Towards a circular economy: exploring factors to repair broken electrical and electronics products by users with pro-environmental inclination

DRS 2018 Design Research Society 2018 Catalyst

University of Limerick
25th - 28th June 2018

Towards a circular economy: exploring factors to repair broken electrical and electronics products by users with pro-environmental inclination

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doi: 10.21606/dma.2017.556

User repair can prolong product lifespan and support in turn the transformative Circular Economy agenda. Current research concerning user motivations and propensity to repair differs as to the extent at which users' environmental concerns influence repair propensity. Because of this, the focus of this study is on potential individuals with pro-environmental inclination, as a mean to identify the factors supporting and hindering repair. To this end, an in-depth survey exploring factors influencing repair propensity for electrical and electronic goods was executed. Findings from 208 respondents affiliated with pro-environmental communities identify innovativeness and frugality traits as significant factors influencing repair propensity. Qualitative analysis has shown the significance of financial considerations in deciding to repair or replace, and how access to helping relationships alleviate most of the barriers to repair, including lack of access to repair shops and lack of knowledge and skills. The findings of this study provide much needed insight into repair behaviour. Furthermore, the insights provided will aid researchers and policy makers to develop appropriate interventions to support repair.

Circular economy, Consumer Behaviour, Repair, Product lifespan

1 Introduction

The generation of huge volumes of waste electrical and electronic equipment (WEEE) as a result of overconsumption is a growing environmental problem across the world (Babu, Parande & Basha, 2007). In Europe, 11.5Mt of WEEE was generated in 2015, with 1.5 Mt originating from the United Kingdom (Baldé, Wang, Kuehr & Huisman, 2015). Repair is a viable option for diverting and

recovering materials from the waste streams (Bekin, Carrigan & Szmigin, 2007; Brook Lyndhurst, 2010; Cooper, 2010; ERM, 2011; King, Burgess, Ijomah & McMahon, 2006; Nicole van Nes & Cramer, 2005). It can extend product lifespan, delay replacement purchase, and the production of e-waste. Repair is the least environmentally detrimental option to restore an item compared to remanufacturing and refurbishment (King et al., 2006). The user can perform repair and support the transformative Circular Economy zero waste reduction agenda set out by the European Union (EC, 2015).

Currently, the majority of users lacks enthusiasm for engaging in repair behaviour (Brook Lyndhurst, 2010). It is partly because design strategies such as "*material efficiency and miniaturisation, glue-based joint mechanism, higher levels of on-chip integration and new technologies for power storage and printed electronics*" (Mashhadi, Esmaeilian, Cade, Wiens & Behdad, 2016, p. 1) make any attempt to repair difficult. It is also partly because the user is influenced by strategies of consumer behaviour, marketing and communications research which are used to fuel overconsumption as opposed to retention (see Abela, 2006; Hamilton, 2010; Kilbourne, 2004; Kjellberg, 2008; O'Shaughnessy & O'Shaughnessy, 2002). Pro-environmental users are recognised to display stronger product retention tendency, including greater attempts to repair items to meet their values and fulfil their lifestyles choices (Haws, Naylor, Coulter & Bearden, 2011; Haws, Winterich & Naylor, 2013). Yet, research on the factors influencing repair propensity put forward conflicting outcomes as to the extent to which environmental concerns influence repair behaviour (Lilley, Bailey, & Charnley, 2013; Scott & Weaver, 2014; Terzioglu, Brass & Lockton, 2015).

Previous research explored design strategies for influencing product durability (van Nes & Cramer, 2005) and postponing product replacement (Mugge, Schoormans & Schifferstein, 2005). It also explored the role of community repair (Bekin et al., 2007), the state of the repair market (Chismar, 2008; Twigg-Flesner, 2010) and user replacement's behaviour (Abelson, 2009; Cooper, 2010; van Nes, 2010) to advance understanding of the user. Research on the factors influencing repair propensity investigate the behaviour of individuals who had different level of repair propensity. More research is required on the factors influencing repair propensity on a group of individuals which appears at first to be the most inclined to embrace the Circular Economy Agenda set by the European Union for sustainability reasons, yet appear to fail to engage with the behaviour. The research is for policy-makers, researchers and environmental and repair advocates in selecting the means to support users to adopt repair behaviour.

