

Consumer service innovation in a circular economy – the customer value perspective

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Abstract

We are already overusing non-renewable resources and exceeding the environmental capacity of our planet and consumption is constantly growing. There is an alarming need to replace the current linear economic model with a more sustainable and preserving model called the Circular Economy (CE). The idea of the CE is to keep products and materials in use as long as possible, preserving or even increasing their value. The transition towards a CE requires a fundamental redesign of business models and end-to-end value chains. Instead of selling products, companies should move to retain ownership and sell their use as a service, allowing them to optimize the use of resources. Thus, buying for a service creates value differently for consumers than buying and owning a product. Therefore, there is a need to understand how CE-based services create value for consumers. In this study, customer value is perceived as a trade-off between the benefits and sacrifices that a consumer perceives when purchasing a product or a service. Our data is derived from consumer group interviews that took place in February 2016 in Finland. In the group interviews we introduced potential CE services to consumers. The data show that consumers are gaining practical, economic and personal benefits from three potential CE rental services: a sofa, a washing machine and clothing. Moreover, the study revealed that the benefits elicited by the washing machine model related mainly to practical benefits, while the sofa model, in particular, offered personal benefits to consumers. It also seemed that the sofa and clothing CE models entailed more psychological sacrifices compared to the washing machine model. The results also indicate that when making a decision on renting or owning, the balance between the economic benefits and sacrifices is crucial. If buying is seen as economically favourable, it easily wins out over renting, since it is a more familiar way to act. With regards to some products, personal and emotional benefits tend to override other factors.

Keywords

Circular economy, customer value, services, value creation, innovation

1 INTRODUCTION

1.1 Transition towards the circular economy

Currently, the linear economic model is based on ‘take–use–dispose’ industrial processes. Yet, we are increasingly exceeding the globe’s environmental capacity. Economically, the need for other solutions is evident as a significant amount of non-renewable resources are diminishing and the price volatility of natural resources is increasing. Global population will continue to grow, with the middle class set to top 5 billion by 2030, while many emerging nations will look for increased prosperity. Global trends, such as urbanisation, unemployment, environmental consciousness, tightening legislation and technological leaps, will accelerate the transition towards a more sustainable and preserving economic model.

While the idea of the linear economy is based on producing and consuming products as cheaply as possible and then discarding them as waste, the circular economy (CE) is based on an economic system in which no materials are wasted. In brief, CE is an economic model in which the

focus is to keep materials in use for as long as possible and also to preserve, or even upgrade, their value by creating added value through services and smart solutions (Kraaijenhagen, C. et al., 2016).

Although there are clear environmental reasons for this transformation, the CE also offers significant potential for economic growth: the transition to a circular economy will be driven by the promise of over one trillion US dollars in business opportunities, as estimated by the Ellen MacArthur Foundation (Ellen Mac Arthur Foundation (EMF) 2012). This calculation is based on the estimated material savings, increased productivity, new jobs, and new product and business innovations.

Transitioning towards the CE requires a fundamental redesign of business models and end-to-end value chains. Instead of selling products, companies should move to retain ownership and sell their use as a *service*. Transition from product selling encourages companies to extend the life-cycle of products by repairing, reusing and remanufacturing products. It also encourages the efficient use of products and strives towards cost and material

efficiency production processes (Tukker and Tischner 2006). The service model also assures that at the end products are recycled instead of being in consumers' possession after use.

In the transition towards service business, the specific characteristics of services need to be considered in CE service innovations. Services are intangible in nature and can be regarded as relational, interactive processes with customers (Edvardsson and Olsson 1996; Grönroos 1990). Consequently, the customers' role is important in the service co-production and value co-creation (Jaakkola and Hakanen 2013; Vargo and Lusch 2004). The perceived customer value is the key to successful business models in CE

1.2 Research gap and research questions

Value co-creation is the foundation of all business and economic activity (Vargo and Lusch 2004). In order to fully achieve the potential of the CE, consumers need to accrue value from the services they purchase. Customer value needs to be the central focus for companies when developing CE-based services. However, studies applying the concept of customer value to the CE context are scarce, with only a few discussions available in the PSS literature (Tukker and Tischner 2006; Tukker 2015).

