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The Sustainable Management of used Mobile Phones: a repertory grid analysis

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Abstract

Used mobile phones create a unique problem when it comes to managing electronic waste (E-waste). This study investigated what factors influence consumer attitudes towards adopting a more sustainable approach when dealing with their used mobile phones. A reuse, refurbish and recycle strategy (3R) was used as a lens to examine the current literature from which an initial model was developed. Using the repertory grid interview technique twelve participants in New Zealand were interviewed to try to determine their core beliefs when it came to managing their used mobile phones. The results of the study indicate that consumers care about the effect of used mobile phones on the environment and provide a direction in which to target educational messaging on sustainability and the impact of used mobile phones. Messages should focus on reusing and recycling, in order to achieve maximum value, in particular the negative effects of storing old mobile phones should be emphasized.

Keywords

E-waste, mobile phones, recycling, repertory grid analysis

Introduction

As mobile phones become more widely used, society as a whole, shares responsibility for managing their environmental impact. The twelfth United Nations Sustainable Development Goals focuses on responsible consumption and production, developing sustainable approaches to recycling is an important part of this goal, as are the efforts to establish a circular economy (Stahel, 2016) where manufactured goods are fully or partly reused rather than being thrown away. The issue with mobile phones is that people appear to prefer to keep them rather than send them for recycling (Welfens et al. 2013). The problem with this approach is that they are more likely to end up in the household waste stream than recycling centers (Jang and Kim 2010). However, even when recycling options are available, approximately 90% of mobile phones still end up in landfills (Silveira and Chang 2010) where they leach toxic chemicals such as heavy metals into the surrounding environment (Sarath et al. 2015). This situation is made worse by the rapid life cycle of mobile phones that is between 9 months and 2 years and is driven by both technological and fashion changes (Wilhelm et al. 2015). Using data from New Zealand, this paper explores how consumer attitudes and their underlying factors play a role when it comes to managing used mobile phones.

Mobile Phones as E-Waste

As one of the smallest yet most widely used devices, mobile phones are a significant contributor to the issue of e-waste (Ongondo and Williams 2011a). The original brick phones available in the early 1980's were used by only a few people (Wilson 2010) however, by 2013, mobile phone sales worldwide totaled 1.8 billion units, an increase of 3.5 percent from 2012 (Rivera and van der Meulen 2014). It is predicted that the number of mobile phones being retired every year will continue to grow, however only a small number of these mobile phones are being collected (Geyer and Blass 2010). In New Zealand, in 2013/2014 there were over 5.3 million mobile connections with mobile revenue sales of 2.49 billion dollars (Commerce Commission 2015). This results in estimates of up to three million mobile phones becoming obsolete every year with only about two per cent of those phones being recycled, and suggests that over 70 percent of people have at least one unconnected mobile phone (Fletcher 2014).

Mobile phones can be defined as being a disposal technology, that is, a technology that is expected to have a short life cycle (Huang and Truong 2008). This short innovation cycle along with low recycling rates means the issue of mobile phone waste will only increase (Perkins et al. 2014). Another problematic aspect of mobile phones is their relatively small size which means people find it easier to dispose of them in inconspicuous ways that are not necessary sustainable, such as in house hold rubbish (Huang and Truong 2008). Their small size also makes them much easier to store and as a result, consumers may be less inhibited when it comes to storing them in a cupboard or drawer because they take up little room (Baxter and Gram-Hanssen 2016). It may even encourage consumers to store several generations of mobile phones at home, compounding the problem for the future, as it only delays the entry of the mobile phones into the waste stream (Jang and Kim 2010).

Mobile phones that are collected for reuse, often end up going to third world countries (Panambunan-Ferse and Breiter 2013) however, the importation of mobile phones for reuse can be problematic. For instance in 2010, 3,112,669 used mobiles phones were imported into Sri Lanka and that volume steadily increased to 3,968,084 in 2013, which indicates a 27 percent growth in import volumes over a 4-year period (Thavalingam and Karunasena 2016). This creates an issue when the mobile phones reach the end of their useful lives and need to be recycled, because in developing countries, the importation and recycling of e-waste is often unregulated (Heacock et al. 2016). Ghana for example has no regulations to manage the inflow of waste electronic products and of the 70 percent of second hand products that were imported in 2009, a significant portion were deemed to be electronic products that were nearly at the end of their useful life and therefore likely to enter the waste stream within a short period (Amoyaw-Osei et al. 2011). Informal recycling is problematic because the recycling process, such as the burning of electronics in large open fires, releases large amounts of toxic gas (Sarath et al. 2015) and the process is often overseen by people without any protective clothing (Welfens et al. 2013). There is also the potential for chemicals within the mobile phones to combine during low temperature open burning and create by-products that are even more toxic than the phones individual components (Nnorom and Osibanjo 2009).

