sweden, I would be forever grateful if you take 7 minutes to share your thoughts with me. As a thank you, I will raffle five (5) 300 sek ICA gift cards!

Click here to answer the survey: https://www.soscisurvey.de/iiieemscthesis/?q=qnr1

I would also really appreciate it if you are willing to share this post within your network!

Thank you so very much!

All the best,
Mariana

HELP A STUDENT BY ANSWERING THIS SURVEY!

WHO ARE YOU?	A current resident of Sweden
WHAT IS THIS ABOUT?	Your experiences repairing electronics
HOW LONG DOES IT TAKE?	About 7 mins!
WHAT ELSE?	YOU CAN WIN A 300 SEK ICA GIFT CARD »
WHAT IS THIS FOR?	My MSc Thesis at Lund University
	Thank you so much!!
	to answer click on the link above

Questionnaire

Hello,

I'm Mariana, a master's student at Lund University in Sweden, and I'm currently writing my master's thesis on **"Incentivizing Electronics Repair in Sweden"**. The aim of this survey is to learn about your experiences with, and opinions about, repairing your personal electronics in Sweden. **This survey has 11 questions and it will take approximately 7 minutes to complete.**

Your participation in this study is completely voluntary. There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential.

As a thank you for helping with my master's thesis, I will raffle five 300sek ICA gift cards. See details on this at the end of the survey.

If you have questions at any time about the survey or the procedures, you may email me at ma8267lo-s@student.lu.se

By clicking **"Next"** below you are indicating that you have read and understood this consent form and agree to participate in this research study.
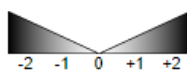
Definitions

This survey is interested in your experience with **personal electronics** which refers to the following items:

- Computers
- Tablets
- Electronic watches
- Cellphones
- Earphones/headphones
- Musical equipment
- Televisions
- Projectors
- Digital cameras

When thinking about **repair**, it can be any of the following actions:

- Repairing the device yourself
- Taking it to a repair shop
- Taking it to the manufacturer

88

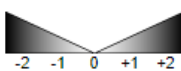1. I think that repairing personal electronic devices is:

	-2	-1	0	+1	+2	
Hard	○	○	○	○	○	Easy
Worthless	○	○	○	○	○	Worthwhile
Frustating	○	○	○	○	○	Satisfying
Harmful	○	○	○	○	○	Beneficial
Bad	○	○	○	○	○	Good
Expensive	○	○	○	○	○	Affordable
Time consuming	○	○	○	○	○	Quick

2. I think that repairing my personal electronics will result in:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
My device working as well as when it was new	○	○	○	○	○
A sign that my device will continue to break or malfunction	○	○	○	○	○
Feeling proud of myself	○	○	○	○	○
An uncomfortable experience	○	○	○	○	○
A waste of time	○	○	○	○	○
A good deal	○	○	○	○	○
Protecting the environment	○	○	○	○	○
A waste of money	○	○	○	○	○

3. Repairing my personal electronic devices makes me feel:

	-2	-1	0	+1	+2	
Nervous	○	○	○	○	○	Relaxed
Unsure	○	○	○	○	○	Confident
Annoyed	○	○	○	○	○	Pleased
Uncomfortable	○	○	○	○	○	Comfortable

4. To what extent do you agree or disagree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Most people important to me think that I should repair my personal electronic devices when they break	○	○	○	○	○
Most people important to me expect me to repair my personal electronic devices when they break	○	○	○	○	○
Most people like me try to repair their personal electronic devices before replacing them	○	○	○	○	○
Not trying to repair personal electronics when they break would violate my principles	○	○	○	○	○
I believe repairing electronics is an adequate thing for me to do	○	○	○	○	○

5. To what extent do you agree or disagree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Repairing personal electronics when they break is a good idea	○	○	○	○	○
It is often a better deal to buy a new electronic device than to repair an old one	○	○	○	○	○
Repairing electronic devices is important to me	○	○	○	○	○
Repair is bad for my economy	○	○	○	○	○
I think it's acceptable to replace an electronic device that could be repaired as long as I recycle or donate the device I'm replacing	○	○	○	○	○
I think it's acceptable to replace an electronic device that could be repaired if it's replaced with a secondhand device	○	○	○	○	○
Repair is good for the environment	○	○	○	○	○
Repair is good for the local economy	○	○	○	○	○
I am willing to spend time to try to repair personal electronics when they break	○	○	○	○	○
I intent to look into repairing my personal electronic devices next time they break	○	○	○	○	○

90

6. To what extent do you agree or disagree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Trying to repair a personal electronic that has broken is something I automatically do	○	○	○	○	○
Replacing a personal electronic that has broken is something I do without thinking	○	○	○	○	○
Growing up my parents always tried to repair electronic devices before replacing them	○	○	○	○	○

7. In the past five years, how often have you tried to repair your broken electronics?

○	○	○	○	○
Never	Rarely	Sometimes	Most of the time	Always

8. To what extend do you think the following factors have impeded you from repairing your personal electronic devices in the past?