Simultaneously, there is a significant knowledge gap in both academic research and business regarding the way that value is created in the CE. There is a need to increase our understanding of the way customer value is perceived by consumers in the CE and the ways in which the value concept can be better utilized when developing CE-based services. In order to answer the research need, we pose the following research question: *How do CE-based services create value for consumers?* In particular, the study identifies consumer perceived benefits and sacrifices in CE-based services.

We focus on discussing consumer perceptions of novel CE-based services and the related customer value. We chose three different price categories of consumer products, which are familiar to consumers and ideated a service model based on them. The products chosen were clothing, washing machines and sofas. In addition being in different price category products, a washing machine represents more technological item than clothing and sofa. The cases are also significant in the perspective of circular economy. Currently, the amount of money used in clothing was 662 euros per year in 2016 in Finland (TMS 2017). On the other hand, every year 13 kilograms of old textiles are thrown away in Finland (HS 2016). Globally, Finland represents a small economy and worldwide the need for the more sustainable model is huge. Furthermore, washing machines are a common example of the innovative circular economy business models enabled by IoT technologies adding value for customers and saving environment (Bressanelli et al. 2017). Thirdly, a sofa represents an interesting case of understanding of value creation related to different life styles and situations of consumers. It also explores the value creation in the context of furniture as a service that was suggested in our workshop.

We also explore the managerial implications in terms of the way the identified customer value elements can be used in developing CE-based services. The data utilized in this

study were collected in group interviews.

1.3 The structure of the paper

The paper starts with a literature review of research on consumers and customer value in the CE, followed by a description of our methodology and the study results. The findings are then discussed and conclusions drawn, with consideration given to the managerial implications and future study paths.

2 CONSUMERS AND CUSTOMER VALUE IN THE CE

2.1 Consumers' acceptance and value attributes related to CE-based services

The transition from owning a product to buying a service quite often requires that consumers have a new kind of CE-positive mindset and the will to change their everyday practices. Earlier studies have indicated that it is easier to gain acceptance of a new practice when it closely resembles other, already common, practices (Mylan 2015).

Previous studies have identified the factors that influence the acceptance of novel circular services (Antikainen et al. 2015; Lammi et al. 2011; Mylan 2015; Rexfelt and Hjort af Ornäs 2009). In order to offer superior value, services have to be easy-to-use, time saving, low-risk and cost-effective (Antikainen et al. 2015; Lammi et al. 2011; Mylan 2015).

Based on their study, Antikainen and Lammi (2016) stated that the importance of each factor differs based on the characteristics of the current product/service, as well as the characteristics of the individual consumer. According to Antikainen & Lammi (2016) some of the consumer-related factors are more linked to temporal issues, such as current life situation, and some are more permanent, such as consumers' attitudes to change. The study also presents that the relationship with the product has an influence on how attractive consumers perceive owning vs. renting or leasing (Antikainen and Lammi 2016). The products that consumers use a lot become extensions of themselves, or parts of their identity. Therefore, renting might be less attractive than owning, because owning seems to have a connection to identity building. Also, where products relate to happy life events that are significant to consumers, people have a tendency to value these products more (Antikainen and Lammi 2016). In Antikainen and Lammi's study (2016), some consumers had a close relationship with their sofas, and thus they were reluctant to hire or lease.

In the PSS literature, Tukker (2015) stated that for consumers, the most-valued attributes were having control over things, artefacts, and life itself. Consumers tend to favour owning when control seeking is an issue, and when they have tendency to value the product highly. The challenge with services is that they might be less accessible, or have less tangible value compared to owning products, since they might not allow consumers to have as much behavioural freedom. Consumer may also be suspicious in terms of the price of the service. They may perceive different kinds of risks when purchasing services and not thoroughly understanding the cost structure and what they get as the outcome of the service.

Table 1. Factors influencing acceptance/value of circular consumers services (modified from Rexfelt & Hjort af Ornäs 2009).