In 1994, New Zealand signed up to the Basel Convention, which deals with the import and export of hazardous waste across international boundaries (Ministry for the Environment 2007). In 2002, the Basel Convention began to address issues of e-waste including introducing the Mobile Phone Partnership Initiative (MPPI), which promotes the management of end-of-life mobile phones and focuses on;

1. Achieving better product stewardship.
2. Influencing consumer behavior towards more environmentally friendly actions.
3. Promoting the best reuse, refurbishing, material recovery, recycling and disposal options.
4. Mobilizing political and institutional support for environmentally sound management (Basel.Convention 2008).

In October 2008 the overall guidance for MPPI was submitted to the ninth meeting of the Conference of Parties to the Basel Convention and in October 2011 the final guidance for MPPI was adopted (Basel.Convention 2011).

The 3 R's

Murugesan (2008) discussed a strategy for keeping e-waste out of landfills that consisted of reuse, refurbish and recycling (The 3 R's). This approach provides the option of reuse where products do not require any intervention and are still functional when they reach the end of their useful life with a particular consumer. Whilst the 3R's proposed by Murugesan (2008) are strategies designed to limit the environmental impact of e-waste this study considers the 3R's from a different perspective, they are used as a lens to examine consumer attitudes towards the sustainable management of used mobile phones. Reuse, refurbish and recycle are all potential outcomes when a consumer's current mobile phone is perceived to have reached the end of its initial useful life. However, each of these outcomes are based on different underlying concepts, the implications of which are discussed next.

Reuse

Reuse is defined an outcome that is based on consumer attitudes towards the storing of a used mobile phone for future reuse, or alternatively, consumer attitudes towards the passing of a mobile phone onto a

third party for reuse but not recycling. This can include on giving or selling the mobile phone to friends, family, charity, or even being used as a trade-in for a new mobile phone. A mobile phone could even be stored for a period and then passed onto a third party.

Refurbish

Some studies (Quariguasi Frota Neto and Bloemhof-Ruwaard 2009) use the term refurbish or remanufacture to represent processes such as the repair or upgrading of a mobile phone for resale. However, for the purpose of this research, refurbishing is defined as an outcome that is based on consumer attitudes towards the purchasing a refurbished mobile phone.

Recycle

Recycling is defined as an outcome that is based on consumer attitudes towards engaging with recycling. For this study, this is when a mobile phone is sent to a third party to be broken down into its component parts or materials for reuse, but where the phone will not be reused as a communication device.

Extending the 3R's – The 3R model

A review of the current literature was undertaken using keywords such as 'sustainability', 'mobile phones', 'attitudes' and 'e-waste' Additional key words and sentences together with citation tracking were also used to expand the literature search further. The model shown as Figure 1 was developed using the 3R's described by Murugesan (2008) as a lens through which to examine the literature, and to address the research question:

What factors and consumer attitudes affect the sustainable management of used mobile phones?

Initially, a causation, deductive coding approach was adopted during the literature review using methods described by Miles, Huberman, and Saldana (2013). This meant that during the literature review initial master codes were developed to reflect areas in each class of variable. For example, attitudes that affected reuse were coded as reuse-storing or reuse-on giving. The literature was then reviewed again to identify sub codes that reflected the model factors and their perceived direction of causation. However it became clear that there was an overlap in terms of how certain factors or sub codes could be applied to more than one higher level attitude or code, as a result a simultaneous coding approach was then also adopted forming a hybrid approach (Saldaña 2013).

Two attitudes were identified as affecting reuse, these were storing and on giving. These attitudes are in turn influenced by a number of underlying factors such as gender, availability of a spare phone, trade in value etc. as detailed in Figure 1.

