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How to sell refurbished smartphones? An investigation of different customer groups and appropriate incentives

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Abstract

As smartphones are being replaced at an increasing rate, it becomes more and more important to find ways to reuse (parts of) existing phones. This research investigates the potential of selling refurbished smartphones using a quantitative study. An online survey was conducted questioning 250 respondents, in which the perceived consumer risks and benefits associated with refurbished phones were investigated. Furthermore, we studied the impact of various incentives that companies can employ to improve consumers' purchase intention of refurbished phones. Through a cluster analysis six distinct customer groups were identified. Our sample demonstrated a positive attitude towards refurbished smartphones, with most potential for three out of our six customer groups (46% of our sample). This indicates that refurbished smartphones can be a market success. It was found that perceived environmental benefits and awareness of refurbishing have a positive impact on the consumers' purchase intention for refurbished smartphones. Most of the highest scoring incentives for purchasing refurbished smartphones were product-related and included improved battery life, guaranteed software updates and upgraded performance, indicating a need for continued performance. This research contributes to our theoretical understanding of consumer responses to refurbished smartphones and can help companies in launching these products successfully.

Highlights

- This paper explores incentives affecting consumer responses to refurbished phones
- Different customer groups vary in their response to refurbished phones
- Creating awareness enhances consumers' purchase intention of refurbished phones
- Making environmental benefits more apparent enhances consumers' purchase intention
- Incentives that ensure continued performance influence purchase intention the most

Keywords

Refurbishing; circular economy; consumer decision making; remanufacturing; smartphones; incentives.

Word count: 8000 words

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1. Introduction

The Circular Economy is a global economic model that aims to decouple economic growth and human development from the consumption of finite resources. The Circular Economy aspires to transform linear consumption into a circular system by minimising waste and keeping the value of materials (Ellen MacArthur Foundation, 2013; Geissdoerfer et al., accepted). This can be achieved through different cycles of re-using, repairing, redistributing, refurbishing and recycling. Products, services and new business models are designed and used to optimise the use and re-use of resources (Bakker et al., 2014; Bocken et al., 2016).

This study identifies smartphones as a key product, which is nowadays purchased and replaced often. Figures show that in 2014 there were 97 mobile phone subscriptions per 100 people (The World Bank, 2016). Total smartphone shipments reached 1.3 billion in 2014 (Danova, 2015) and are expected to rise to 3 billion in 2030 (Andrae & Edler, 2015). Moreover, people use their phone less than 2.5 years on average, collection rates for recycling, refurbishing and/or remanufacturing smartphones (in Europe) are around 15%, and the secondary (e.g., refurbished) smartphone market is only a fraction (6%) of the primary market (Ellen MacArthur Foundation, 2012). Shorter lifecycles of smartphones and the limited end-of-life scenarios lead to electronic waste and the loss of scarce materials (Rathore et al., 2011). However, after initial use, smartphones still have sufficient value for reuse and re-using smartphones is more effective for reducing the effects on climate change than mere recycling. Hence, this paper explores refurbishing as a promising strategy to contribute to the Circular Economy and reduce the detrimental impact of smartphone consumption.

Refurbishing (or refurbishment) is the process of returning a used product (e.g., smartphone) into a good working condition, by cleaning, replacing and/or repairing major components (such as the smartphone's screen or battery) that are faulty, damaged or close to failure and making cosmetic changes to update the appearance of a product (Ellen MacArthur Foundation, 2013; ERN, 2015). According to EU law (Directive 1999/44/EC Article 7.1), refurbished smartphones must come with a one-year warranty. In general, refurbished products are priced ~30% lower than the new product (e.g., www.leapp.nl). Refurbishing is in essence different from remanufacturing, because the latter suggests that used products are restored to a *like new* or better than new condition (Rathore et al., 2011). As there are ample opportunities for both refurbishing (e.g., replacing battery) and remanufacturing (e.g., upgrading hardware) in smartphones, we decided to include both in this study. In this paper, we use the term refurbishing to refer to both practices because this term is most commonly used for selling used smartphones that have been restored.

Refurbishing is regarded as an environmentally beneficial strategy that allows companies to retain the value of products and materials (Ellen MacArthur Foundation, 2013). Through refurbishing, it is possible to save

significant (critical) raw materials and energy, and to avoid emissions (e.g., CO_2) (Andrae, 2016), and thereby contribute to the Circular Economy.

There is consensus in academic literature that giving products a second life through refurbishment can be commercially viable for companies (Atasu et al., 2008; Guide & Van Wassenhove, 2001; Linton, 2008). Specifically, prior research has examined *operational* issues of refurbishing, such as the implementation of reverse logistics processes (Guide & Van Wassenhove, 2001; Östlin et al., 2008), *managerial* aspects, such as pricing (Liang et al., 2009; Subramanian & Subramanyam, 2012), and sales cannibalisation (Atasu et al., 2010; Guide & Li, 2010). To further support the success of refurbishing, researchers have described *product design* aspects that enable easier refurbishing (Hatcher et al., 2011, 2014; Ijomah et al., 2007), such as reducing the total number of components (Ijomah et al., 2007).

An important factor for the success of refurbishing that has received far less attention is the consumer (Van Weelden et al., 2016). How do consumers perceive refurbished smartphones and under which conditions are they willing to accept these? In other words, there is a need for insights on how to sell refurbished products in a way that appeals to consumers (Atasu et al., 2010; Guide & Li, 2010; Jiménez-Parra et al., 2014).

A first stream of academic research on consumer responses to refurbished products has investigated consumers' willingness to pay (Hamzaoui Essoussi & Linton, 2010; Harms & Linton, 2015; Hazen et al., 2012; Michaud & Llerena. 2011), which is defined as the maximum amount of money that consumers would pay for a specific product. These studies demonstrated that consumers' are willing to pay less for refurbished products than for new ones. Furthermore, past research has adapted existing models for product adoption to explain the general factors and individual differences influencing the decision-making process for purchasing refurbished products (Jiménez-Parra et al., 2014; Khor & Hazen, 2016; Wang & Hazen, 2015; Wang et al., 2013). The uncovered factors included consumers' attitude towards remanufacturing, subjective norm (Khor & Hazen, 2016), consumer's knowledge regarding cost, quality and environmental impact of refurbished products (Wang & Hazen, 2015; Wang et al., 2013), as well as personal motivations and marketing mix influences (Jiménez-Parra et al., 2014). Although these studies provide insights on how consumers respond to refurbished products, they only provide a general overview of influencing factors. To make well-reasoned decisions on how to implement refurbishing, companies need additional, more specific insights on the incentives that will increase consumers' purchase intention of refurbished smartphones and the relevance of these incentives for different customer groups (Abbey et al., 2015; Jiménez-Parra et al., 2014; Wang et al., 2013). Incentives are defined as the strategic choices that companies can make concerning the product definition, choice for services, and marketing activities. For example, companies can alter the smartphone's components during the refurbishing process, provide additional services (e.g., warranty), or provide additional information to persuade consumers to purchase refurbished smartphones (Van Weelden et al., 2016).

This paper contributes to the literature by investigating the potential of various incentives for enhancing the purchase intention of refurbished smartphones. Secondly, prior research has shown that people differ in their perception of refurbished smartphones. However, a comprehensive understanding of the specific customer groups suitable for selling refurbished smartphones to is missing. This research aims to identify different customer groups for smartphones. Specifically, we investigate consumer responses towards refurbished

smartphones and the effects of various incentives for different customer groups. Companies can use these insights to steer their commercial and marketing activities to successfully sell refurbished smartphones. The remainder of this paper is organized as follows. Section 2 presents our theoretical framework and discusses the perceived barriers, risks and benefits that consumers can experience when considering the purchase of refurbished products. Next, we describe various incentives for purchasing refurbished smartphones, which are expected to boost the sales of refurbished smartphones, because they aim to break barriers, reduce risks and/or emphasise benefits of refurbished smartphones. Section 3 describes the methodology of the quantitative study. Section 4 presents the results of the study, including the formulation of six customer groups. Section 5 contains the discussion and suggestions for further research.