Factors influencing the acceptance/value of services		
Category	Factor	Author
Price	Perceived fixed and variable costs, insight in total life-cycle costs	Meijkamp 2000; Mont 2004b; Schrader 1999;
	Price of products, costly most successful	Littig 2000; Mont 2004a; Schrader 1999
	Perceived relative advantages compared to alternatives	Littig 2000; Meijkamp 2000; Mont 2004a; Schrader 1999; Ornäs 2009
	Availability wherever and whenever needed, convenience	Meijkamp 2000; Schrader 1999
Product /service	Transaction costs (time and money)	Meijkamp 2000; Schrader 1999
	Quality of the PSS, reliability	Meijkamp 2000
	Accessibility, freedom to use	Tukker 2015
	Consumer	Habits as an obstacle to acceptance
	Issue of ownership	Littig, 2000
	Environmental attitudes, may have relatively little importance	Littig 2000; Meijkamp 2000
Relationship with company	Reputation, image	Mont, 2004b; Schrader 1999
	Uncertainties risks, costs and responsibility)	Mont 2004b
	Communication between supplier and consumer	Mont 2004b

2.2 Customer value in the CE

In the emerging circular economy, services will have a profound role in a shift towards a more resource efficient economy. Whether it is a question of, for example, recycling, leasing, lending or sharing, from the companies' perspective, it is a question of developing a service business and the related business models. Value creation and customers' roles in value co-creation then become central (Vargo and Lusch 2004).

Customer value can be seen as a dual concept. Firstly, in order to be successful, companies have to create perceived value for customers. Secondly, customers in return give value through multiple forms of engagement for the company (Kumar & Reinartz 2016). One of the more commonly cited definitions of customer value is given by Zeithaml (1988 p.14), who defined "value" as "... the consumer's overall assessment of the utility of a product

based on perceptions of what is received and what is given".

In defining customer value instead of product features and technical specifications, the emphasis is often put on benefits and solutions for the customer. A service business also requires a thorough understanding of customers' contexts, needs and desires, and to involve customers in new service development (NSD) so as to enhance service innovation (Alam and Perry 2002). When innovating and designing new services, it may be beneficial to adopt a service-oriented approach to the whole business model development (Hakanen and Murtonen 2015). The change from selling ownerships towards offering service capacity and product benefits encourages companies to reconsider their processes, from design to the reuse of the products.

Customer value has been studied from many perspectives. A hierarchical structure of customer value may be represented by using a means-end chain (Woodruff, 1997; Zeithaml 1988). In this approach product attributes, that may be concrete or abstract, positive or negative, form the lowest level in the customer value hierarchy. Goals and purposes represent the highest level of the customer value hierarchy. According to this model, customers pursue relevant goals and purposes through consumption of products and services (Zeithaml 1988; Woodruff 1997).

One of the most cited definitions of customer value in the marketing literature, depicts value as a trade-off between benefits and sacrifices that customers perceive when they purchase and use a service (Eggert and Ulaga 2002; Lindgreen and Wynstra 2005; Ravald and Grönroos 1996). Benefits result from the performance of the product or service (Whittaker, Ledden and Kalafatis 2007) and concern the practical and emotional utility of the offering (Huber, Herrmann and Henneberg 2007). In addition, the quality of relationships and interaction between the service provider and the customer influences the benefits perceived by the customer (Hakanen and Jaakkola 2012; Jaakkola and Hakanen 2013; Ravald and Grönroos 1996).

On the other hand, monetary costs, time, effort and risk are sacrifices that the customer may perceive when purchasing services (Huber et al. 2007; Lapierre 2000; Ravald and Grönroos 1996). Arguably, both aspects of customer value – benefits and sacrifices – need to be considered when studying customer value in the CE. However, convincing customers of the value of a service may be a challenge for companies given the intangible nature of a service (Hakanen and Jaakkola 2012). Also, the relational and interactive nature of a service may influence the way consumers perceive the customer value of CE-based services.

The tentative framework of the study is built upon the viewpoints for customer value presented below (Figure 1). Customer value forms as a trade-off between benefits and sacrifices that customers perceive when they purchase and use a service (Eggert and Ulaga 2002; Lindgreen and Wynstra 2005; Ravald and Grönroos 1996, Woodall 2003, Zeithaml 1988). The benefits are derived into practical, economic, personal and social benefits (e.g. Woodall 2003). Since our context are consumer services we left out the strategic benefits. The sacrifices are divided into two, monetary and non-monetary sacrifices. Monetary sacrifices can be for example price, cost of use and maintenance cost.

Non-monetary costs can be related to psychological things and needed time or effort. This framework is used in identifying the factors that create value for consumers in CE-based services and analysing our data and reporting the results.