Refurbishing was been linked to one underlying attitude, the attitude towards purchasing a refurbished mobile phone. The process of sending a phone away to a third party for refurbishing is already contained within the reuse outcome, however there is still a need to account for people's perceptions towards purchasing a refurbished mobile phone. As with attitudes towards storing and on giving, it appears purchasing a refurbished mobile phone is impacted by a number of underlying factors such as knowledge, price and reputation as detailed in Figure 1.

Recycling is the last of the three outcomes presented in the 3R model, and as with refurbishing, has been linked to a single attitude, engaging, which is defined as the decision consumers make to engage in the recycling of mobile phones. Engagement is directly affected by several underlying factors such as regulations, incentives and social norms as shown in Figure 1. Engagement is important because for any recycling program to be successful consumers need to be actively engaged (Yau 2012).

Research Method

The aim of this research is to understand how people's attitudes are defined by their experiences. In order to achieve this, Personal construct theory (PCT) was adopted. PCT was first proposed by Kelly (1955) to explain how people conceptualize their experiences. It views individuals as scientists who actively try to understand the world around them by attempting to recognize repeating patterns in their experiences

(Jankowicz 2005), and then representing those patterns as bi polar concepts called constructs (Paszowska-Rogacz and Kabzinska 2012).

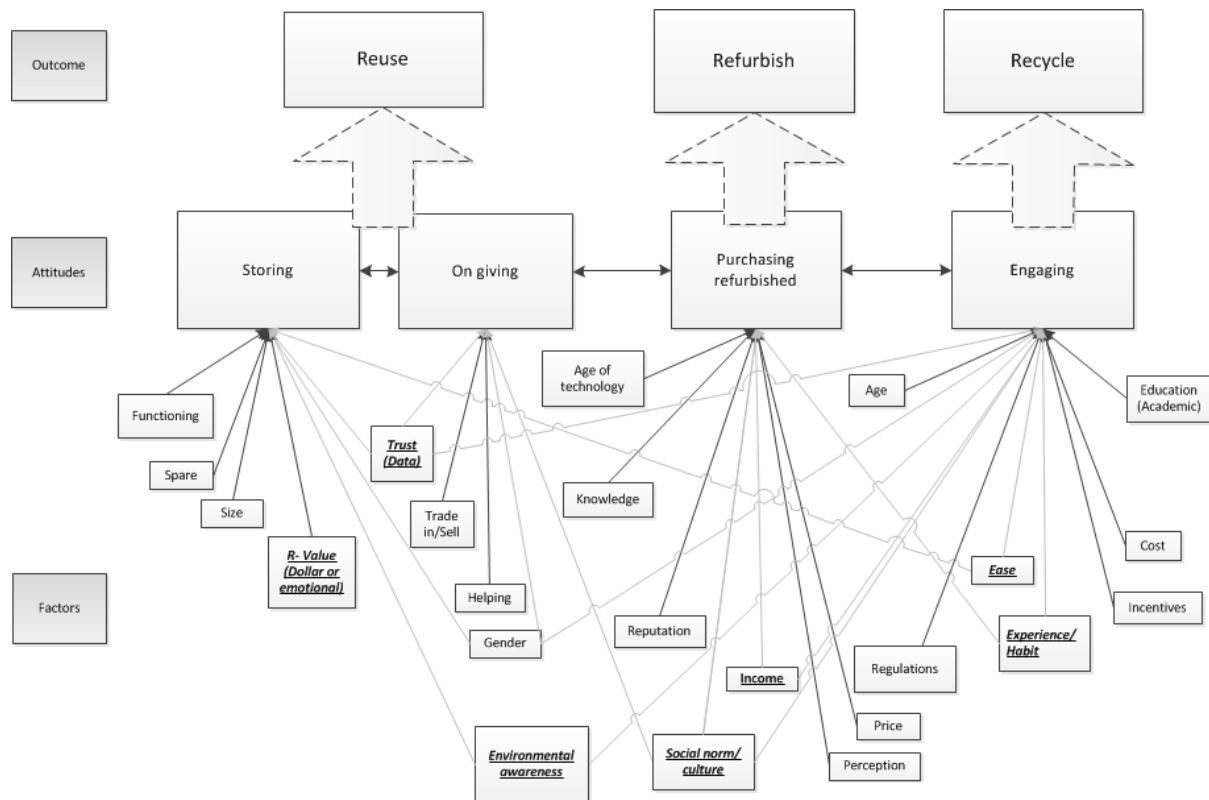


Figure 1. The 3R Model

The repertory grid (repgrid) interview method, also developed by Kelly, is a way to tap into people’s constructs. It is being increasingly used in information systems research because it helps to elicit participants underlying attitudes and beliefs (Bernard and Flitman 2002; Hunter and Beck 2000; Tan and Hunter 2002; Whyte and Bytheway 1996) and can be used for both quantitative and qualitative research (Marsden and Littler 2000). A repgrid consists of a matrix of elements and constructs, the elements are areas of interest whilst the constructs are descriptions that are used to explain the elements, and are created as poles. The elements and constructs can be created either by the interviewer (supplied element) or the subject (elicited element) (Tan and Hunter 2002). For this research, the elements were developed by the researcher with all but one of the constructs being elicited from the participants, this is consistent with the approach suggest by Jankowicz (2005). Whilst the use of preconceived elements does have the potential to introduce some researcher bias it is the preferred approach when trying to compare participants’ mental models as it acts as a common denominator (Wright 2006). The elements themselves are aligned between the opposing poles of the constructs and each element is rated using either a Likert or dichotomous yes/no scale to indicate which pole it is closer to. A five point Likert scale was adopted for use in this study. Because elements were supplied and not elicited a process of element familiarization (Fallman and Waterworth 2005) was undertaken with each participant prior to the interview to ensure they fully understood the context of each element.

In total five elements were used during the interview process. These consisted of three elements relating to reusing, refurbishing, and recycling old mobile phones as these represented the area of interest. Two grounding elements were also provided, “the worst thing to do with an old mobile phone” and “the ideal thing to do with an old mobile phone”.