2. Theoretical background: consumers' decision-making processes, incentives, and individual differences

This section presents our theoretical framework, which is based on the consumer decision-making model introduced by Engel, Kollat & Blackwell (1968) (Section 2.1). Based on this EKB model, potential strategies to influence the perceived risks and benefits were distinguished, which resulted in a set of 16 incentives (Section 2.2). Furthermore, the theory of individual differences was used to explore which characteristics of individual consumers may influence the adoption of refurbished smartphones (Section 2.3).

2.1 Theoretical framework

Circular products and business models are designed to slow resource loops, to extend product life, and to close resource loops (Bocken et al., 2016). 'Circular consumption' is concerned with consumers' decision-making processes in relation to circular products and business models. As understanding consumers' decision-making processes is thus key for increasing consumers' purchase intention of refurbished smartphones, we have firstly based our theoretical framework on the widely used consumer decision-making model (EKB model) (Engel et al. 1968).

The EKB model characterizes consumers' decision-making process as a problem-solving task that takes place in several phases, including a pre-purchase phase, orientation phase, evaluation phase and post-purchase phase. Such a cognitive decision-making process is representative for utilitarian, high involvement products, and consequently, the EKB-model has been used to study consumer acceptance of refurbished smartphones (Van Weelden et al., 2016). Specifically, Van Weelden et al. (2016) demonstrated that although the initial responses to refurbished smartphones are favourable, in the *orientation* and *evaluation* phases, when consumers decide about the product alternatives suitable to satisfy their needs, various aspects can prevent consumers from purchasing refurbished smartphones.

During the orientation phase, consumers seek information and possible alternatives to form a final consideration set that consists of alternatives they are aware of and have chosen as valuable for detailed consideration. In the evaluation phase, consumers engage in a subjective, comparative assessment of the risks and benefits that different alternatives, such as refurbished smartphones, can provide to make a well-informed purchase decision. Here, our research draws upon the theory of perceived risk (Mitchell, 1992) and perceived benefit to understand how consumers perceive the balance between risks and benefits and develop a final attitude towards refurbished

smartphones. These two theories have been previously applied to remanufactured automobile parts (Wang et al., 2013).

Prior research has used these theories and the EKB model to provide a general overview of factors influencing consumers' purchase intention of refurbished products. For example, it is found that perceived risk negatively influences consumers' purchase attitude (Wang et al., 2013). Although demonstrating this effect is important, it does not provide concrete insights on how to lower the perceived risk. To further build the theoretical knowledge on consumers' acceptance of refurbished smartphones, it is important to understand the specific incentives that can influence the perceived risks and benefits. Based on the EKB model, the theory of perceived risk, and perceived benefit, this paper proposes several incentives and quantitatively investigates how important these incentives are for consumers' purchase intention.

Finally, this research draws upon the theory of individual differences (Motowidlo et al., 1997) to explain why consumers differ in their behaviour. Consumers differ in their personality, knowledge, and skills. We propose that these traits influence their intention to purchase refurbished smartphones. Thus, the comparative assessment of risks and benefits takes place in the context of an individual consumer. Accordingly, we added individual differences as an overall influencing factor to the EKB model for refurbished smartphones as proposed by Van Weelden et al. (2016). Figure 1 presents the theoretical framework that was used in this paper.

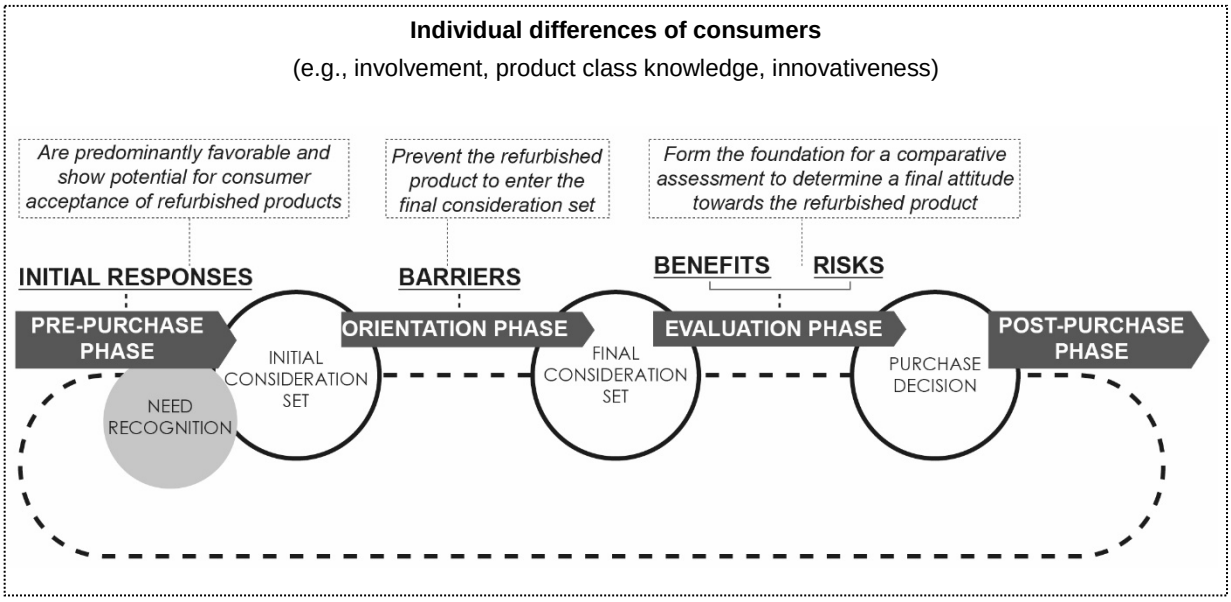


Figure 1. Theoretical framework of the consumer decision-making process when purchasing refurbished smartphones (based on Van Weelden et al., 2016)

2.1.1 Orientation phase: Barriers

A major barrier for refurbished products is that they may not be available in all markets. However, even if refurbished smartphones are offered, two barriers in the orientation phase can hinder refurbished smartphones to

enter the final consideration set of consumers' decision-making process (see Figure 1): Llack of awareness and a misconception of the refurbishing concept. *Lack of awareness* prevents consumers from considering the purchase of a refurbished smartphone (Van Weelden et al., 2016; Wei et al., 2015). Many consumers are currently unaware that refurbished smartphones are available. If it is not available in their familiar retail channels, potential consumers may miss the opportunity altogether. However, there is also a general *misconception of the refurbishing concept*, as the difference from second-hand smartphones is not directly clear to some consumers (Hazen et al., 2012; Van Weelden et al., 2016).

2.1.2 Evaluation phase: Benefits & risks

In the evaluation phase, consumers weigh the benefits and risks of refurbished smartphones (see Figure 1). For consumers, purchasing a refurbished smartphone has two main benefits over buying a new one. Firstly, a refurbished smartphone offers *financial benefits* because of the lower price (Atasu et al., 2008; Guide & Li, 2010). These perceived financial benefits can positively influence the chances for refurbished smartphones to be bought (Jiménez-Parra et al., 2014; Wang & Hazen; 2015; Young et al., 2010).