2 Literature review on factors influencing repair propensity

The following section presents the factors influencing repair propensity. The review draws from existing literature on the topic (Lilley et al., 2013; Scott & Weaver, 2014; Terzioglu et al., 2015) and the lessons from data mining on repair experiences (Mashhadi et al., 2016).

2.1 Perceived Inconvenience of repair

The user can perceive repair to be inconvenient because elements outside the user's control can make the repair process difficult to navigate. These elements include the lack of repair outlets (Lilley et al., 2013); a heightened negative perception of manufacturers and repair industry (Scott & Weaver, 2014); and users' lack of knowledge and skills. Repair companies, manufacturers and retailers can mismanage users' expectation by delaying the repair, having inconsistent access to spare parts and delivering poor customer service (Consumer Reports, 2001; Scelfo, 2009). The creation of a network providing spare parts can alleviate the shortage of spare parts (Lilley et al., 2013; Mashhadi et al., 2016; Terzioglu et al., 2015). Manufacturers and retailers also pass higher costs onto the user (caused by the high cost of infrastructure to process repair and decreasing skilled workforce). One solution is for manufacturers to outsource warranty services to other organisations which lengthen the repair process (Scelfo, 2009) or to pass on the cost directly to users (Klausner, Grimm & Horvath, 1999; McCollough, 2009; Twigg-Flesner, 2010). Users finally lack the skills and knowledge to understand devices, diagnose problems and comprehend service manuals (Chismar,

2008; McCollough, 2009). Community repair events provide a space where the user can reduce the required effort to learn a new skill and cost.

2.2 Lack of trust in repair shops

Users have been seen to lack trust in repair shops' efficacy (Scott & Weaver, 2014) and often are dissatisfied with the received repair services (Consumer Reports, 2001). Scott and Weaver (2014) suggested that it negatively impacts on repair propensity. The user can also not trust repair shops because of their lack of transparency on their pricing. The user can also fear to be overcharged by repair shops, discouraging repair (Lilley et al., 2013).

2.3 Product design inhibiting repair

The design can prohibit the user to repair. The introduction of products with ever-increasing embedded electronics; design features such as plastic or metal shells which sustain damage when forced; the sealed assembly which does not allow access to inner parts; and the use of glue to join mechanisms can all affect engagement in repair activities (Chapman, 2009; Guiltinan, 2009b; Lilley et al., 2013; Mashhadi et al., 2016; van Nes & Cramer, 2005; Terzioglu et al., 2015).

2.4 Perceived cost of repairs and replacement

The user can consider costs and benefits to decide whether repair or replacement is the most satisfactory option to meet his/her needs (Cooper, 2005; Okada, 2001). Some elements may influence the user's judgement as to whether they should replace an item or repair it. The user can perceive the broken item to hold greater value than a replacement item (Okada, 2001). If a product falls outside the statutory guarantee period or the warranty does not cover it, the user can perceive the cost of repair as being higher than replacement (Cooper & Christer, 2010; Twigg-Flesner, 2010; Utaka, 2006). Experts can advise replacing the item if the cost of repair is higher than replacement (Scelfo, 2009). The user can also favour new items being introduced within the marketplace because they have enhanced performance and reduced retail prices for household consumer goods (Cooper, 2010). It increases the perception that the broken item is technologically obsolete and influence replacement as opposed to repair (Cripps & Meyer, 1994; Guiltinan, 2009).

Lilley et al. (2013), Scott and Weaver (2014) and Terzioglu et al. (2015) found that the perceived cost of repair and replacement can influence repair behaviour. Terzioglu et al. (2015) found amongst the non-professional repairers that finance/time/labour loss were key motivations to repair small household appliances and electrical items. Scott and Weaver (2014) found that the cost of repair and replacement were more important with individuals with lower repair propensity level. It aligns with Lilley et al. (2013) who found that individuals who do not fix items were more likely to discard a product if the cost of replacement is low.

2.5 Relationships between attachment to item and repair

Emotional attachment brought about by memories and, experience and emotion to an item influencing him/her to retain, maintain and repair the latter. Terzioglu et al. (2015) consider the theme of everyday use and essential need to describe the relationship of attachment that can exist between an individual and items they have within the household (e.g. a boiler). Extensive research on product attachment has been carried out to support product design (Mugge, Schifferstein & Schoormans, 2010; Mugge & Schoormans, 2008; Page, 2014). Lilley et al. (2013), Scott and Weaver (2014), Terzioglu et al. (2015) recognise attachment as a factor positively influencing propensity to repair.

