

Premature Product Replacement

An Exploration of the Reasons Why People Replace Products

van den Berge, R.B.R.; Magnier, L.B.M.; Mugge, R.

Publication date

2020

Document Version

Accepted author manuscript

Published in

Proceedings of the IS4CE2020 Conference of the International Society for the Circular Economy

Citation (APA)

van den Berge, R. B. R., Magnier, L. B. M., & Mugge, R. (2020). Premature Product Replacement: An Exploration of the Reasons Why People Replace Products. In K. Webster (Ed.), *Proceedings of the IS4CE2020 Conference of the International Society for the Circular Economy*

Important note

To cite this publication, please use the final published version (if applicable). Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights. We will remove access to the work immediately and investigate your claim.

Premature Product Replacement: An Exploration of the Reasons Why People Replace Products

***R.B.R. van den Berge¹, L. Magnier¹ and R. Mugge¹**

¹Faculty of Industrial Design Engineering, Delft University of Technology, Landbergstraat 15, 2628 Delft ,
The Netherlands

*r.b.r.vandenberge@tudelft.nl

Abstract

Prolonging product lifetimes is a crucial aspect of the Circular Economy. Currently, a lot of products are replaced while still functioning or in need of (minor) repair. Although industry creates a demand for new products with the introduction of new technologies and promotion activities, consumers' evolving needs and barriers towards repair activities stimulate premature replacement. Yet, recent literature on consumers' reasoning behind the decision to prematurely replace products is scarce. This research contributes by providing an in-depth understanding of the underlying reasons of the (premature) replacement of consumer electronics and white goods.

The reasons to replace and barriers towards repair activities were explored in semi-structured interviews with consumers (n=10). Product, user and market-related factors were found as factors influencing (premature) product replacement. First, defect or faltering functionalities and the age/value depreciation of products has large effect on replacement. When the age of the product increases, the more likely it will be replaced by a new one even if the product still functions properly. Furthermore, cosmetic wear also stimulates replacement. New desires, the lack of repair knowledge and individual differences between users also impact the replacement. In addition, consumers lack knowledge about the impact of products' early replacement on the environment. While they prefer long-lasting, well-functioning products, the desire to fulfil their evolving needs is essential. Regarding the market, the low price of new products and high price of repair reinforce the decision to replace a product. Deals and discounts also tend to trigger premature product replacement. Our findings aim to pinpoint important factors of premature product replacement that need to be addressed by researchers, industries and policymakers in order to prolong products' lifetime.

Keywords: product lifetime; longevity; replacement reasons; repair barriers

Introduction

One of the fastest growing waste streams in the EU consists of electrical and electronic equipment (WEEE). With 9 million tonnes generated in 2005, it is expected to grow to more than 12 million tonnes by 2020 (European Commission, 2018). Until now, research has focussed on the outer loops (e.g. recycling) of the circular economy systems diagrams (Mac Arthur Foundation, 2013). Looking at the environmental impact, more can be gained by focusing on the inner loops, and persuade consumers to use products longer (Mugge, 2017).

Extending products' lifetime is however challenging. At the moment, many products are replaced while technically still functioning (Cooper, 2004; Cox et al., 2013). For example, recent studies show that 31% of

washing machines (Hennies & Stamminger, 2016), 66% of vacuum cleaners (Harmer et al. 2019), 56% of TVs (Hennies & Stamminger, 2016), and 69% of smartphones (Wieser & Tröger, 2018) were disposed for other reasons than being broken beyond repair. Examples of these reasons are dissatisfaction with product functionalities, no longer liking the product, or a gap between the consumers' (new) needs and the features of the product (Hennies & Stamminger, 2016) (Wieser & Tröger, 2018).

From an environmental perspective it is often more desirable to repair a product than to replace it (Pérez-Belis, 2017), yet consumers face barriers towards repair. Several researches showed that the price of repair (i.e. labour costs, price of spare parts) is considered as high. Second, they found a lack of a good repair infrastructure (i.e. taking to repairer, having a replacement in the meantime) and a low availability of spare parts. Lastly, as new products are readily available, it is easy to simply buy a new one (Tecchio et al., 2016; Sabbaghi et al., 2017; Harmer et al, 2019). Considering all this, repair of products is often judged as a non-viable option.