Secondly, refurbished smartphones offer *environmental benefits* (Atasu et al., 2008; Michaud & Llerena, 2011; Van Weelden et al., 2016). These benefits are largely unknown to consumers, as refurbished smartphones are currently marketed mostly from a cost-savings perspective (Jiménez-Parra et al., 2014; Khor & Hazen, 2016; Michaud & Llerena, 2011). Although environmental motives are usually not the main purchase driver, making environmental benefits more salient may alter the perception of refurbished products, and increase adoption (Harms & Linton, 2015; Van Weelden et al., 2016; Young et al., 2010).

Evidently, there are perceived risks associated with purchasing refurbished smartphones. The theory of perceived risk proposes that there are different types of risk that influence how consumers behave towards products. Firstly, refurbished smartphones trigger a perceived *performance risk* (Guide & Li, 2010; Hazen et al., 2016; Michaud & Llerena, 2011; Sharma et al., 2016; Wang et al., 2013), which may hinder their adoption (Bray et al., 2011). Due to uncertainty about the use history and refurbishing process and the fact that refurbished smartphones are typically older, potential consumers may fear that a refurbished smartphone will not perform as well as a new one. This can lead to uncertainty about the performance (Van Weelden et al., 2016; Wang & Hazen; 2015; Wang et al., 2013).

Refurbished products may also provide a *financial risk*. If a refurbished smartphone falls short of expectations, consumers will experience this as a financial loss. Earlier studies on refurbished products (Hamzaoui Essoussi & Linton, 2010; Michaud & Llerena, 2011; Wang et al., 2013) explained that a high perceived financial risk results in rejection of refurbished products especially when the price is high.

2.2. Breaking barriers and influencing risks and benefits

To successfully introduce refurbished smartphones, Original Equipment Manufacturers (OEMs) and/or refurbishing companies need to influence consumers' decision-making processes so that consumers are more likely to be aware of and choose refurbished products. Based on the EKB model, the theory of perceived risk, and perceived benefit, this section presents possible incentives that companies can employ to tackle the problems in consumers' decision-making process building on prior research (e.g., Van Weelden et al., 2016). The incentives aim to boost the adoption of refurbished smartphones by 1) providing information, 2) adapting the

product, or 3) providing service. We propose16 incentives, which will be tested for potential impact in our research. All incentives seek to break barriers in the orientation phase, or reduce the perceived risks or emphasise the benefits in the evaluation phase and thus aim to advance consumers' decision-making process of refurbished smartphones as displayed in Figure 1.

2.2.1 Providing information

Companies can raise awareness and reduce the misconception of refurbished smartphones by presenting consumers with more *information about the refurbishing process*. Consumer awareness and knowledge can increase through promotional activities and content marketing (Michaud & Llerena, 2011; Van Weelden et al., 2016; Wang et al., 2013). Having more information available reduces the perceived performance risk caused by a misunderstanding of the refurbishing concept, and emphasises the under-recognised environmental benefits.

Another option is to give more specific information about individual products (Michaud & Llerena, 2011; Van Weelden et al., 2016; Wang et al., 2013). Companies can introduce a *classification system* to provide consumers with insight into the condition of every unit. A classification system informs consumers about what to expect from their specific smartphone regarding outer appearance, use history, battery status etcetera and thereby reduce the perceived performance and financial risk.

A *quality certification* can also reduce the perceived risk (Michaud & Llerena, 2011; Van Weelden et al., 2016; Wang et al., 2013). There are high-quality standards for refurbished smartphones, and certification of these standards (e.g., via third-party certification systems) would offer consumers a clear understanding of the performance quality and appearance of the smartphone.

Finally, consumers' risk can also decrease by offering independent and *unbiased testimonials*, ensuring consumers that the product is functioning properly (De Maeyer & Estelami, 2011; Van Weelden et al., 2016). Showing potential consumers the positive experiences that others have had with refurbished smartphones can feel reassuring.

2.2.2 Adapting the product

Companies can also employ incentives that relate to the actual smartphone and its functional performance to reduce risks and enhance perceived financial benefits. Although adapting the product via hardware upgrades is not yet possible for all smartphones, smartphone design provides ample opportunities for enabling these changes in future refurbishing processes (Rathore et al., 2011; Van Weelden et al., 2016; Wilhelm et al., 2011). By upgrading separable components of the smartphone during this process, different levels of restoration can be established covering the needs of different customer segments. We test the effects of upgrading the following six components:

1. Battery
2. Performance
3. Screen
4. Internal storage
5. Camera
6. Innovative features like NFC (Near Field Communication), wireless charging or fingerprint scanner

Refurbishing can also facilitate an *updated appearance*. A novel appearance can positively affect perceived performance quality (Mugge & Schoormans, 2012). However, a special appearance for refurbished products may also have a detrimental effect, given the second-hand stigma associated with refurbishing (Van Weelden et al., 2016).

Guaranteed software updates can reduce perceived performance risk (Van Weelden et al., 2016). Older smartphone models, which refurbished devices inherently are, often lack proper software support, leaving them vulnerable to security threats and premature obsolescence (Benton et al., 2015). Both incentives will be tested in our study as well.

2.2.3 Providing service

Companies may also advance consumers' decision-making process by introducing refurbished smartphones paired with additional services. This would strongly reduce the perceived risks (Van Weelden et al., 2016). Firstly, companies can allow consumers to try the product by introducing a *longer trial period*. This reduces doubts that consumers have about the functionality, thereby decreasing the financial and performance risks of refurbished smartphones.

Another way to achieve this is through extensive warranties (Van Weelden et al., 2016; Wilhelm et al., 2011). Giving consumers the option to *extend the warranty coverage* (like water or drop damage) or *period* can give them the extra incentive to overcome the perceived risks associated with refurbished smartphones.

Finally, offering consumers a new business model via a *leasing option* may decrease the perceived performance and financial risks (Van Weelden et al., 2016). Providing the access to or functionality of a product rather than ownership are viewed as key business models in the Circular Economy, as these models deal with product retrieval inherently (Bakker & Den Hollander, 2014; Bocken et al., 2014, 2016).

2.3. Individual differences influencing adoption

When adapting the aforementioned incentives into a product launch strategy, it is important that companies target the correct customer segment. The theory of individual differences proposes that differences in consumers' personality, knowledge, and skills will influence their behaviour. Accordingly, it is important to consider the effects of individual differences to understand how different consumers respond to both the proposition of refurbished smartphones and the proposed incentives. We distilled seven individual differences from the literature that are likely to influence adoption of refurbished smartphones.

Firstly, consumers differ in their involvement in smartphones. *Involvement in smartphones* (1) is the interest that a consumer has in this specific product category (Zaichkowsky, 1985). This value concerns the involvement that extends beyond using the smartphone's utilitarian function, such as following news items concerning smartphones, reading magazines or being involved with smartphone brands.

Not all consumers have the same amount of *knowledge about smartphones* (2). Knowledge of the product class (a.k.a product category) influences the purchase decision (Grewal et al., 2004). A lack of product class knowledge can negatively impact the chance of consumers buying ethical products, because less knowledgeable

consumers are more likely to avoid the perceived risks associated with refurbished smartphones (Bray et al., 2011, Van Weelden et al., 2016; Wang & Hazen; 2015).

Some consumers have a higher *consumer innovativeness* (3) than others. This means that they are more inclined to try new things, whereas others are more conservative when it comes to purchasing decisions (Truong, 2013). This innovativeness expresses itself in a desire to use the latest technology, preferably before others. It is inherent to refurbished smartphones that these do not include the latest models (Atasu et al., 2010; Guide & Li, 2010; Jiménez-Parra et al., 2014), which was identified as a barrier for adoption by Van Weelden et al. (2016). This may imply that more innovative consumers are less keen to purchase refurbished smartphones if these do not include new functionalities.