2.6 Environmental concerns

Concerns for the environment and engagement in the sustainability agenda can encourage repair. Scott and Weaver (2014) considered environmental concerns as a factor influencing repair propensity and measured it using Ellen's (1994) scale onto their sample. The scale measures environmental concerns by considering the individual trade-offs between the cost and benefits of individual action on environmental problems and the immediate personal rewards. Scott and Weaver (2014) found that environmental concern did not correlate with repair propensity. On the other hand, Lilley et al. (2013) identify it as an important factor for their profile of users who repair most often. Terzioglu et al. (2016) also identify it as an element which influences the likelihood of repair in small electrical items.

2.7 Frugality

The user can have frugality traits which influence product retention. It can enhance their stewardship traits by using the item more efficiently and encourage them to be thriftier in the way they use financial resources. Frugality traits relate to repair and replacement decisions made by the user as they consider the economic pros and cons (Bayus, 1991; Okada, 2001). It was put forward by Scott & Weaver (2014) as a hypothetical factor influencing repair. Scott and Weaver (2014) recognise stewardship as a sub-element of frugality to correlate with repair propensity.

2.8 Product Retention Tendency

It refers to the tendency of the user to retain possessions through a desire to avoid waste (Haws, Naylor, Coulter, & Bearden, 2012). Product retention tendency may influence inclination to repair items.

2.9 Use Innovativeness

The user can be receptive to, and creative with, using and adapting a product in new ways to suit a new purpose. Price and Ridgway (1983) refer to it as a personality trait and call it 'use innovativeness'. It includes the following aspects: creativity-curiosity, risk preferences, voluntary simplicity, creative re-use and multiple use potential. Scott and Weaver (2014) found use innovativeness to be one of the most significant factors correlating with repair propensity. Lilley et al. (2013) and Terzioglu et al. (2015) both highlight personal satisfaction from the challenge in trying to repair and the possibility to display skills as a motivation to repair. It aligns with aspects of risk preference and creativity curiosity within use-innovativeness.

2.10 Demographics – age, income, education

Users with higher incomes have been seen to replace more than to repair (Bayus, 1991; McCollough, 2007, 2010). Lower-income households tend to focus on immediate fiscal need. They can be unable to make use of a guarantee and choose to discard the item rather than to repair it (Lilley et al. 2013). Age has been correlating positively with repair (McCollough, 2010). Educational attainment has conflicting results on whether the higher educational attainment relates to early or delayed replacement (Bayus, 1991; McCollough, 2010). Scott and Weaver (2014) posit that income and education both relate negatively to repair whilst age correlates positively with the repair of items. In Lilley et al. (2013), the repairing users were predominantly holders of tertiary and vocational education, providing them with the skills and knowledge necessary to repair.

2.11 Product care

Increased product care is a potential outcome exhibited when users with a higher repair propensity compare the economic cost and benefits of maintenance, against the economic cost and benefits of replacement (Boyd and McConocha, 1996; Okada, 2001; Scott and Weaver, 2014).

2.12 Product Acquisition Usage

The user may consider purchasing a repairable item because he has higher repair propensity level (Scott & Weaver, 2014). Lilley et al. (2013) recognise that individuals who repair are more likely to purchase premium items which are perceived to be of higher quality. When the user considers the

product reparability at the initial purchase, it impacts positively on the likelihood of repair (Guiltinan, 2009).

2.13 Conceptual Framework

The conceptual framework developed by Scott and Weaver (2014) highlights three broad categories to classify the factors (Market, Product, Consumer) and a category highlighting repair outcomes from repair propensity including acquisition choice for reparable items and greater product care (see Figure 1 for classification of the factors and definition). It does not include product design consideration, yet it offers a positive baseline for comparison in future studies.