	Not at all	Slightly	Moderately	Considerably	To a great extent
Not having access to instructions on how to maintain and repair my electronics	○	○	○	○	○
Not having my device covered by guarantee	○	○	○	○	○
The cost of repair being higher than the cost of buying a new item	○	○	○	○	○
Not knowing where to go to repair my electronic device	○	○	○	○	○
Not trusting the repair service will do the job right	○	○	○	○	○
Not trusting that the repair service is being transparent	○	○	○	○	○
Not knowing the cost of repair up-front	○	○	○	○	○
Not having a way to easily compare repair prices	○	○	○	○	○
Not having the time to figure it out	○	○	○	○	○

9. Are there other factors that have impeded you from repairing your personal electronic devices in the past?

Write any other factors that influence your decision to repair electronics (if any)

91

10. Think back to the last personal electronic that either broke, stopped working, or malfunctioned, what did you do?

○ Kept using it without repairing it

○ Repaired it myself

○ Took it to a repair service – it was repaired successfully

○ Took it to a repair service – it wasn't repairable so I replaced it

○ Took it to a repair service – it was too expensive so I replaced it

○ I replaced it

○ I can't remember having an electronic device break or malfunction

11. Use this space to share anything else about your experience repairing personal electronics

12. What is your current place of residence?

13. For how long have you lived in Sweden?

14. What is the highest level of education you have completed?

○ High school

○ Trade/vocational/technical

○ Associates

○ Bachelors

○ Masters

○ Professional

○ Doctorate

92

15. What do you do professionally?

- ○ Student
- ○ Employed
- ○ Unemployed/seeking employment
- ○ Retired
- ○ Other:

  [   ]

16. How old are you?

I am [   ] years old

17. What gender do you identify with?

- ○ Female
- ○ Male
- ○ Genderqueer/non-binary
- ○ Other

  [   ]

18. What is your marital status?

- ○ Single
- ○ Married or living with a partner
- ○ Widowed

19. Do you have children?

- ○ yes
- ○ no

Thank you for answering this survey!

Let me know if you would like to participate on the lottery OR see the results of this study by clicking the options below and entering your email address.

Please note no further information about the interview will be saved in combination with email addresses, so your survey will continue to be anonymous if you enter your email below. Moreover, your email address will not be passed on to third parties.

- ☐ I would like to participate in the lottery to win a 300 sek ICA card.
- ☐ I am interested in the results of this study. Please send me a summary by e-mail.

The survey has been completed and your answers have been saved, you may close your browser now. Thank you!

Appendix F: List of Codes

Appendix Figure 5. List of codes for thematic coding exercise

Number	Code	Category
1	Afraid-nervous	Affect
3	Angry	
4	Awkward	
5	Embarrassment	
6	Exciting	
7	Frustration	
8	Happy	
9	Hard to change attitude	
10	I don't want to do it	
11	I feel frustrated when an item breaks	
12	It's connected to bad emotions	
13	Lost	
14	Overwhelming	
15	Proud	
16	Sad	
17	Stressed	
18	Uncertain	
19	Uncomfortable	
20	Buying new is bad	Attitudes
21	Cheap products are not worth repairing	
22	Dangerous	
23	Environmentally aware	
24	Environmentally friendly	
25	Expensive products are worth repairing	
26	I don't know where to go	
27	I don't trust the manufacturers	
28	I don't trust the repair shop	
29	I prefer buying new	
30	I prefer to replace with second hand than to repair	
31	Increase attachment	
32	Is good	
33	Is not worth it	
34	It is worth repairing when..	
35	It's complicated	
36	It's expensive	
37	It's the right thing to do	
38	New items are better than repaired ones	
39	New items are worth repairing	
40	Old items are not worth repairing	

41	Products are not designed to be repaired	
42	Repair is cheaper than replace	
43	Repair is smth you do when you don't have money	
44	Repairing helps the sector grow	
45	Time consuming	
46	Unpleasant experience to repair	
47	You do not need to buy a new one	
48	Access to spares	Facilitating conditions
49	Accessibility to repair service	
50	Better service	
51	Cost of repair	
52	Data security	
53	Guarantees	
54	If others did it	
55	Inconvenient	
56	Information	
57	Insurance	
58	Inviting or cool shop	
59	Poor product design	
60	Promote repair	
61	Recycling facilities	
62	Time	
63	Transparency	
64	Trust in repair service	
65	Vuelta en vano	
66	Didn't repaired or replaced	Habits
67	Functions slowed down	
68	Item stopped working	
69	Item was still working	
70	Repair	
71	Replaced	
72	Exchanged at store	
73	Gave to family or friends	
74	I was told I couldn't repair	
75	New	
76	Old item stored at home	
77	Second hand	
78	All-in-one shop	Ideas for improvement
79	Improve information about repairability	
80	Improved transparency	
81	Maintenance yearly services	
82	Make repair politically correct	
83	Conflict aversion	Social Factors
84	Culture of repair in Sweden	