Some consumers find price more important than others. This *value consciousness* (4) is expected to influence the decision-making process. A major benefit of refurbished smartphones is the lower price (Guide & Li, 2010; Hamzaoui Essoussi & Linton, 2010; Michaud & Llerena, 2011; Wang et al., 2013). Consumers who are keen on receiving value for money may be tempted by the proposition of refurbished smartphones.

Furthermore, consumers differ in their *environmental consciousness* (5) (Kim & Choi, 2005). If sustainability is a determining factor in the purchase behaviour of an individual, the proposition of refurbished smartphones might appeal more.

Consumers differ in the degree to which they take their peers into account when making purchase decisions. This *social-adjustive function* (6) (Grewal et al., 2004) is indicated by how consumers see the use of smartphones in public. For example: to what extent do consumers see a smartphone as a status symbol? Refurbished products have a stigma of 'less-than-new', which makes it interesting to consider the importance of peer opinions (Jiménez-Parra et al., 2014; Wang et al., 2013).

The value-expressive function (7) of a product category deals with a consumer's desire to use a product that fits his/her identity and beliefs (Grewal et al., 2004). Smartphones can help consumers express themselves, and the level at which consumers do so is expected to vary between consumers (Horváth & Sajtos, 2002). Refurbished and thus used smartphones may not appeal as much to consumers who attribute a high value-expressive function to smartphones.

3. Methods

Based on prior research (Van Weelden et al., 2016), several incentives were formulated in Section 2.2 that companies can employ to positively impact consumers' purchase intention. However, as Van Weelden et al.'s research (2016) was exploratory, these incentives need to be empirically tested to determine their effectiveness. Data was gathered through an online questionnaire, which consisted of four sections (see Table 1).

3.1 Procedure and stimuli

The questionnaire started with an introduction of the refurbishing concept:

> *"Refurbishing means returning a used smartphone to good working condition by cleaning, replacing or repairing major components (such as the screen or battery) that are faulty, damaged or close to failure and making cosmetic changes to update the appearance of a product. According*

to EU law (Directive 1999/44/EC Article 7.1), refurbished smartphones must come with a one-year warranty. In general, refurbished products are priced ~30% lower than the new product."

Subsequently, the respondents were asked about their response to refurbished smartphones. Specifically, we asked respondents to rate their purchase intention, general attitude, the perceived barriers, benefits and risks. All constructs were measured with multiple items on seven point Likert scales, from 1 ('strongly disagree') to 7 ('strongly agree'). Most scales were based on prior research (see Appendix).

Section 1:	**Section 2:**	**Section 3:**	**Section 4:**
Response to refurbished smartphones	**Impact of incentives**	**Individual differences**	**Demographics**
Purchase intention	Information on refurbishing process	Involvement	Age
General attitude	Classification system	Product class knowledge	Gender
Awareness of refurbishing	Unbiased testimonials	Consumer innovativeness	Country of residence
Financial benefits	Quality certification	Value consciousness	Education
Environmental benefits	Upgraded battery	Environmental consciousness	Comments
Performance risk	Upgraded performance	Social-adjustive function	
Financial risk	Upgraded screen	Value-expressive function	
	Upgraded internal storage		
	Upgraded camera		
	More innovative features		
	Updated appearance		
	Guaranteed software updates		
	Longer trial period		
	Extendable protection warranty coverage		
	Extendable protection warranty period		
	Leasing option		

Table 1: Constructs in the online questionnaire

Next, respondents were presented with the 16 incentives. All incentives were elucidated with a short description. Respondents were asked to rate the impact of each incentive on their purchase intention of refurbished smartphones by answering the following question: Would this incentive increase the chance of you purchasing a refurbished smartphone? from 1 (not at all) to 7 (very much).

Finally, respondents filled in several individual differences scales and demographics. This section also allowed respondents to leave comments.

3.2 Sample

The online questionnaire was sent out through two channels, an online newsletter and Twitter. Two hundred and fifty respondents filled in the questionnaire on time.

The sample (76% males, ages ranging from 15 to 71, mean age = 38) consisted of different nationalities, although most respondents were European: Germany (31.2%), The Netherlands (12.0%), United Kingdom

(12.0%), Switzerland (5.2%), France (4.8%), Italy (4.8%) and Austria (4.4%). The remaining 25% was spread over another fifteen countries including Russia, the United States and Australia.

4. Results

Firstly, we report the mean values of the variables in our study (Section 4.1). Secondly, we analyse general consumer responses to refurbished smartphones by investigating which barriers, benefits, and risks influence purchase intention (Section 4.2). Thirdly, we analyse the importance of the 16 incentives for stimulating people's purchase intention of refurbished smartphones (Section 4.3). Finally, we present a cluster analysis based on the individual differences scales to explore how different customer groups respond to refurbished products and the 16 incentives. This cluster analysis starts with a justification of the used cluster procedure (Section 4.4), after which the cluster analysis results are described in general terms (Section 4.5). Finally, section 4.6 provides a detailed description of the six customer groups resulting from the clusters and the incentives that are most influential for their purchase intention of refurbished smartphones.

4.1 Mean values

Table 2 reports the mean values and standard deviations for the variables in the questionnaire that measured consumer response to refurbished smartphones and the different individual differences scales. These means and standard deviations can be used to assess how the sample generally evaluated refurbished smartphones. Considering that the variables were measured on 7-point scales, we conclude that our sample had a positive attitude towards refurbished smartphones and perceived great environmental benefits.

Response to refurbished smartphones	Mean	SD	Individual differences	Mean	SD
Purchase intention	5.36	1.22	Involvement	5.29	1.03
General attitude	5.75	0.95	Product class knowledge	4.30	1.51
Awareness of refurbishing	4.25	1.68	Consumer innovativeness	3.00	1.38
Financial benefits	5.09	1.04	Value consciousness	5.28	1.34
Environmental benefits	6.30	0.77	Environmental consciousness	5.93	1.00
Performance risk	4.10	1.49	Social-adjustive function	2.70	1.39
Financial risk	3.61	1.27	Value-expressive function	3.84	1.79

Table 2: Mean values of the variables measuring the response to refurbished products and the individual differences scales

4.2 Effects of awareness, risks and benefits on the purchase intention of refurbished smartphones

A stepwise regression was conducted to explore the effects of awareness of refurbishing, the perceived risks and benefits, and the individual differences on the intention to purchase a refurbished smartphone. *Purchase intention* was included as the dependent variable, and awareness, financial benefits, environmental benefits, performance risk, financial risk as well as the seven individual differences were included as independent variables. Stepwise regression was employed to select a useful subset of independent variables that was most useful for predicting purchase intention of refurbished smartphones. The regression model was significant ($F(4,245) = 27.62$, $p < .001$), and explained 31% of the variance in purchase intention. A significant positive effect was found for perceived environmental benefits ($\beta = .32$, $p < .001$), suggesting that people who recognise more environmental benefits are more inclined to purchase a refurbished smartphone. Furthermore, awareness of refurbishing ($\beta = .14$, $p < .05$) had a significant positive effect on purchase intention. Significant negative effects were found for perceived performance risk ($\beta = -.22$, $p < .001$) and consumer innovativeness ($\beta = -.27$, $p < .001$).

Interestingly, no effect was found for financial benefits, whereas this is currently heavily used as a marketing strategy to sell refurbished smartphones.