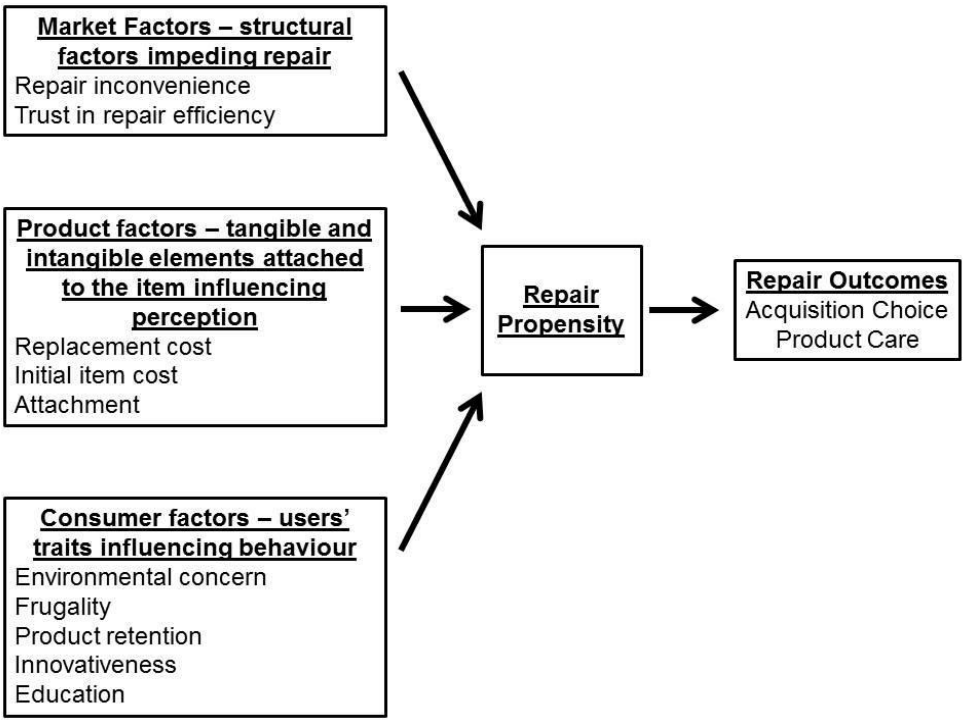

Figure 1 - Scott and Weaver (2014) - Conceptual model for repair propensity

2.14 Literature review conclusion

The review of the literature identified a number of factors influencing repair propensity. Innovativeness and the perceived cost of repair and replacement are critical factors influencing repair propensity. However, there were conflicting findings as to the extent to which environmental concerns influence an inclination towards repair.

3 Methodology

From the literature review, a survey was designed to enable systematic capture of quantitative and qualitative data (Robson, 2002). It was distributed both online and offline. The intention was to gain a high volume of data in a relatively short amount of time. The survey aimed to assess the factors influencing user's repair propensity adapting aspects of studies by Lilley et al. (2013), Scott and Weaver (2014), Terzioglu et al. (2015) and Mashhadi et al. (2016). It was done to allow bases for comparison and discussion on the outcomes. The first part of the survey assessed the factors influencing repair propensity. The second part of the survey collected users' repair experiences

3.1 Sampling

A criterion purposive sampling technique was used (Patton, 2001). It refers to *''selecting cases that meet some predetermined criterion of importance''* (Patton, 2001, p. 238). The sample had to

constitute a fairly homogeneous group. The purposive sample is also a technique for the most effective use of limited resources (Patton, 2001). Working with an organisation called Footpaths, a carbon reduction community programme (Footpaths Leicester, 2017), the survey was distributed at the Green Festival of Making and Mending in October 2015 Leicester and sent through Footpaths Leicester mailing list to engage with individuals who have pro-environmental inclinations. A control question was included in the survey to ensure the respondents' affiliation and involvement with environmental communities.

3.2 Quantitative analysis

For the analysis of the factors, to obtain a value for each element, the answered questions were averaged out per categories to find the mean. A correlation analysis was then carried out for each category against the repair propensity mean. The mean for data lines with missing values was not included in the correlational analysis. In the second analysis, 4 out of 7 significant variables were analysed together into a regression model to identify the variables that were most significant. Similar to Scott and Weaver (2014), product care and consideration of repair during acquisition were not included in the regression analysis because they are an outcome of repair propensity. Multicollinearity for the sample was examined using the Variance Inflation Factor (VIF) which indicated an absence of multicollinearity effects with VIF statistics all under 2.0, well below the guideline of 10 (Hair, Anderson, Tatham & Black, 1998).