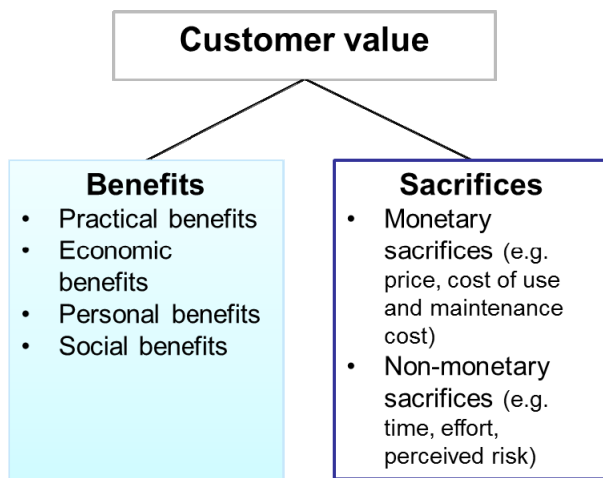


Figure 1: The customer value framework (modified from Woodall 2003; Zeithaml 1998)

3 METHODOLOGY

This paper is part of a project entitled AARRE (Capitalising on Invisible Value – User-driven Business Models in the Emerging Circular Economy).

The nature of the research and the aim to increase understanding of how CE-based services create value for consumers motivated the selection of a qualitative research approach. The qualitative research can be defined as a form of social inquiry adopting a flexible and data-driven research design, using relatively unstructured data, emphasizing the essential role of subjectivity in the research process, studying a small number of naturally occurring cases in detail, and using verbal rather than statistical forms of analysis (Hammersley 2013). In contrast to quantitative research that seeks to explain outcomes by examining the frequency with which they are empirically associated with possible causes, qualitative analysis employs a type of reasoning that is analogous to riddle-solving (Alasuutari 1995). Thus, the aim is to increase understanding of the studied phenomenon by conceptualizing it and providing rich empirical insight into the factors that create value for consumers in CE-based services. Therefore, we extend and complement prior literature with a new value creation based perspective and provide a new empirical insight and advice for practitioners in business. Instead of breadth, depth of research and richness of qualitative data were pursued with a limited number of informants.

Our data was collected from consumer group interviews. The participants were selected so that versatile, complementing views and rich qualitative data were gained on the topic. Thus, the participants differed in terms of their age, education and gender.

The group interviews took place in February 2016; 41 consumers (17 women and 24 men) were divided into five discussion groups that were facilitated by a researcher. The youngest consumer was 19 years and the oldest 72. Most of

the consumers, 22, were working, 10 were students, 5 retired and 5 unemployed. All discussions took between 2.5 and 3 hours and were recorded. The discussions were in Finnish. Group interviews were recorded as audio files and reported as text files so as to increase the reliability of the findings (Yin 2013). The data were analysed using the ATLAS software program.

Focus groups became commonplace in social sciences in the 1980's. Sociologist Robert Merton and his colleagues developed a 'focused interviewing' method after World War II (Merton, [1956] 1990). Merton and his colleagues were interested in collective behaviour and the social context of persuasion of the troops, especially in communication and in film viewers. We used a group interview method in this study, since thinking about new solutions works well in a group context. Although a researcher led the group interviews, other participants in the group also influenced the discussion.

Group interviews are a fast and efficient method; they provided the research material easily from several people. In addition, group interviews were well suited to our research setting: we were keen to find out what people think about new business models, but also how and why they think what they think (see Threlfall 1999).

In our group interviews, participants shared together, in a social context (eg Berger & Luckmann 1994), estimates and perceptions of the new business models and acceptance of the models in the near future. The method emphasized group dynamics rather than individual choice. The researcher led the situation by presenting pre-defined questions, each of which was answered in turn. The participants of the group expressed both their own assessments and commented on one another's answers and questioned each other. Thus, the interview was structured according to the situation; the views expressed by the members of the group influenced the formation of the debate.

In this study we focused on analysing group interviews related to renting a sofa, a washing machine, and clothing. We presented consumers with three comparative cases so as to gain concrete ideas about the specific CE services proposed. The CE services were selected as being representative of three different price category products. The services also differed in their level of technology-orientation: the washing machine was a technology-focused product, while the others were not. On the other hand, clothing clearly represented the most personal product of the three.

Case 1: Would you be interested in renting a sofa if:

- there would also a warranty (for example if the sofa became dirty),
- you could also change your sofa for a new one after five years?