4.3 The potential of the proposed incentives for increasing the purchase intention of refurbished smartphones

To investigate whether the incentives significantly differed from each other regarding their impact on consumers' purchase intention, we performed a repeated measures analysis of variance (ANOVA) with impact on consumers' purchase intention as the dependent variable and incentives as the independent variable. As respondents rated all incentives in this study, a repeated measures ANOVA was selected because this analysis tests for equality of means under the assumption that the scores for the different incentives are dependent. Post hoc comparisons were used to compare the means of each pair of the 16 incentives. Specifically, this enabled us to uncover which of the incentives had the greatest potential for increasing the chance to purchase a refurbished smartphone. The scores of the incentives differed significantly ($F(9,254) = 85.18$, $p < .001$). Table 3 presents the mean values and standard deviations of the 16 incentives arranged from having the most to the least impact on consumers' purchase intention.

As shown in Table 3, an upgraded battery ($M = 6.44$, $SD = 0.94$) had the highest score, whereas a leasing option ($M = 3.64$, $SD = 2.08$) had the lowest score. When comparing the scores between the three incentives categories, it becomes clear that the highest scores are given to incentives that are related to the product. The three highest scoring incentives: a better battery ($M = 6.44$, $SD = 0.94$), guaranteed software updates ($M = 6.25$, $SD = 0.99$) and upgraded performance ($M = 5.91$, $SD = 1.24$) indicate a strong need for practical, safe, and well-performing refurbished smartphones. These are followed by the information-based incentives, with the highest being a classification system. Respondents thus expressed a desire for more information on the refurbishing process. A classification system, information on the process and a quality certification all scored relatively positive results. Service-oriented offers, such as extra warranty, have the lowest potential for influencing purchase intention of refurbished smartphones.

Incentives	Category	Mean	SD
Upgraded battery	Product	6.44	0.94
Guaranteed software updates	Product	6.25	0.99
Upgraded performance	Product	5.91	1.24
Classification system	Information	5.69	1.10
Info on refurbishing process	Information	5.65	1.24
Quality certification	Information	5.50	1.39
Upgraded internal storage	Product	5.39	1.45
Upgraded screen	Product	5.34	1.45
Unbiased testimonials	Information	5.16	1.45
Upgraded camera	Product	5.13	1.62
Extendable protection period	Service	4.99	1.64
More innovative features	Product	4.84	1.78
Extended trial period	Service	4.57	1.82
Extendable protection coverage	Service	4.26	1.82
Updated appearance	Product	3.96	1.82
Leasing option	Service	3.64	2.08

Table 3: An overview of the proposed incentives arranged from having the most to the least impact on consumers' purchase intention

4.4 Cluster analysis procedure

To investigate differences between various customer groups concerning their evaluation of refurbished smartphones and the potential of incentives for increasing their purchase intention, we performed a cluster analysis. A cluster analysis categorises all respondents into one of the clusters. Using a two-step cluster analysis, these clusters are designed to differ significantly on several predetermined variables (Hair et al., 2014). The seven variables measuring the individual differences were chosen to create clusters.

Taking into consideration the sample size and because the clusters were used as customer groups, between four and six clusters was considered an appropriate solution. Therefore, the solutions for 4-6 clusters were compared to find the best fit. Two factors describe the model fit: the predictor importance and cluster ratio (Hair et al., 2014). Firstly, the predictor importance explains the influence of a single variable in respondents' cluster placement. Considering that all individual differences variables were expected to influence people's responses to refurbished smartphones, it is desirable that all variables are important for creating the clusters. Only in the six-clusters model, all variables had a considerable impact in forming the clusters. Secondly, the size ratio between different clusters should be as small as possible, and no more than 1:3 (Hair et al., 2014). For the six-clusters model, this ratio was acceptable at 1:2.3.

4.5 Cluster analysis results

To investigate whether the clusters differ regarding their responses to refurbished smartphones and the potential of the incentives, we performed several one-way ANOVAs. In these ANOVAs, the individual differences scales, the response to refurbished smartphones variables, and the impact of the 16 incentives were included as the dependent variables and the six clusters as the independent variable. Post hoc comparisons using either the Tukey or the Games-Howell post hoc tests (in case of unequal variances) were performed to compare specific pairs of clusters. Table 4 presents an overview of the six customer groups resulting from the clusters based on their differences with respect to demographics, individual differences, and their response to refurbished smartphones. As expected, the clusters showed significant differences on all individual differences scales ($p <$ .001). We also found significant differences between clusters regarding the response to refurbished smartphones. Cluster 1 has a higher *purchase intention* than clusters 4 and 5. Also, clusters 1 and 2's *general attitude* towards refurbished smartphones is more positive than cluster 3. Cluster 2 perceived more *financial benefits* than cluster 3. Finally, cluster 5 sees more performance risk in purchasing a refurbished smartphone than clusters 1 and 2.

Table 5 present an overview of how the six customer groups resulting from the clusters differ regarding the impact of the 16 incentives for enhancing their purchase intention of refurbished smartphones. Significant differences between clusters were found for all product-related incentives and the *classification system*. We illustrate these effects in the next section.

Table 4: An overview of the demographics and the individual differences scores of the proposed customer groups and the significant differences between the customer groups concerning their response to refurbished smartphones

	1 Casual Supporter	2 Sustainability Enthusiast	3 Conservative Critic	4 Susceptible Follower	5 Proud Power-User	6 Expert Techie	Post hoc tests	
Demographics								
# respondents	46	25	29	45	58	47		250
% of respondents	18%	10%	12%	18%	23%	19%		100%
Age	35.8	38.5	45.4	36.5	34.7	38.5		37.6
Male	39%	76%	76%	76%	88%	79%		72%
Female	59%	24%	21%	20%	9%	15%		24%
Individual differences								
Involvement**	4.51 (0.99)	5.01 (1.00)	4.40 (0.84)	5.30 (0.63)	6.14 (0.72)	5.71 (0.70)		5.29 (1.03)
Product class knowledge **	2.77 (0.87)	4.09 (1.64)	3.30 (1.05)	4.19 (1.18)	5.69 (0.96)	4.92 (1.03)		4.30 (1.51)
Consumer innovativeness**	1.82 (0.69)	1.65 (0.68)	2.59 (0.90)	2.96 (1.02)	4.05 (1.43)	3.89 (0.93)		3.00 (1.38)
Value consciousness**	5.40 (0.87)	2.48 (1.00)	5.32 (0.87)	4.94 (1.02)	6.18 (0.75)	5.85 (0.73)		5.28 (1.34)
Environmental consciousness**	6.49 (0.57)	6.57 (0.63)	4.61 (0.78)	6.27 (0.59)	5.59 (1.22)	5.96 (0.65)		5.93 (1.00)
Social-adjustive function**	1.93 (0.78)	2.01 (0.90)	2.08 (0.65)	4.23 (0.82)	3.53 (1.48)	1.72 (0.70)		2.70 (1.39)
Value-expressive function**	3.29 (1.64)	4.67 (1.48)	2.62 (1.23)	5.24 (1.00)	5.01 (1.20)	1.92 (0.90)		3.84 (1.79)
Response to refurbished smartphones								
Purchase intention*	5.84 (0.98)	5.74 (1.07)	5.31 (0.99)	5.20 (1.01)	5.10 (1.52)	5.17 (1.20)	1 > 4, 5	5.36 (1.22)
General attitude**	6.03 (0.77)	6.17 (0.81)	5.40 (0.95)	5.73 (0.88)	5.52 (1.14)	5.76 (0.86)	1, 2 > 3	5.75 (0.95)
Awareness of refurbishing*	4.04 (1.65)	3.79 (1.87)	4.11 (1.45)	3.81 (1.60)	4.63 (1.64)	4.72 (1.62)		4.25 (1.68)
Financial benefits	5.19 (0.84)	5.49 (0.69)	4.84 (0.69)	5.09 (1.18)	5.00 (1.29)	5.05 (0.97)	2 > 3	5.09 (1.04)
Environmental benefits	6.35 (0.71)	6.51 (0.70)	5.93 (0.80)	6.31 (0.66)	6.29 (0.88)	6.35 (0.74)		6.30 (0.77)
Performance risk*	3.71 (1.36)	3.51 (1.21)	3.91 (1.38)	4.40 (1.38)	4.54 (1.60)	4.08 (1.51)	5 > 1, 2	4.10 (1.49)
Financial risk	3.45 (1.15)	3.04 (0.92)	3.71 (1.10)	3.74 (1.15)	3.85 (1.50)	3.58 (1.31)		3.61 (1.27)

* The one-way ANOVA over the six clusters was significant at $p < .05$

** The one-way ANOVA over the six clusters was significant at $p < .01$

Table 5: An overview of how the six customer groups differ regarding the impact of the 16 incentives for enhancing their purchase intention of refurbished smartphones.