3.3 Qualitative analysis

For the qualitative analysis of users' repair experiences, a thematic analysis was carried out to identify further factors influencing repair propensity. Thematic analysis is a foundational tool within qualitative research. It is flexible and offers the opportunity to draw a rich and detailed account of data (Braun & Clarke, 2006). The process of coding includes six phases. It is done to create meaningful patterns. The phases are: familiarisation with data, generating initial codes, searching for themes among codes, reviewing themes, defining and naming themes, and producing the final report.

4 Findings on the factors influencing repair propensity

The results of the quantitative and qualitative analysis of the factors influencing repair propensity are presented.

4.1 Quantitative results

The correlation analysis provided an initial understanding of factors that correlate the most and the least with higher repair propensity. Receptiveness to creativity and innovation was the most significant factors. The intention and behaviour associated with trying to keep an item for a long time through product care, the certain attachment to the item's value both financial and emotional and the need to preserve resources because of frugality traits correlated with the inclination to repair. Finally, the data indicated that a lack of trust in third-party repairers encouraged users to engage in repair activities themselves.

Consideration of repair at acquisition does not correlate with repair propensity. The lack of offers for repairable items and the premiums price put on those that exist may discourage repair. The perceived cost of replacement discourages repair. Stewardship traits did not correlate with the inclination to repair. In previous research, it was a significant factor influencing repair propensity. Environmental concerns correlate negatively with repair propensity which raised questions about the nature of the sample and the questions asked to assess environmental concern.

The table below highlights in ranking order the factors that correlated the most significantly with repair propensity:

Table 1 - Correlation analysis results in ranking order

Broad Factor Categories	Ranking order	Factors influencing repair propensity	Correlation	Sign (2 tailed)	n
Consumer	1	Innovativeness	.462**	.000	192
Repair Outcome	2	Product Care	.222**	.002	198
Product	3	Relationship between attachment to item and repair	.202**	.004	201
Consumer	4	Frugality including thriftiness and stewardship	.172*	0.16	194
Market	5	Lack of trust in repair efficacy	.164*	.020	201
Consumer	7	Thriftiness	.140*	.048	201
Product	8	Product Retention Tendency	.126	.076	200
Consumer	9	Education	.117	.97	201
Product	10	Cost of repairs	.093	.191	201
Market	11	Inconvenience of repair	.085	.231	201
Consumer	12	Income	.080	.260	208
Consumer	13	Stewardship	.076	.281	201
Consumer	14	Environmental Concern	.074	.294	200
Consumer	15	Age	.015	.838	201
Product	16	Perceived cost of replacement product	.010	.890	201
Repair Outcome	17	Consideration of repair at acquisition	-0.18	.803	201

For the regression analysis, thriftiness was taken out from the analysis to reduce multicollinearity with the frugality variable. The two variables that were the most significant were innovativeness (t=6.819. p <.001) and traits of frugality (t= -2.841, p <.005). The table below presents the results of the regression analysis:

Table 2 - Regression analysis results

	Beta	t	Sign
Innovativeness	.646	6.547	.000**
Frugality including tightwad and stewardship	-.262	-2.841	.005*
Relationship between attachment to item and repair	-.073	-.955	.341
Lack of trust in repair shops	-.014	-.172	.864

Note: * p <.005, ** p <.001

Hence, the creativity and receptiveness to innovation is a strong predictor of whether someone is going to try to repair or not. Traits of frugality were also seen to be significant. Amongst the frugality trait, thriftiness correlated further with repair propensity than stewardship.

4.2 Qualitative results

Thematic analysis was carried out as to identify what encourages and discourages repair. Two themes were extracted from the analysis: the degree to which repair is more or less convenient, and the degree to which an item is valued or devalued.