We define the term premature replacement as the replacement of a product, while it is physically still functioning or in need of (minor) repair. In this way the replaced product becomes obsolete. Literature on premature obsolescence makes a distinction between absolute obsolescence (i.e. the physical wear down of the product), and relative obsolescence (i.e. an evaluation of the 'old' product compared to a new product) (Granberg, 1997, Cooper, 2004). Building on these distinctions, Van Nes and Cramer (2005) formulated four general reasons to replace. These are wear and tear, when the product is broken/does not function (at the initial level) anymore; improved utility, when the product does not function sufficiently due to improved demands for safety/economy of use of the product; improved expression, when the product does not function sufficiently due to comfort/quality/expression reasons, and new desires, when the product is functioning well but replaced due to a need for particular product characteristics that are offered in new products. Furthermore, they also mention consumer characteristics and situational influences that are influencing the replacement decision. Consumer characteristics refer to the users' attitude towards products and perceptions about what is considered as 'obsolete' or in need of repair (Bayus, 1991). Demographical factors, such as age, gender, income, geographic location and education, have a strong influence on this and explain why different people make different choices in the same situation (Bayus, 1991; Atlason et al., 2017; Lieder et al 2017). For example, younger consumers generally buy cheaper products and use them for a shorter period of time compared to older consumers (Hennies & Stamminger, 2016). The situational influences refer to changes in the users' life (e.g. having a baby or moving to a new home) (Van Nes & Cramer, 2005; Schäfer et al., 2012). Lastly, previous research showed that new (technological) developments and product marketing shorten replacement intervals of consumers and therefore, trigger the consumer to replace as well (Guiltinan, 2010).

Although previous research provides valuable insights in general replacement reasons, in the meantime new technological developments (e.g. IoT etc) have been widespread. Possibly people's replacement behaviours have changed over time. In addition, more recent studies (McCollough, 2009; Wilhelm et al., 2011; Wilhelm, 2012; Echegaray, 2016; Hennies and Stamminger, 2016; Tecchio et al., 2016; Wilson, 2017; Wieser & Tröger, 2018; Sabbaghi & Behdad, 2018; Harmer et al., 2019; Tecchio et al., 2019) are quantitative in nature and report only about specific failures and their frequency per product category. More knowledge on the underlying reasoning is needed for industry and policy to tackle early replacement and contribute to a circular economy. Specifically, it is important to understand the role of consumers (e.g. expertise, environmental consciousness, innovativeness) as well as the role of the product, its design (e.g. appearance, functionalities) and the services around it (e.g., warranty, repair opportunities) in relation to newly introduced products and market developments causing the user to replace. This research contributes to the literature by providing thorough qualitative insights in the reasons for product replacement in four different types of electronic products.

Methodology

In order to gather in-depth insights in the reasons to replace products and repair barriers, we decided to follow a qualitative approach. This provides rich information about consumer underlying reasoning and personal experiences. Therefore, semi-structured interviews were conducted with the participants. The explorative nature of this method also leaves room to discover new insights (Patton, 2002).

In this research, we decided to focus on the replacement reasons of two categories of white goods / household appliances; washing machines (WM), vacuum cleaners (VC), and two categories of consumer electronics; (smart)televisions (TV) and smartphones (SP). These product categories were chosen as replacing them has a negative environmental impact, many consumers own these products and judge them as important, and there is diversity in terms of the average use time, the presence of new technological trends and average lifetime.

Figure 1: Examples of products discussed in the interviews; old (left) vs new (right).



In-depth interviews were conducted with members of the PEL lab. This is a consumer data base from the Industrial Design Engineering faculty and consists of around 1590 households with different demographical factors. From the total sample of 22 participants, 10 interviews were analysed for this paper. All participants replaced one or two of the different product types (WM=4; VC=4; TV=4; SP=4) within six months preceding the interview and varied in age (34-68 years old), gender (female n=9; male n=7), income, and educational level.