		1 Casual Supporter	2 Sustainability Enthusiast	3 Conservative Critic	4 Susceptible Follower	5 Proud Power-User	6 Expert Techie	Post hoc tests	Total
Incentive	**Category**								
Upgraded battery**	Product	6.65 (0.63)	6.00 (1.41)	5.97 (1.35)	6.33 (0.92)	6.55 (0.72)	6.70 (0.50)		6.44 (0.94)
Guaranteed software updates**	Product	6.37 (0.70)	6.16 (1.16)	5.62 (1.51)	6.07 (0.90)	6.57 (0.70)	6.36 (0.86)	5 > 3, 4	6.25 (0.99)
Upgraded performance**	Product	5.91 (1.04)	5.32 (1.38)	5.31 (1.53)	5.84 (1.17)	6.43 (0.89)	6.00 (1.29)	5 > 2, 3	5.91 (1.24)
Classification system*	Information	5.76 (0.96)	5.28 (1.31)	5.52 (1.04)	5.58 (1.04)	6.07 (1.01)	5.60 (1.16)	5 > 2	5.69 (1.10)
Info on refurbishing process	Information	5.76 (1.07)	5.56 (1.63)	5.10 (1.16)	5.84 (1.05)	5.81 (1.17)	5.53 (1.33)		5.65 (1.24)
Quality certification	Information	5.46 (1.23)	5.52 (1.30)	5.07 (1.48)	5.47 (1.47)	5.76 (1.30)	5.51 (1.49)		5.50 (1.39)
Upgraded internal storage**	Product	5.41 (1.07)	4.52 (2.17)	4.79 (1.71)	5.33 (1.25)	5.79 (1.21)	5.77 (1.19)		5.39 (1.45)
Upgraded screen**	Product	5.33 (1.22)	4.20 (1.92)	5.03 (1.43)	5.29 (1.36)	5.86 (1.11)	5.55 (1.43)	5, 6 > 2	5.34 (1.45)
Unbiased testimonials	Information	5.37 (1.26)	4.76 (1.84)	4.79 (1.21)	4.98 (1.61)	5.52 (1.35)	5.13 (1.35)		5.16 (1.45)
Upgraded camera**	Product	5.04 (1.61)	3.84 (1.97)	4.83 (1.49)	5.27 (1.37)	5.74 (1.31)	5.21 (1.61)	4, 5 > 2	5.13 (1.62)
Extendable protection period	Service	4.85 (1.60)	4.52 (1.86)	4.72 (1.44)	4.93 (1.76)	5.24 (1.61)	5.28 (1.50)		4.99 (1.64)
More innovative features*	Product	4.50 (1.68)	4.20 (1.98)	4.07 (1.98)	4.96 (1.67)	5.48 (1.48)	5.06 (1.73)	5 > 2, 3	4.84 (1.78)
Extended trial period	Service	4.89 (1.72)	4.00 (1.83)	4.03 (1.65)	4.36 (1.69)	4.86 (1.78)	4.72 (2.02)		4.57 (1.82)
Extendable protection coverage	Service	4.20 (1.90)	3.80 (2.04)	3.97 (1.27)	4.29 (1.73)	4.64 (1.87)	4.26 (1.84)		4.26 (1.82)
Updated appearance**	Product	3.48 (1.64)	3.20 (1.83)	3.83 (1.74)	4.42 (1.54)	4.47 (1.96)	3.85 (1.81)	5 > 2	3.96 (1.82)
Leasing option	Service	3.96 (2.08)	3.56 (2.04)	3.55 (1.79)	4.00 (2.12)	3.69 (2.16)	3.00 (1.97)		3.64 (2.08)

* The one-way ANOVA over the six clusters was significant at $p < .05$

** The one-way ANOVA over the six clusters was significant at $p < .01$

4.6 Cluster descriptions

This section describes the six customer groups, based on the clusters from the cluster analysis and the differences between these groups on the variables in our questionnaire. Specifically, we provide a description of each cluster based on differences on the individual differences scales to shape an image of the people in that customer group. Subsequently, we discuss what this customer group thinks of refurbished smartphones and which incentives have the greatest potential to increase their purchase intention. These descriptions were backed up by qualitative data gathered from the comment section of the questionnaire. Each cluster is illustrated with a quote from the comment section.

4.6.1 Casual Supporter

"I like sustainable products, but I see my smartphone mostly as a tool"

Casual Supporters have a high environmental consciousness when compared to others. Smartphones, however, are not products that they are highly involved with. They use a smartphone casually, and see it more as a utilitarian tool than a status symbol or extension of their personality. Their lower involvement in smartphones goes along with a low level of innovativeness and thus conservative purchase behaviour. Casual supporters do not need the newest technology to be satisfied with their smartphone. Their level of knowledge about smartphones is also low when compared to other groups, but they do want to have good value for their money. Furthermore, this group consists for 60% of women, compared to an average of 16% for all other clusters.

Casual Supporters respond positively to the proposition of refurbished smartphones. Although the initial awareness is relatively low, purchase intention is the highest of all customer groups and they perceive less performance risk. Because Casual Supporters are more focused on the smartphone's primary utility, they are more likely to accept devices that are not new. The sustainability benefits of a refurbished model align with the high motivation to consume in a sustainable way.

Looking at the incentives, the Casual Supporter is strongly influenced by the product-related incentives of an upgraded battery, guaranteed software updates and an upgraded performance. Also, the information-related incentives of a categorisation system and more information on the refurbishment process can increase their purchase intention for refurbished smartphones. No significant differences were found between this cluster and the other clusters regarding the potential of the incentives.

4.6.2 Sustainability Enthusiast

"I happily pay the price for any sustainable alternative"

Sustainability Enthusiasts have a strong environmental consciousness and thus the highest motivation to use sustainable products. They are intrinsically motivated to use such products because these fit with their identity and values. They are relatively conservative when it comes to purchasing smartphones and do not desire the newest features. Price is less important to the Sustainability Enthusiast. Despite their high environmental concern, Sustainability Enthusiasts are generally unaware of the possibility to purchase refurbished smartphones. Nevertheless, as they prefer smartphones with standard features and they are driven by sustainable motives, the proposition of a refurbished smartphone is appealing to them. Specifically, they have a positive attitude, see

many perceived benefits, and have confidence in the refurbishing process, as they see less risk. This is supported by the fact that they have (comparatively) lower performance standards and see price as relatively unimportant.