4.2.1 The degree to which repair is more or less convenient

Users' level of access to the following resources influences the degree to which they consider repair to be more or less convenient:

- Financial resources
- Skills and knowledge to repair

- Safety Concerns
- Helping relationships
- Repair shops
- Tools and Parts
- Offered services to replace item
- Time

For half of the respondents, financial considerations were the main criteria influencing repair or replacement. On the one hand, a repair was considered to save money and reduce the cost of replacement (n=49):

''It is possible to repair, and costs less than a replacement''

''Repair saves money''

On the other hand, the cost of repair and the cost of replacement were considered to have a significant impact on whether respondents chose to replace an object rather than repairing it (n=53). Replacement parts can be more expensive than new products which discourage repair. Cheaper products rather than replacement parts are found in the market discouraging some respondents to repair. One participant reported that a new motherboard for his computer was "*the same price as second hand [Apple] Mac*". In some cases, respondents did not use their knowledge or experience to determine the cost of repair. They presume that it will be more expensive to repair than to replace:

''I presumed repair cost would outweigh price of new one''

Services such as warranties and returns guarantee also encouraged replacement rather than repair. One respondent returned an electric bathroom scale to John Lewis, rather than choosing to repair it because it was still under guarantee. Repair requires some technical skills and knowledge. For a quarter of the respondents, the lack of skills and knowledge discouraged from engaging in product repair:

''I'm not good at understanding how things work mechanically''

''I don't really have the skills''

Contrastingly, in a few cases, respondents indicated some enthusiasm for developing repair skills. Some respondents indicated that by repairing an item they would learn a new skill:

''do some research and try my best to fix it on at least learn from my mistakes''

A number of respondents were concerned about the safety of trying to repair an electrical item (n=27). It discouraged them from trying to repair items on their own. One participant indicated that she would rather ask someone with more experience:

''I would NEVER try to repair an electrical item. I would get someone else to do it''

The extent to which the user's peers can support repair influences perception on whether repair is convenient or not. For a quarter of participants (n=70), they relied on third parties to obtain information or help in trying to repair an item. Some participants relied on their family and acquaintances for support in repairing items:

''I get my husband to tell me what to do''

''I'll ask a friend for help if I was unsuccessful''

The reliance on third party's help to repair strengthens the bonds between community members. It also reflects the inconvenience that repair presents. As such, a number of respondents reported that they did not know where to find repair shops (n=38). For a few respondents, the lack of tools, parts and information also discouraged repair (n=7). Finally, respondents were constrained by time to engage in repair (n=20).

4.2.2 The degree to which an item is valued or devalued

The degree to which the item is valued by the user is influenced by the following considerations:

- Perception of reparability and expected product lifespan
- Purpose of the item
- Age of the item
- Initial value of the item
- Item features

The perceived reparability or irreparability of an item influenced the repair propensity of a large proportion of respondents (n=97). Amongst them, 60% anticipated that their item can be fixed. A few reported that their item would last longer if fixed. 40% considered that their item was irreparable. The judgement made on the item's reparability was in some cases based on knowledge, in others on assumptions. One participant used his experience to determine whether an item could be repaired:

> *''From experience I know that leaking kettles are rarely fixed successfully''*

Another didn't make an attempt to repair because he did not know if the item could be repaired:

> *''*[I did not repair it because] *I did not know if it could be repaired''*

The item's perceived purpose influenced a number of respondents to repair or not (n=60). The majority disliked the redefinition and association of the item's purpose with ''waste'' as a concept. It created some dissonances in the user. It encouraged them to repair. Many respondents expressed through their dislike of waste their environmental concerns:

> *''I hate waste and fear for the planet''*

In a few cases (n=12), respondents used demeaning terms to describe the item. It was a means to redefine the purpose of the item from useful to not. It aids in justifying disposal. In one case, the item is associated with 'waste' to support the user's decision to not repair:

> *''it was a hunk of junk when I bought it - ugly and unreliable''*

Product retention tendency and product replacement preferences influenced respondents' perception of the item's value (n=42). In the majority of cases, respondents indicated that they would rather repair than replace to retain the item:

> *''I would far rather repair than buy another item''*

> *''*[it] *means it does not need replacing''*

Age was an important element influencing disposal of an item (n=52). The user defines the perishability of a material object. The older the item was the more likely the item was replaced. One respondent explained that he did not repair his toaster because it was of an appropriate age to be thrown away:

> *''the* [toaster] *was old enough and has aged enough to be thrown away''*

In a few cases, the newness of the item influenced replacement as opposed to repair. The acknowledgement that the item is new allowed respondents to defer the responsibility to the retailers in handling the item. The retailer is perceived to retain some ownership of the item. If the item is recently purchased and do not meet expectations, it can be returned instead of repaired:

> *''*[I did not repair it] *because the product did not function as described, and it was very recently purchased''*

The initial value of the item can influence respondents to repair (n=20). The more expensive the item was, the more likely they were to try and repair it and vice versa. In two cases, stored data influenced decisions around the repair. One respondent explained that they repaired their computer because of the data it held. In another case, a lack of trust in a third party to deal with sensitive data on a device discouraged repair:

''I was not happy about someone I didn't know repairing it as it had sensitive data on it (research data, stored passwords etc.)''