A triadic elicitation process was used during the interviews where participants were presented with a group of three elements, and asked which two elements were similar to each other but were different from the third. An example, is where participants were asked, of these three areas, “Reusing an old mobile phone”, “Purchasing a refurbished mobile phone” and the “Ideal thing to do with old mobile phone”, which two were similar but different from the third. The phrase or word the participant used to describe why two of the elements were similar was captured as an initial construct at the emergent pole of the repertory grid. For example, “Reusing an old mobile phone” and “Purchasing a refurbished old mobile phone” could be similar because of the idea of “reusing parts for self”. The phrase or word that the participant then used to describe why the third element was not similar was then captured as an initial construct at the implicit pole of repertory grid.

Sample size and selection

Tan and Hunter (2002) suggest a sample size between 15 and 25 is large enough to generate enough constructs within the repgrid technique however, Winter (2003) suggests a smaller sample size of between 10-17 is sufficient to elicit a satisfactory number of factors, whilst other studies have only used 2 participants for repgrid generation (Phythian and King 1992). For this research, 12 participants were interviewed using a convenience sampling approach with each interview expected to produce at least 10 elicited constructs and a single supplied construct. Interviews were in depth and lasted between 90 minutes and two hours. Whilst a convenience sampling approach was adopted, care was taken to ensure participants were as diverse as possible. All participants were located in the Wellington region of New Zealand.

Content analysis

This study used directed content analysis as the intent was to test a theoretical model (Hsieh and Shannon 2005). Directed content analysis is deductive in nature, the researcher establishes some predetermined key words or categories using sources such as the current literature (Kondracki et al. 2002). This approach is appropriate where there is some pre-existing knowledge as was the case in this research. Whilst the constructs formed the meaning units for the content analysis (Jankowicz 2005), the context in which the constructs were created was also considered. In order to determine where a core construct belonged in the coding matrix a number of areas were reviewed. These included:

- An examination of the underlying subordinate constructs that generated the core constructs.
- The repgrid elements that led to the original construct elicitation.
- The background demographic questions captured using the short questionnaire at the start of the interview.
- An interview memo.
- The interview recording.

Findings

The results from each participant were reviewed individually in terms of both the elements in their individual repertory grid and the general results suggested by their constructs. The repertory grids were then reviewed as a group. Overall the results of the element analysis suggests that in general, all three approaches, reuse, refurbishing and recycling appear to be perceived as being good ways of managing used mobile phones, but to varying degrees. However, whilst all three are generally perceived to be good, participants appeared to prefer either reuse or recycling out of the three approaches. The alignment of reuse towards the ideal thing to do is potentially problematic considering the long-term, environmental ramifications, of storing used mobile phones. In general, the perception that reuse and therefore storing a used mobile phone is closer to the ideal thing to do provides some support to Baxter and Gram-Hanssen (2016) where it was suggested that mobile phones may be stored because people perceive their actions as being environmentally neutral. However, the results of this study suggest that the environmentally neutral position may be too conservative and that in fact people perceive storing as a positive outcome in terms of the environment.