The purchase intention of Sustainability Enthusiasts is influenced most by the product-related incentives of guaranteed software updates, an upgraded battery, and an upgraded performance. However, the performance-increasing incentives, such as a faster smartphone, better screen, better pictures, more innovative features, and an upgraded appearance have less potential impact on the purchase intention than these incentives have for other groups. Furthermore, this customer group is less influenced by a classification system.

4.6.3 Conservative Critic

"I'm not fully convinced by sustainable electronics"

Conservative Critics have low involvement in and knowledge about smartphones. Furthermore, they do not have a strong desire to use sustainable products. Conservative Critics do not use smartphones to communicate their identity, and care little about others' opinions. The Conservative Critic is significantly older than the other customer groups.

Conservative Critics have a relatively negative attitude towards the proposition of refurbished smartphones. Specifically, they perceive fewer financial and environmental benefits.

Persuading the Conservative Critic to purchase a refurbished smartphone will be challenging, which is also evident from their responses to the proposed incentives. The scores for many incentives are lower than those of the other customer groups. Specifically, though the incentives related to a better performance (through updates, battery, and speed) are among the most influential incentives for Conservative Critics, their impact is lower than that for other groups.

4.6.4 Susceptible Follower

"I want a smartphone that expresses who I am"

Susceptible Followers have relatively high scores for both the value-expressive and social-adjustive functions of smartphones. They are thus looking for a smartphone that fits their personality and find it important that others value the smartphone they possess.

Although Susceptible Followers are environmentally conscious, they are generally unfamiliar with the concept of refurbished smartphones and have a low purchase intention. This may be caused by the limited amount of refurbished smartphones in the current market, due to which it is not generally accepted to own a refurbished smartphone. The Susceptible Follower may believe that a refurbished smartphone does not fit their personality or that this is perceived as such by their peers.

Next to the generally preferred incentives of an upgraded battery, guaranteed software updates, and an upgraded performance, Susceptible Followers respond positively to an updated camera and an updated appearance. A smartphone's appearance can reflect the personality of the owner, and if the appearance is updated and unique, it is more appealing. Being unfamiliar with refurbishing, acquiring more information on the process will also increase their purchase intention.

4.6.5 Proud Power-User

"I select my smartphone based on both performance and symbolism"

Proud Power-Users can be considered an 'expert' customer group. They have the highest scores for involvement and knowledge. Furthermore, they are innovative, which suggests that Proud Power-Users tend to buy the latest available technology before others do. Price is an important factor in making a purchase decision. They also express strong value-expressive and social-adjustive functions of smartphones, stressing the importance of using a smartphone that (s)he sees as fitting one's personality and that is judged as appropriate by one's peers.

Being an expert user, the Proud power-user is familiar with the practice of refurbishing, but their initial evaluation is rather negative. Proud Power-Users do not like to settle for last year's model. Hence, they perceive higher performance and financial risks in refurbished smartphones.

Proud Power-Users have relatively high scores for the product-related incentives (e.g., software updates, upgraded battery, overall speed, screen quality, picture quality, and innovative features) because these would enable them to acquire a smartphone that provides high-quality performance and possesses the latest technology, despite being refurbished. They also show great interest in information on the specific refurbished models through a classification system.

4.6.6 Expert Techie

"I set high demands for the smartphone I use"

Expert Techies are the second expert customer group. Similar to Proud Power-Users, they are involved in and knowledgeable about smartphones and like to have the latest technology. Contrary to the Proud Power-User, the smartphone does not necessarily reflect their personality and they are not influenced by peers (low value-expressive and social-adjustive functions).

Due to their knowledge of smartphones, Expert Techies are well aware of the refurbishing process. However, it is unlikely that refurbished smartphones can meet their expectations, which is evident from their low purchase intention.

Expert Techies' response towards the incentives reflects their expertise and desire for new technology and high performance as especially the product-related incentives that result in a better performance increase the chance of purchasing a refurbished smartphone.

5. Discussion and conclusions

Although the Circular Economy gains increasing interest in scientific research and among companies (Geissdorfer et al., accepted), not much is known about consumers' acceptance of circular products. This research contributes to this lack of understanding by investigating consumers' purchase intention of refurbished smartphones. Refurbishing smartphones can be an attractive strategy for the Circular Economy because it offers important environmental and economic benefits. Drawing upon the EKB model (Engel et al., 1968), and the theories of perceived risk, perceived benefit, and individual differences, we proposed a theoretical framework that distinguished the most important factors that influence consumers' purchase intention of refurbished

smartphones. Based on these theories, 16 incentives were presented that aim to advance consumers' decision-making process of refurbished smartphones and quantitatively assessed the potential impact of these incentives for boosting purchase intention for specific customer groups. The main contributions of this work are threefold: (1) an improved understanding of consumers' purchase intention towards refurbished smartphones, (2) insight in the effectiveness of specific incentives to increase consumers' purchase intention of refurbished smartphones, and (3) knowledge about the different customer groups' attitudes towards refurbished smartphones. Next to providing a theoretical contribution to the literature on the Circular Economy, these insights can support companies in practice, by helping them to steer and focus their product, marketing, and positioning strategies on specific customer groups.

This research suggests there is great potential for the sales of refurbished smartphones. Six customer groups were specified, with different attitudes towards refurbished products. Refurbished smartphones were found to be most suitable for the Casual Supporter and the Sustainability Enthusiast and to some extent for the Susceptible Follower. These groups demonstrated a high interest in environmental issues and do not necessarily desire the latest technology. This should encourage companies to start selling refurbished, 'last-year' models. The Sustainability Enthusiast is most environmentally conscious and refurbished smartphones fit that interest. Susceptible Followers care about their image and may use refurbished smartphones to express their environmental consciousness. If companies want to target Sustainability Enthusiasts and Susceptible Followers, they should make the environmental benefits more salient in refurbished smartphones so that the owner can use this for self-expression by communicating his/her environmental consciousness to one's peers. It is likely that product appearance can play a role in communicating the environmental benefits of refurbished smartphones (Van Weelden et al., 2016). Casual supporters have an interest in environmental issues, but, being less concerned with image and technical details, could be convinced with 'good value for money'. As these groups together represent 46% of the sample, our research supports earlier findings that refurbishing is a commercially viable business concept (Guide & Van Wassenhove, 2001; Linton, 2008). 'Proud Power Users' have a low initial *purchase intention*. However, the potential effect of performance-enhancing incentives is significantly higher for this group. If adapted to the specific needs of this customer group, refurbished smartphones could thus also be well received by more demanding consumers in the future.

We found that perceived *environmental benefits* and *awareness of refurbishing* have a positive impact on consumers' purchase intention for refurbished smartphones. This supports earlier research that revealed a lack of familiarity and misconception of refurbishing and which indicated the importance of creating awareness and emphasising the environmental impact (Atasu et al., 2008; Michaud & Llerena, 2011; Van Weelden et al., 2016). Our results show that providing consumers with information about refurbishing has a positive impact on their purchase intention, which should be an easy to implement solution for companies. A classification system would also be an effective measure to convince consumers of the performance quality of refurbished smartphones. Moreover, we found that perceived *performance risk* and *personal innovativeness* had a negative impact on *purchase intention*. This confirms the importance of perceived performance risk for impeding the adoption of refurbished products (Guide & Li, 2010; Michaud & Llerena, 2011; Van Weelden et al., 2016; Wang et al., 2013). We also confirm the findings of Van Weelden et al., (2015), that a perceived lack of newness in refurbished smartphones is a barrier for their adoption.