The interviews were semi-structured, were conducted at people's homes and lasted 30-60 minutes. The interviews were recorded by audio. We asked the participants to elaborate on their reasons for replacement, (previous) repair activities and attitude towards repair. Furthermore, questions were asked about their knowledge concerning the environmental impact of products, and whether they considered this during purchase.

The interviews were fully transcribed and anonymised. The data was analysed in Atlas.ti. We used open coding linked to quotes from the interviews to describe the researched phenomenon (Strauss, 1987). In the first round of coding in vivo codes were marked to stay close to the raw data (Saldaña; 2013a). After a discussion with the research team these were reduced to 415 codes. The codes clustered in 74 groups and subsequently categorized in 10 themes. These themes were discussed and refined within the research team.

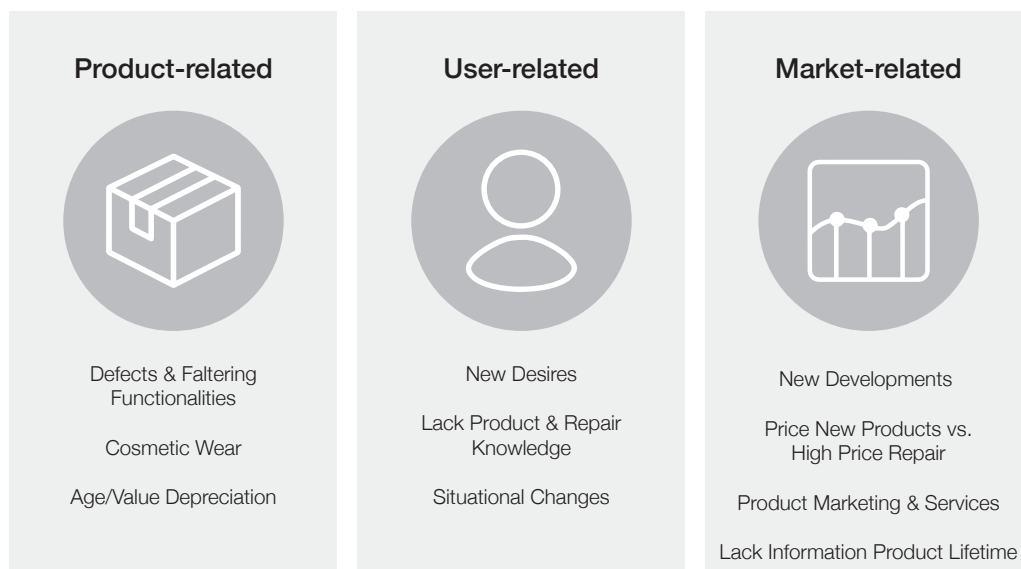
Results and Discussion

Our results revealed three factors that influenced premature product replacement. These factors cover the 10 themes found in the analysis and related to the product, the user and the market, Figure 2. Important to note is that it is often a mix of factors causing the replacement.

The product-related factor refers to the product itself and its functionalities. Factors stimulating replacement are *defects and faltering functionalities*, *cosmetic wear* and the *age/value depreciation* of products over time. The user-related factors refer to users' *new desires*, *lack of product and repair knowledge* and *situational changes* within the users' life. The market-related factors refer to *new developments*, the *price of new products vs. high price repair*, *product marketing* and a *lack of information about product lifetimes*.

The main reasons for replacement or not repairing a product for each influencing factor are summarized in figure 2 and in more detail explained below. In addition, some links to previous research are made and potential interesting attention points for design are indicated.

Figure 2: The three factors influencing premature product replacement of products



Product-related factors

Defects or the faltering of functionalities are common reasons to replace products. When the product started to hamper, the participants indicated feelings of irritation; e.g. when slowed down in functionality, or became unreliable or unsafe. This is in line with previous research stressing that consumers in general want well-functioning products that keep up with their needs (Van Nes and Cramer, 2005).