Content analysis

A ranking system was adopted in this research to compare how frequently certain codes occur (Hsieh and Shannon 2005). This ranking related to how many codes were coded to a specific subcategory, category or combination of subcategory-category. The frequency of the codes found within a specific area was used as an indicator of its importance to the participants as a group. Constructs were assigned to subcategories, but several subcategories had links to more than one category. As a result, the content analysis table was compressed and realigned so that subcategories, which were related to multiple categories, were now split by category. This meant that categories that had been previously split by subcategory could now be combined. The result was that it was possible to give each category a ranking as shown in Figure 2.

Discussion

This study attempted to determine what underlying factors impact people's attitudes, and how those attitudes can affect the sustainable management of used mobile phones. It appears, based on the repgrid element analysis, participants generally see reuse, purchasing refurbished mobile phones and recycling as positive ways to manage used mobile phones, the following section will discuss the both the factors and attitudes presented in the 3R model that lead to these outcomes. Subcategories which did not receive any coded constructs are not included in the discussion.

Environmental awareness

There have been conflicting suggestions that consumers with greater environmental awareness are more likely to engage in recycling (Leiserowitz et al. 2006; Welfens et al. 2015; Yin et al. 2014) or conversely that higher levels of environmental awareness makes no difference (Baxter and Gram-Hanssen 2016; Wang et al. 2011). The results of this study seem to indicate there is a link between environmental awareness and engagement as it was the top subcategory/category ranking in this study. However, the degree to which people feel environmental awareness is important appears to vary across individuals. An important implication of these results is that it identifies that people's core beliefs reflect a need to be environmentally aware and recycle old mobile phones, which is important because people's core beliefs are the most difficult beliefs to change. Therefore, the challenge of raising environmental awareness using educational programs does not face the task of having to create or change existing core beliefs, however there is still a need to leverage and amplify existing beliefs in order to be effective. By raising this relative level of importance, it may be possible stimulate behavioral changes that reflect those heightened attitudes.

Environmental awareness was also linked with storing old mobile phones and was one of the top three subcategory/category rankings in this study. When considered together with the suggestion that storing is perceived to be closer to the ideal thing to do than the worst it provides additional support that concern for the environment plays a role in peoples attitudes towards storing used mobile phones. Several other studies (Ongondo and Williams 2011a; Speake and Yangke 2015; Suckling and Lee 2015; Welfens et al. 2013; Wilhelm et al. 2011; Ylä-Mella et al. 2015) have identified that people tend to store their used mobile phones. As suggested previously, the problem is that storing a used mobile phone may not be the most environmentally appropriate course of action because of the potential loss of future use (Ylä-Mella et al. 2015) and the risk that stored mobile phones are more likely to end up in the household rubbish (Jang and Kim 2010). Finally, the impact of environmental awareness when considered in the context of purchasing refurbished mobile phones does not appear to be significant. As a result, environmental awareness appears to be an important consideration across two areas, storing and engagement. It is therefore suggested educational and take back programs should target people's perceptions that storing a used mobile phone is an environmentally friendly option and provide information to suggest the contrary is true, whilst at the same time continuing to encourage recycling.