	85	Culture of repair exists to some extent	
	86	Culture of repair is weak	
	87	Does not exist	
	88	I start to hear more about the repair	
	89	People repair in Sweden	
	90	Ppl don't get into your business	
	91	Swedes don't want to sobresalir	
	92	Electronics were simpler, more durable back then	
	93	Having new electronics is a sign of success	
	94	It is accepted to replace when device works	
	95	Market does not provide durable choices	
	96	Parents don't repair as much anymore	
	97	Parents used to repair	
	98	Parents used to replace	
	99	People want cheap products	
	100	Ppl want new	
	101	Roles	
	102	Second hand is the new pink	
	103	Self-concept	
	104	Social support	
	105	Society promotes consumerism	
	106	Status	
	107	Subcultures	
	108	Swedes like technology	
	109	Swedes want to do the right thing	
	110	We didn't have many electronics	

Appendix G: Recoded ordinal variables

Appendix Figure 6. Recorded ordinal variables

Variables	Ordinal Scale	Nominal scale
Frequency of repair behavior	1 = Never 2 = Rarely 3 = Sometimes	0= relatively less frequent
	4 = Most of the time 5 = Always	1= relatively more frequent
Habits Intention to repair Roles Self-concept Total facilitating conditions Total intentions Total norms Total outcomes beliefs Total Outcomes evaluations	1 = Strongly disagree 2 = Disagree 3 = Neutral	0= no
	4 = Agree 5 = Strongly Agree	1 = yes
Total affect	1= Strongly negative 2= Negative 3= Neutral	0= bad
	4 = Positive 5 = Strongly positive	1= good

Appendix H: Multicollinearity test

Repair behavior

Appendix Figure 7. Collinearity Statistics for repair behavior

| Model | Collinearity Statistics | |
	Tolerance	VIF
1 Intentions	.862	1.160
Habits	.862	1.160

Dependent Variable: Frequency of repair

Intention to repair

Appendix Figure 8. Collinearity Statistics for repair behavior

| Model | Collinearity Statistics | |
	Tolerance	VIF
Total Evaluation of Outcomes	.843	1.186
Total Beliefs about Outcomes	.756	1.323
1 Total Norms	.786	1.272
Roles	.754	1.326
Self-concept	.796	1.256
Total Affect	.784	1.276

Dependent Variable: Intentions

Appendix I: Regression analysis with outliers

Frequency of repair behavior

Appendix Figure 9. Logistic regression explaining the likelihood of reporting relatively more frequent electronics repair with intention, habit, and facilitating conditions variables

Predictor	ß	SE B	Wald's x^2	df	p	Odds ratio
Intention to repair	1.767	.676	6.826	1	.009	5.854
Habits	1.705	.386	19.518	1	.000	5.504
Facilitating conditions	.478	.495	0.932	1	.334	1.612
Constant	-2.838	.680	17.428	1	.000	.059
Test			**X^2**	**df**	**p**	
Omnibus tests of model coefficients			42.934	3	.000	
Hosmer and Lemeshow test			2.609	4	.625	
Model summary and classification						
Pseudo R square statistics		.234 (Cox & Snell R²)			.313 (Nagelkerke R²)	
Overall percentage correct						72.7

Intentions to repair

Appendix Figure 10. Logistic regression explaining the likelihood of reporting intention to repair electronics with beliefs about outcomes, evaluation about outcomes, norms, roles, self-concept, and affect variables

Predictor	ß	SE B	Wald's x^2	df	p	Odds ratio
Beliefs about outcomes	1.861	.679	7.518	1	.006	6.429
Evaluation of outcomes	1.854	.691	7.207	1	.007	6.384
Norms	3.535	1.131	9.778	1	.002	34.299
Roles	.939	.597	2.474	1	.116	2.557
Self-Concept	.768	.614	1.565	1	.211	2.156
Affect	-1.215	.654	3.447	1	.063	.297
Constant	-1.533	.598	6.558	1	.010	.216
Test			**x^2**	**df**	**p**	
Omnibus tests of model coefficients			61.620	6	.000	
Hosmer and Lemeshow test			4.410	7	.731	
Model summary and classification						
Pseudo R square statistics		.312 (Cox & Snell R²)			.515 (Nagelkerke R²)	
Overall percentage correct						87.9