We investigated different incentives to influence consumers' purchase decision. The results show that there are different ways to boost the adoption of refurbished smartphones, but overall, product-related incentives that reduce the perceived performance risk, such as delivering better battery life, guaranteed software updates and upgraded performance scored the highest, indicating a crucial consumer need for continued performance in refurbished smartphones. Although this seems straightforward, nowadays this is actually in conflict with the architectural design of most smartphones. Given the architecture of today's smartphones, it is difficult for companies to upgrade internal performance components. Companies should include 'design for remanufacturing' strategies in the design of new smartphones to make these upgrades feasible (Hatcher et al., 2011). The rise of a modular architecture (e.g., PhoneBloks (phonebloks.com) and Fairphone (www.fairphone.com)) could respond to this need and help companies to advance consumers' adoption of refurbished smartphones while keeping the costs low and thereby maintain the financial benefit. Furthermore, supporting software updates is currently problematic for many manufacturers given the complexity of the development for this fragmented market. Supporting more openness and standardization can help companies to support their devices for a longer time period. Installing a new battery is usually standard during the refurbishing process for smartphones, as this component is vulnerable to a decreased performance over time (Bakker & Kuijer, 2014). However, considering the low awareness of the customer groups that show the greatest potential and their request for more information on the refurbishing process, it is advisable that companies emphasise this to potential consumers.

5.1 Future research and limitations

This research was limited to smartphones. Smartphones are used intensively and in a personal way, which may influence the perceived risks of purchasing a refurbished device. Accordingly, it is unclear whether our findings are generalizable to other product categories, such as white goods. These product categories may reveal different customer groups and other promising incentives. Future research should investigate these issues.

Although our findings revealed six customer groups that varied on environmental consciousness and other individual differences, it is possible that our sample was more likely to adopt refurbished smartphones. Accordingly, it would be valuable for future research to replicate our findings using other samples in other geographical areas (Rathore et al., 2011; Sharma et al., 2016; Wei et al., 2015), where different cultural factors play a role in purchase decisions.

Another limitation is that we measured purchase *intention* rather than actual consumer behaviour. There are many reasons why an intention to purchase a refurbished smartphone does not result in an actual purchase (Ajzen, 1991; Khor & Hazen, 2016; Van Weelden et al., 2016). Future research should aim to investigate these factors to help companies successfully market refurbished smartphones.

Our findings suggested that updating the smartphone's appearance was relatively unimportant for consumers. However, we did not show the effect of such an update in an actual picture of a refurbished smartphone. Respondents may have experienced difficulty imagining these effects and thus more research is needed to test the effects of updating the appearance on consumer response to refurbished products.

The leasing option had the least impact on consumers' purchase intention of refurbished smartphones. Although consumers do not necessarily see the benefit of new business models (e.g. leasing) per se, coupled with the

desirable features (better battery life, guaranteed software updates and upgraded performance) there may be an opportunity for companies to deliver service-driven business models. More research is needed to investigate specific combinations of incentives.

Finally, our research did not investigate the role of brands. Prior research has shown that refurbished products sold by a company with a strong brand image helps the adoption of refurbished smartphones (Hamzaoui Essoussi & Linton, 2014). Future research could investigate other business models or branding strategies, tailored to selling refurbished smartphones.

5.2 Conclusion

This research sought to understand the market for refurbished smartphones. Our sample demonstrated a positive attitude towards refurbished smartphones, with most potential for three out of six customer groups (46% of our sample). This indicates that refurbished smartphones can be a market success. It was found that perceived environmental benefits and awareness of refurbishing have a positive impact on consumers' purchase intention of refurbished smartphones and thus companies need to communicate this more to consumers. Furthermore, perceived performance risk had a negative effect. Most of the highest scoring incentives for purchasing refurbished smartphones were product-related and tackled this performance risk, such as improved battery life, guaranteed software updates and upgraded performance. Companies thus need to advance these opportunities in refurbishing to make refurbished smartphones a success. Furthermore, specific customer groups can be attracted with particular incentives, and thus it is critical to understand the customer group that is targeted. This work contributes to the literature on refurbished consumer products, and the understanding of the potential of strategies in the Circular Economy more broadly. Finally, companies could use these insights to establish a promising market strategy for refurbished smartphones, which is both commercially relevant and creates a substantial environmental benefit.

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Appendix

Response to refurbished smartphones
Purchase intention, α = .83 (based on Truong, 2003)
Given the information above, I'm likely to buy a refurbished smartphone.
Given the information above, I'm willing to buy a refurbished smartphone.
General attitude, α = .86
I think refurbished smartphones are good.
I like refurbished smartphones.
I think refurbished smartphones are favorable.
I have a positive attitude towards refurbished smartphones.
Awareness of refurbishing, α = .88 (based on product knowledge scale of Wang et al., 2013)
I was already familiar with refurbished products before this introduction.
I am familiar with the performance of refurbished phones.
I am familiar with the quality of refurbished phones.
Financial benefits, α = .80
When purchasing a refurbished smartphone instead of a new one, there is a substantial financial benefit.
Compared to the price of a new smartphone, the price of a refurbished smartphone makes it an interesting offer to me.
Refurbished smartphones are priced significantly lower than new smartphones.
Environmental benefits, α = .83
Refurbished smartphones offer significant environmental benefits.
Refurbished smartphones are an important strategy to create a sustainable future.
Refurbished smartphones can help save the environment.
Performance risk, α = .88 (based on Stone & Grønhaug, 1993)
Considering buying a refurbished smartphone, I worry about whether the product will really perform as well as it is supposed to.
If I were to buy a refurbished smartphone, I would be concerned that the smartphone will not provide the level of benefits that I expect.
The thought of buying a refurbished smartphone causes me to be concerned for how dependable and reliable it will be.
Financial risk, α = .83 (based on DelVecchio & Smith, 2005)
Given the expenses associated with smartphones, there is a substantial financial risk in purchasing a refurbished smartphone.
I would worry about the cost of purchasing a refurbished smartphone.
Given the financial commitment, I may regret purchasing a refurbished smartphone.
I could lose a significant amount of money if I ended up with a refurbished smartphone that didn't work.

Individual differences

Involvement, α = .63 (based on Zaichkowsky, 1985)

I would be interested in reading information about how a smartphone is made.

I'm interested in reading news articles about smartphones.

I have compared product characteristics among brands of smartphones.

Product class knowledge, α = .93 (based on Chang, 2004)

I am knowledgeable about smartphones.

I know a lot about smartphones.

I am an expert with respect to smartphones.

Consumer innovativeness, α = .78 (based on Truong, 2013)

Overall, I like buying smartphones with the latest technology

If I needed to buy a smartphone, I would buy the latest one available

I tend to purchase the latest smartphone before others do

Value consciousness, α = .82 (based on Lichtenstein et al., 1990)

When shopping, I compare the prices of different brands to be sure I get the best value for the money.

When purchasing a product, I always try to maximize the quality I get for the money I spend.

I generally shop around for lower prices on products, but they must still meet certain quality requirements before I buy them.

Environmental consciousness, α = .85 (based on green purchase behavior scale of Kim & Choi, 2005)

I make a special effort to buy products that are made from sustainable materials.

I have changed which products I use because of sustainability related reasons.

I have avoided buying a product because it had potentially harmful effects to people and/or the environment.

I make a special effort to buy products that are made from sustainable materials.

Social-adjustive function, α = .72 (based on Grewal et al., 2004)

It is important for me that my friends know the brand of smartphone I have.

Smartphones are a symbol of social status.

I like to be seen with my smartphone.

Value-expressive function, α = .92 (based on Grewal et al., 2004)

I tend to purchase a smartphone that fits my identity.

Overall, I like a smartphone that reflects who I am.

I make a special effort to buy a smartphone that says something about myself as an individual.