P3 – SP “I experienced a decrease in its functionality and as soon as you experience that, you start to get annoyed with things that were working smoothly before, but now do not anymore.”

Next to the malfunctioning of products, cosmetic wear, such as traces of use and small parts that broke of, triggered the replacement as well. In line with previous literature (Visser et al., 2018), robustness was mentioned as a preferred product appearance. Some consumer electronics, such as TVs, seem to be more sensitive to technological developments and trends than others, such as washing machines, and therefore, more often replaced because of cosmetic reasons.

P2 – VC: “Well, there was one small part that had broken off the hose, so it was really a bit worn”

Over time, the consumer became more comfortable in replacing the product when it suddenly stops working or starts to wear (e.g. decrease in functionality). The value of the researched products seemed to decrease with the increasing product age respectively. The depreciation can be explained by the decrease in product performance that often happens with electronic products over time. This makes the product age a determining factor in the replacement decision. It is interesting to notice that a sudden defect, or the malfunctioning of a product is more likely to lead to product replacement by the consumer when the product age increased. Responses even imply that consumers nowadays expect the products to fail within a certain timeframe.

P -17 – WM: [The previous washing machine] broke and that was really very bad, [...] Not having a washing machine is not an option. [...] the breakdown had a run up period [...] he got more and more cures in the past two years [...] our washing machine lasted for 13 years, we were kind of enthusiastic about that.

Despite the age/value depreciation, the satisfaction level of the participants increased when a product lasted for a long time. Especially for washing machines and vacuum cleaners, most of the participants just wanted to use their product as long as possible. This is mostly because of monetary reasons, but also because reasons of convenience. This indicates a consumer preference for products designed to have a long life, which is promising for the consumer acceptance of the Circular Economy principles. However, the existing barriers towards repair need to be overcome.

Generally, the participants indicated to consider repair when a defect occurs early in the product lifetime, but there is a perceived uncertainty of how long the product will last after repair. Although the (mandatory) warranty period of two years had a positive influence on repair activities, the higher the product age, the greater the perceived risk of the product breaking down again shortly after the repair. After a certain amount of years, repair is considered not worthwhile anymore because of the earlier mentioned value depreciation of products.

User-related factors

New desires of consumers can lead to premature replacement of products. For example, in recent years smartphones have been subject to many developments. While these technological developments and the regular launch of new products by the industry could be considered market-related factors of replacement, consumers have at the same time developed new desires for faster and better performing models, (e.g. a bigger screen, improved memory capacity, camera of higher quality).

P3 - TV Replacing this TV was rather a subjective choice I have to say [...] since I'm a movie lover, it is a great wish come true. [...] We had a good one, then it could always be a little bit better. [...] A bigger size, image quality and applications you can put on it.

Specific needs and desires are depending on the consumer's personal needs and wishes, and can be explained by individual differences within demographic factors, such as age, gender, and personal beliefs., Situational changes and life events also have an influence (e.g. having children can increase the demand for a new washing machine).

Repairing a product is not always considered as an alternative to replacement by consumers. The cause of the defect is in most cases not well understood and consumers may lack repair experience. Most participants indicated they did not undertake repair activities. They did not consider it as an option, or did not think it was worthwhile to invest time and money to discover the defect, and subsequently, solve the issue. Furthermore, participants believed they were not able to fix the issues of the product themselves, so support from a repair expert or a person with repair knowledge was needed.

P4 - VC: Well, I don't think I am able to repair myself. I mean if there is a crack in the hose then I can fix it with a tape. Yes, exactly, but if it goes much further than. Then I still need help with that.

Lastly, repair is considered as effortful to arrange. A repairer needs to be found, consulted, and an appointment needs to be made, or the product should be taken to the repair shop. Replacement is therefore seen as a more convenient and simpler solution.

Market-related factors

Several influences from the market (i.e. manufacturers, resellers etc.) stimulate replacement as well. Currently, most business models make revenue from selling new products with new (technological) developments and therefore benefit from product replacement.