Although negligible in number, it is important to consider the rise in items with embedded data and electronics which may deter users from repairing items.

5 Discussion

The main purpose of this research was to provide insight into the repair behaviour of individuals with pro-environmental inclination, in response to conflicting results in previous research on the extent to which environmental concerns influence repair propensity. Insights were gained through a survey collecting qualitative and quantitative data. The following figure introduces the factors influencing repair propensity identified through the research:

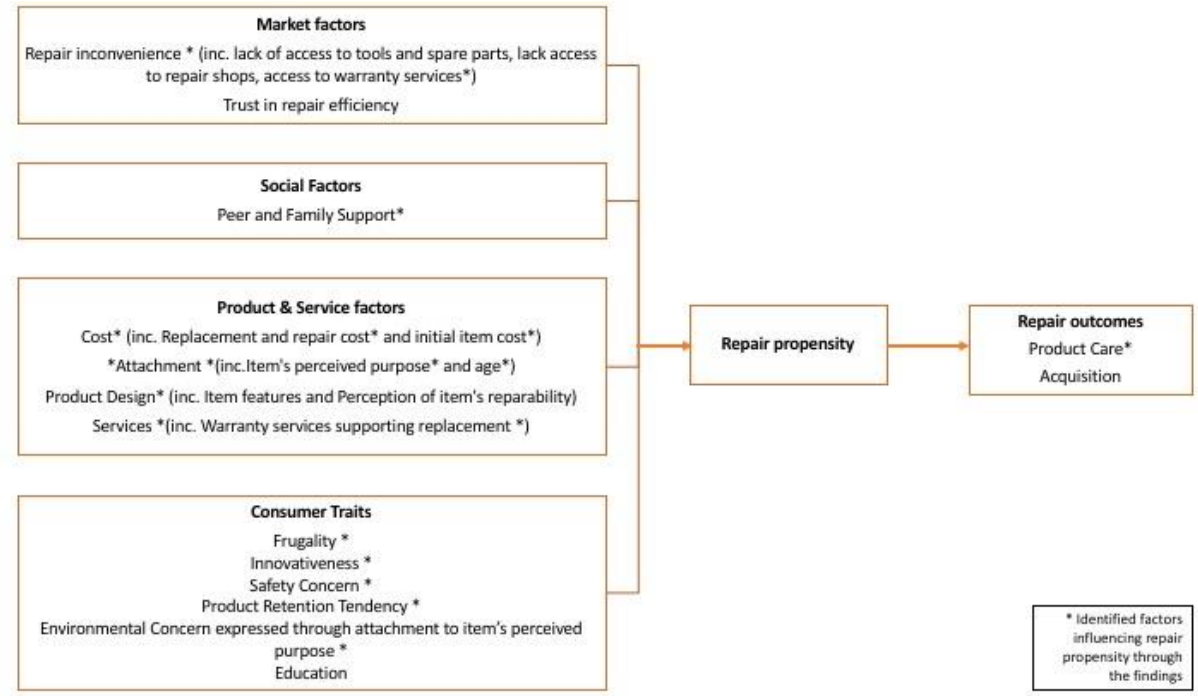

Figure 2 - Factors influencing repair propensity

Significant aspects from the factors influencing repair propensity are discussed in the following sections.

5.1 Frugality traits

Frugality traits were a significant factor influencing repair through the qualitative analysis. Frugality traits include both the latent construct of stewardship and thriftiness. Stewardship is identified by Scott and Weaver (2014) as an important variable influencing repair propensity. In the studied sample, thriftiness with money correlated further. Financial considerations were also one of the main factors influencing repair through the qualitative analysis. Frugality traits for individuals with green attitudes encourage careful use of items and product retention tendency. Work on frugal consumption (Lastovicka, Bettencourt, Hughner & Kuntze, 1999) and product retention tendency of green consumers (Haws et al., 2012; Haws, Winterich & Naylor, 2014) suggest that the engagement with those behaviours is to extract the full value of the item. It sheds light on the high correlation of product care as a sought outcome from higher repair propensity. It is recognised that pro-environmental users use frugality traits as a mean to echo and display their identity. It was found amongst climate change activists, regardless of their level of affluence (Boucher, 2017).