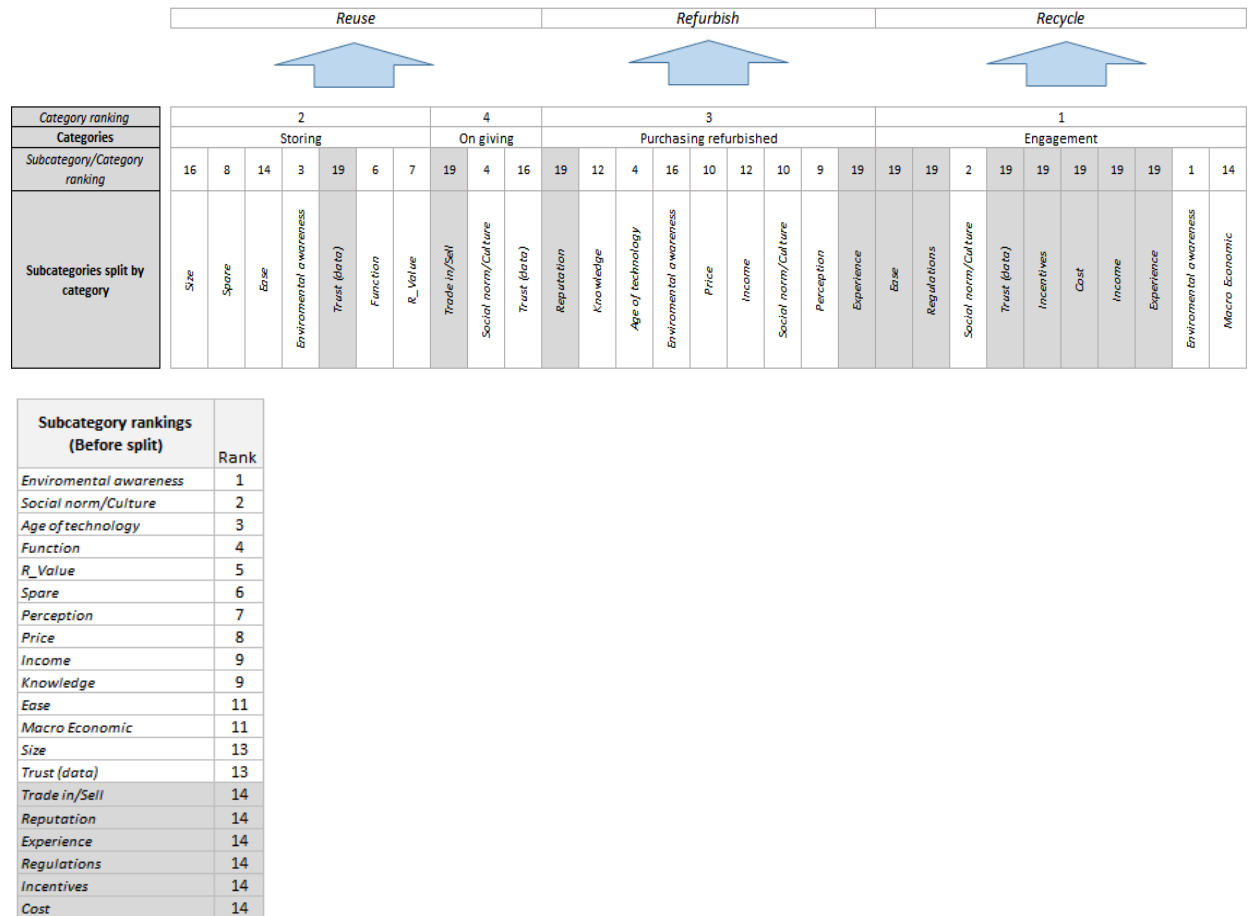


Figure 2: The 3R model after Content Analysis

Note: Subcategories shaded in grey received no coded constructs

Social norm/culture

This study seems to indicate that the social norms and culture that surround peoples lives is the second most important subcategory that affects attitudes towards engaging with recycling, and is significantly more important than any other remaining subcategory under engagement (Figure 2). This supports the suggestion by Hansmann et al. (2006) that both the social and cultural background of individuals appears to impact behaviour, as well as Welfens et al. (2015) who suggested that educational messages needed to target social groups in order to be effective. The use of social media to deliver targeted educational programs may be a good approach because of their speed and levels of distribution, social networks can achieve greater reach at a relatively low cost compared to more traditional modes of delivery such as television and radio advertising. Educational messages that target both environmental awareness and social norm/culture at the same time may also provide the greatest levels of return in terms of improving attitudes towards engaging with recycling and this is important because engagement appears to be the most significant category. For example targeting emotive subjects such as children and future generations, which were often referenced at various levels in peoples constructs, and linking those with concerns for the environment to create messages that emphasise the need to sustain resources for future generations.

Age of technology and perception

The age of technology subcategory and its relationship with purchasing refurbished phones was the only combination under purchasing refurbished that had a significantly high subcategory-category ranking

(Figure 2). This suggests that the age of technology is a significant consideration when people consider purchasing a refurbished mobile phone. This appears to support Ylä-Mella et al. (2015) where it was asserted that the short lifespan of technology is a concern for consumers, which in turn supports suggestions that people are concerned about refurbished mobile phones becoming obsolete (van Weelden et al. 2015). Whilst it is possible to suggest that this concern may only occur in first world countries where consumers are aware of the fast pace of technology and therefore more sensitive to technological changes, it is likely to also be valid in third world countries that have larger second hand markets.