The relatively low price of new products compared to the relatively high price of repair (i.e. labour costs and call out charges) makes it an easy choice for consumers to simply buy new products when they do not fulfil their needs anymore. The participants were asked what could stimulate them to execute repair activities. They mentioned that a lower price, having support in discovering what causes the defect, and accurate and efficient repair services might persuade towards repair.

P15 – WM: You make the consideration whether it is still worth repairing or having it repaired, simply because we cannot do it ourselves. The call-out costs and also the wages are quite expensive. And then you just think, OK, let's buy a new one.

When asked about the influence of marketing on their replacement decision, most participants intuitively answered it did not influence their choice. However, often the participants mention they were influenced by deals, and promotion offers triggering the replacement. This implies marketing did had an (unconscious) influence on their replacement decision.

P1 – SZ: [the vacuum cleaner] still functioned, but was making a lot of noise and smelled. And well... somehow, I didn't trust him at all anymore. From [bank x] I received interest points, and they made me an offer. [...] So that's how I bought this [brand x] vacuum cleaner.

Services orchestrated around buying a new product make the replacement process as smooth as possible. Products are readily available online, with fast homedelivery and often the old product is taken away as well.

P6 – WM: "Home delivery, take back the old one, connecting the new one. That is all included nowadays. [...] Any company that respects itself a little, takes the old devices with them".

Although the energy efficiency of products was often mentioned as a positive environmental feature of products, participants demonstrated a low level of awareness about the impact of product lifetimes on the environment. Greater transparency about the impact of products on the environment provided by the market might encourage consumer to take this into account during the replacement decision. However, currently there are no requirements for manufacturers and producers to communicate this knowledge.

Conclusions

In general people do not necessarily want to replace products. However, in general consumers want their products to function properly to modern standards. Age/value depreciation of products and the fact that consumers' personal needs change over time stimulate premature replacement. The perception and belief of product value decreasing over time, results in the fact that consumers do not consider repair activities for products that do have some (minor) defect. This age/value depreciation is currently not specifically addressed in the literature. Yet, the (mandatory) warranty period has a positive influence on repair activities. Extended warranty periods may offer opportunities for lifetime extension.

When a product wears and a new functionality comes to the market, consumers can also be persuaded to replace products that are still functioning. Important to note is that some consumer products categories seem to be more sensitive to technological developments and trends than others and therefore, more often replaced while still functioning. A design of a product (e.g. modularity) or service (e.g. leasing) for these specific product categories that is able to keep up with new trends and development could be a solution.

The current market facilitates the replacement process by offering new products for a relatively low price and the offering of fast home delivery (e.g. ordered today, delivered tomorrow). This overrules nowadays repair services, which lack an infrastructure and competitive pricing. Because of this, replacement of the product is the preferred option over repair. Product and service design facilitating the user in finding out the potential defect might stimulate repair. Furthermore, the design of convenient, easily accessible and cheaper repair services also has great potential.

In general, the participants had a lack of knowledge about repair and the environmental impact of products with a short lifetime. Better informing consumers about these topics are interesting opportunities to change consumers current replacement attitude into more sustainable behaviour taking possibilities for repair into account as well.

These insights help governments to develop policies that support consumers in prolonging the lifetime or stimulate repair. Furthermore, implications are made for industry on how to design long-lasting products that fit the principles of the Circular Economy. Our findings show that prolonging product lifetimes requires not only a design that resists failure and a decrease in functionality over time; influences from the user and market are as much as important to consider when designing long-lasting products.

Acknowledgements

This research is part of PROMPT project and has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 820331.