It explains to a certain extent the reason why the consideration of repair at acquisition as a sought outcome was not correlating with higher repair propensity in the sample. It differs from previous research where individuals with higher repair propensity were more likely to purchase reparable items (Scott & Weaver, 2014; Mashaadi et al., 2016) and premium brand (Lilley et al. 2013). Frugality traits may discourage the purchase of expensive items. The findings contribute to the debate on the extent to which frugal behaviour amongst the affluent is the way forward to achieve sustainability (Alcott, 2008; Boucher, 2017). It also highlights the need to increase economic and financial literacy amongst users. It will support them to make spending decisions that support the emergence of sustainable consumption and production systems. It also would support them to think about their behaviour in economic term beyond their own personal financial circumstances. Further investigation of economic literacy, beliefs and attitudes amongst pro-environmental users and other layers of the population may help in understanding their repair decision process and identify areas for interventions. Questions also arise on how design can be used to increase economic literacy for sustainable investment.

5.2 Innovativeness & Safety Concerns

Innovativeness was also a significant factor influencing repair propensity to investigate repair. Curiosity and creativity drive innovative individuals to explore areas of interests; and they tend to prefer risk over comfort (Price & Ridgway, 1983). As the lack of skills and knowledge and safety concerns are significant barriers to repair, understanding the factors supporting the acquisition of skills and reducing stress over safety concerns amongst individuals with innovativeness traits could help in developing interventions to support individuals with lower repair propensity.

5.3 Environmental Concerns

Environmental concerns within the sample did not correlate with repair propensity. In the qualitative analysis, environmental concerns were expressed through the dislike of waste and its impact on the environment. It highlighted some limitations in measuring environmental concerns using the Ellen (1994) scale which was used by Scott and Weaver (2014). The translation from attitudes towards the environment, to behaviour, is far more complex and does not limit itself to trade-offs between personal immediate rewards and environmental benefits. It echoes the extensive research carried out on the gap between environmental concerns and pro-environmental behaviour in the last 40 years (e.g. Kollmus & Agyeman, 2002). It highlighted a complex set of factors embedding values, personality traits, and internal and external factors which may influence the adoption of pro-environmental behaviour (Kollmus & Agyeman 2002).

5.4 Attachment and Group Affiliation

The relationship between attachment and repair also correlated with repair propensity. Terzioglu et al. (2015) highlights emotional attachment to small electrical appliances as a motivation to repair. Considering the work by Mugge and Schoormans (2006) on the concept of product attachment and its relationship with identity and group affiliation, it is important to consider whether individuals with pro-environmental inclination retain an item to fulfil expectations through their group affiliation or whether it is more strongly influenced by frugality traits.

5.5 Market and Social structural support

In relation to infrastructures that support repair, the lack of repair shops, tools, parts and information in the marketplace make warranty services offered by retailers more appealing than repair. It echoes findings from a number of research studies (Mashaadi et al. 2016, Terzioglu et al. 2015, Sabbaghi 2015, Lilley et al. 2013). On the other hand, the emergence of community repair is a positive example of structural support for repair (Bekin et al., 2007; Charter & Keiller, 2014). Access to peer and family support provide skills and knowledge and resources. It is valuable to foster

innovativeness and resilience in a community. Further research needs to investigate the value exchange in informal repair relationships.

6 Conclusion

The research explored factors influencing repair propensity in a sample of individuals with pro-environmental inclination using an extensive survey. Innovativeness and frugality were significant factors within the quantitative analysis, and financial considerations and access to peer and family support were prominent factors influencing repair in the qualitative analysis. Future qualitative research with participants is needed to further explore how social factors support the repair and acquisition of repair skills as well as the extent to which limited understanding and literacy around the economy at macro and micro level may limit the consumer in their decision to repair. The study is limited in terms of generalisations as it targets a specific group of individuals, however it does provide valuable insight that could help direct resources and investment within pro-environmental organisations.

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