Spare, functioning and residual value

All three of these subcategories appear under storing and appear to hold a mid-range level of importance in terms of people's attitudes towards storing old mobile phones (Figure 2). However, whilst there are concerns around having a spare and whether or not it is functioning, it does not appear these concerns are founded on actual experiences or outcomes. For instance, when it comes to having a spare mobile phone, Huang and Truong (2008) identified that those who store their phones do not often end up using it and Welfens et al. (2013) suggested some old mobile phones are stored even when they are no longer functioning. This suggests it may be more than just experience that is driving the relevance people place on these areas. Perhaps it relates to the need to collect and store resources, which seems more closely aligned with human instinct than learned experience.

As with the potential relationship between the spare and functioning subcategories, residual value may be related as well, in that the residual value of a phone may be tied to the fact that it still works. What was clear from this study is that when it comes to residual value the most important aspect overall for participants was the financial residual value. This materialistic form of residual value, as opposed to emotional value, may be easier to manage when trying to discourage people from storing their old mobile phone. This is because the transfer of money, particularly where money is not a major issue, may be easier than trying to manage the transfer of items that hold sentimental value. Overall, whilst these three subcategories are different enough to warrant being categorized separately there does appear to be some potential relationships between them, which suggests when trying to manage them as part of an environmental awareness program, consideration should be given towards targeting them as a group.

Ease

In this study ease was linked to both the storing of mobile phones and engagement and recycling (Figure 1). In terms of storing, ease has been identified by several authors (Thavalingam and Karunasena 2016; Ylä-Mella et al. 2015) as likely to impact people's decision to store mobile phones. This study seems to support this assertion however the level of importance which participants attributed to ease was only minimal compared to other factors (Figure 2). In terms of engagement, ease received no coded constructs indicating it did not form any part of the participants core beliefs. This may suggest that approaches that promote ease to encourage engagement, such as take back schemes in highly accessible places (Silveira and Chang 2010), or even permanent installations (Ylä-Mella et al. 2015) may not actually work as intended. The real contribution of these highly visible and accessible takeback places may be to increase the level of a person's environmental awareness which in turn affects engagement.

Size

This study appears to suggest, that whilst a mobile phone's size is considered when storing it is not a significant consideration (Figure 2). This appears to support several authors assertions that the small size of old mobile phones does not create the same type of barrier compared to other large electronic devices, and therefore does not inhibit a consumers decisions to store them (Darby and Obara 2005; Welfens et al. 2015). However, it may be possible to incentivise people to not store them by linking the size of the mobile phone to environmental messages that suggest whilst small the environmental impact can be large.

Trust

A study by Baxter and Gram-Hanssen (2016) suggested that concerns around information security did not appear to be a major concern in household surveys and as a result may be more of a concern for

businesses. The results of this study may partially support this perspective because the subcategory category combination of trust(data) and on giving only had a very low subcategory-category ranking whilst trust(data) in combination with other categories received the lowest ranking as no constructs were coded to them (Figure 2). This suggests that participants in general had virtually no concerns around the misuse of data.

Knowledge, price and income

Knowledge, price, and income were all associated with purchasing refurbished mobile phones and all had a relatively low level of importance (Figure 2). Knowledge and price are both subcategories that are used to help judge the benefit versus risks of used mobile phones (van Weelden et al. 2015), whilst income is more aligned to the relative financial status of individuals (Wang et al. 2011). Since it has been suggested that third world countries have a more developed second hand mobile phone market (Thavalingam and Karunasena 2016), it is possible to surmise that the second hand mobile phone market in New Zealand is not as developed.

In terms of income, its level of importance may also reflect the nature of the demographic group from which the participants came. Thavalingam and Karunasena (2016) suggest that financial status is a barrier to purchasing a mobile phone; however, this may only be the case when there is a significant gap between the price of a mobile phone and their relative income. As a result, whilst there was a significant difference in the income levels of participants in this study, their relative income compared to the potential price of a mobile phone did not appear to be an issue.