References

- Atlasan, R. S., Giacalone, D., & Parajuly, K. (2017). Product design in the circular economy: Users' perception of end-of-life scenarios for electrical and electronic appliances. *Journal of Cleaner Production*, 168, 1059-1069.
- Bayus, B. L. (1991). The consumer durable replacement buyer. *Journal of Marketing*, 55(1), 42-51.
- Cooper, T. (2004). Inadequate life? Evidence of consumer attitudes to product obsolescence. *Journal of Consumer Policy*, 27(4), 421-449. doi: 10.1007/s10603-004-2284-6
- Cox, J., Griffith, S., Giorgi, S., & King, G. (2013). Consumer understanding of product lifetimes. *Resources, Conservation and Recycling*, 79, 21-29.
- Echegaray, F. (2016). Consumers' reactions to product obsolescence in emerging markets: the case of Brazil. *Journal of Cleaner Production*, 134, 191-203.
- Ellen MacArthur Foundation (2013). Towards the Circular Economy: Economic and Business rationale for an accelerated transition. Accessed 36 May 2020 <https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf>
- European Commission (2018) Waste Electrical and Electronic Equipment (WEEE), accessed 22 May 2020, https://ec.europa.eu/environment/waste/weee/index_en.htm

- Granberg, B. (1997). The quality re-evaluation process: Product obsolescence in a consumer-producer interaction framework. Stockholm: University of Stockholm, Department of Economic History, 423.
- Guiltinan, J. (2010). Consumer durables replacement decision-making: An overview and research agenda. *Marketing Letters*, 21(2), 163-174.
- Harmer, L., Cooper, T., Fisher, T., Salvia, G., & Barr, C. (2019). Design, Dirt and Disposal: Influences on the maintenance of vacuum cleaners. *Journal of Cleaner Production*, 228, 1176-1186.
- Hennies, L., & Stamminger, R. (2016). An empirical survey on the obsolescence of appliances in German households. *Resources, conservation and recycling*, 112, 73-82.
- Lieder, M., Asif, F. M., & Rashid, A. (2017). Towards Circular Economy implementation: an agent-based simulation approach for business model changes. *Autonomous Agents and Multi-Agent Systems*, 31(6), 1377-1402.
- McCullough, J. (2009). Factors impacting the demand for repair services of household products: the disappearing repair trades and the throwaway society. *International Journal of Consumer Studies*, 33(6), 619-626.
- Mugge, R. (2017). A consumer's perspective on the circular economy. In *Routledge Handbook of Sustainable Product Design* (pp. 396-412). Routledge.
- Van Nes, N., & Cramer, J. (2005). Influencing product lifetime through product design. *Business Strategy and the Environment*, 14(5), 286-299. doi: 10.1002/bse.491
- Patton, M. Q. (2002). Qualitative interviewing. *Qualitative research & evaluation methods* (pp. 339-380). Thousand Oaks, CA: SAGE
- 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.
- Sabbaghi, M., Cade, W., Behdad, S., & Bisantz, A. M. (2017). The current status of the consumer electronics repair industry in the US: A survey-based study. *Resources, Conservation and Recycling*, 116, 137-151.
- Sabbaghi, M., & Behdad, S. (2018). Consumer decisions to repair mobile phones and manufacturer pricing policies: The concept of value leakage. *Resources, Conservation and Recycling*, 133, 101-111.
- Saldaña, J. (2013a). First cycle coding methods. *The coding manual for qualitative data* (2nd ed. Ed., pp. 91-105). London: SAGE
- Verplanken, B. (2018). Promoting sustainability: towards a segmentation model of individual and household behaviour and behaviour change. *Sustainable Development*, 26(3), 193-205.
- Visser, M., Schoormans, J., & Vogtländer, J. (2018). Consumer buying behaviour of sustainable vacuum cleaners-Consequences for design and marketing. *Journal of cleaner production*, 195, 664-673.
- 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.
- Wilhelm, W., Yankov, A., & Magee, P. (2011). Mobile phone consumption behaviour and the need for sustainability innovations. *Journal of Strategic Innovation and Sustainability*, 7(2), 20-40.
- Wilhelm, W. B. (2012). Encouraging Sustainable Consumption through Product Lifetime Extension : The Case of Mobile Phones. 3(3), 17-32
- Tecchio, P., Ardente, F., & Mathieux, F. (2016). Analysis of durability, reusability and reparability-application to washing machines and dishwashers. Technical report of the Joint Research Centre.
- Tecchio, P., Ardente, F., & Mathieux, F. (2019). Understanding lifetimes and failure modes of defective washing machines and dishwashers. *Journal of cleaner production*, 215, 1112-1122.