Incentives and cost

In this study the incentives subcategory received no constructs during content analysis (Figure 2) this seems to support Speake and Yangke (2015) who suggested incentives did not appear to be a significant factor when it comes to motivating consumers to engage in take back programs. If incentives do not form part of a person's core belief system, it seems unlikely that their use as a motivational tool, even if they are in the form of material compensation, as suggested by Welfens et al. (2015) will work. However, this non-significant outcome appears to be contrary to Ongondo and Williams (2011b) who suggested incentives are an important factor that needs to be considered when trying to improve engagement. These contrary positions may indicate that the effect of incentives is not straight forward, and that other factors may be playing a role in determining its overall effectiveness.

Reputation and experience

Two subcategories, reputation and experience, did not receive any coded constructs in relation to the category of purchasing refurbished mobile phones, whilst experience was not coded to any constructs in relation to engagement (Figure 2). This suggests reputation and experience, in terms of purchasing a refurbished mobile phone, do not form the basis of any participants' core beliefs. It is possible that their lack of importance, as with other factors related to refurbishing mobile phones, reflects the lack of a secondhand market for used mobile within New Zealand.

The lack of constructs coded to experience in terms of engagement also appears to suggest that experience/habit does not affect people's attitudes towards engagement. This is in contrast to Speake and Yangke (2015) where it was suggested there was a link between the formation of habits in terms of recycling and Welfens et al.(2015) who suggested the step to recycling e-waste may be easier if habits already exist. If people's core beliefs are developed from their experiences then the lack of core beliefs may suggest recycling, in general, was not yet an ingrained habit within the participants in this study.

Conclusion

A number of underlying factors were initially identified as likely to affect consumer attitudes towards the sustainable management of used mobile phones. The results of this study however suggest not all of those factors appear to have a role to play when it comes to consumers' core beliefs, and of those factors that do,

there is a broad variety in their level of perceived importance. Environmental awareness was identified as the most important factor in the 3R model and touches on all attitudes, from reuse to purchasing refurbished mobile phones and recycling. This means that consumers', as a group, have core beliefs that reflect a significant underlying concern for the environment however; the level of concern at the individual level is varied. Environmental awareness with its strong association with engagement means success in raising environmental awareness will improve attitudes towards engaging, which has in turn been identified as the single most important attitude.

Environmental awareness's association with storing is also associated with concern for the environment but this concern, which leads to phones being stored, is actually contrary to an environmentally sustainable approach. This means that educational messaging that works on raising awareness levels should also discourage the storing of old mobile phones by highlighting the negative environment impacts. This educational approach with its focus on environmental awareness may be the single most effective way of improving how users manage their used mobile phones.

This study has also identified that a person's social norms or cultural experiences are a significant factor associated with on giving, purchasing refurbished, and engaging, and only second in importance to environmental awareness. These beliefs are generally linked to concerns around more emotive subjects such as family, children, and future generations. The emotive nature of these beliefs could be leveraged by incorporating them into the same educational messages used to promote environmental awareness. This could be achieved by highlighting how, by not managing old mobile phones in terms of waste production and over use of resources; the negative environmental issues faced by future generations will be significant.

Another important result of this study is the limited importance that was attributed to both the attitude of purchasing refurbished mobile phones and all but one of the factors that were related to it. This confirms the relative lack of importance second hand mobile phones hold in the belief structure of participants and is a reflection of the idea that non third world countries have less developed second hand phone markets. The one factor that was identified to be important, the age of technology, indicates this is a significant consideration for people when thinking about used mobile phones. However, this area of concern does not necessarily originate from a negative perspective; rather, the age of technology can be considered positive due to its economic value compared to new mobile phones, and where the perceived functionality of the used phone meets requirements.

One final point identified in this study is that people's attitudes towards storing mobile phones or engaging in recycling do not seem to be significantly influenced by the perceived ease of undertaking these activities. Therefore, engagement in take back programs that promote the idea of ease of disposal may not be experiencing engagement because consumers are not as concerned about ease as they are about other factors. Instead, programs should focus their messaging towards environmental awareness and trying to resonate with the core beliefs that reflect consumers concerns for the environment. Overall, the results of this study provide a direction in which to target educational messaging on sustainability and the impact of used mobile phones, and these messages should focus on factors identified as important in two of the three R's in the 3R model, reusing and recycling, in order to achieve maximum value.

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