Case 2: Would you be interested in renting a washing machine if:

- it could send information about its condition to the service provider in order to receive maintenance before it broke down,
- detergent was included in the same service package, and you could pay based on clothes

washed,

- you could also get advice on more efficient use of the washing machine (for example, detergent dosage) through your email or mobile phone?

Case 3: Would you be interested in renting clothing if:

- you could change your wardrobe based on the seasons,
- you could get everyday clothing, not just clothing for special occasions?

These questions opened up the discussions and, subsequently the informants were able to freely express their views on the topic. In order to stimulate the discussion on the reasoning of the opinions, the interviewees also asked “Why would you be interested in this service?” and “Why you wouldn’t be interested in service?”

This way, they brought up several benefits of services as well as certain concerns and sacrifices that they perceived when they compared the service model to buying a product.

The tentative framework (Figure 1) was used in collecting, analysing and categorizing the qualitative data. Tentative frameworks explain, graphically, the main things to be studied – e.g. the key factors or constructs – and the presumed relationship between them (Miles and Huberman 1994, p. 18). The purpose of the selected tentative framework was to take the customer value perspective to the field of CE. It served as a ‘lens’ through which the data was coded and analysed. The framework provided a category system, which enabled filtering of the studied aspects from the interview data (Kohlbacher 2006). That way we were able to condense the data into its essence and to reveal the insight concerning the research question.

Finally, the identified customer values (benefits/sacrifices) were compared between the three cases and conclusions drawn on the most preferable model.

4 RESULTS

Next, we provide an outline of the identified benefits and sacrifices that the group interview participants brought up in relation to the studied services. The results are categorized according to the tentative framework (Figure 1).

4.1 Practical benefits

Quality of the product

Renting seems to be more desirable when the product is expensive. Therefore it is not surprising that consumers stated that they could afford a higher quality product if they did not have to buy it. This benefit was mentioned for all cases: sofa, washing machine and clothing.

Immediate repair

Consumers appreciate ease and comfort in their everyday life. In the case of the washing machine, consumers valued the option for condition-based maintenance.

“I am interested in the hiring of washing machine especially if the maintenance is integrated, and you don’t have to take care of it.”

Increased performance

Increased performance was also stressed in the context of a washing machine, with some consumers seeing additional value if the washing machine could help them to wash

more efficiently. However, not all consumers regarded this option as valuable, while stressing the value of their privacy.

Flexibility

Based on the study the rental model for a sofa and a washing machine were appreciated for their flexibility.

“I think that it suits someone who’s just doing a one-year stint or is living in a student flat.”

“If someone moves a lot, you have to think about the washing machine and whether you’re going to leave it in the old place or take it to the new one, or maybe the new tenant wants it...for this kind of a person, this is a good option.”

Additional services

Consumers also reported that they might value a service that provides all the required furniture and fittings/accessories and even the interior design for hire.

4.2 Economic benefits

Economic benefits are one of the key factors when consumers make choices. That is especially important if the product is expensive and important in the household.

Lower risks

Concerning the washing machine and the renting of clothes, consumers saw reduced risk as being one of the benefits.

“Let’s say that you may make a mistake when you buy something, so hiring would be a good idea because you can try it for a week, two weeks or a month, and then find out if it’s any good.”

4.3 Personal benefits

Variability

Some consumers valued the idea that they would be able to change the sofa more often through hiring.

“Yes, (I would) hire all kinds of furniture, because it is based on the idea that you cannot enjoy the same sofa for 50 years, because it falls apart. You may want it today, but after three years you might want some other style.”

4.4 Psychological sacrifices

Consumers build a complicated connection to their material surroundings. Therefore, psychological factors are of great importance.

Feeling not so comfortable

In each scenario some of the consumers stated that the model feels weird to them.

“I can’t imagine that I would hire clothing for everyday use.”

“I am the kind of a person that likes to wear clothes until they fall apart. And, then...there is a feeling that others can also use them...”

Lack of relationship

In connection with the sofa and clothing in particular, consumers stated they would not feel so comfortable hiring instead of owning.

“All layers of life relate to all furniture. And I think that it would be terrible (to hire a sofa), I don’t think that I would sit on a hired sofa. I would just keep it in a corner.”

Different payment model

Some consumers saw it as a disadvantage to have, for example, a monthly payment.

“It feels odd that every month I would receive an invoice for the hired sofa.”

Privacy

Some consumers saw a reduction in their privacy as being a sacrifice. For example, for the washing machine model, they felt uncomfortable that their washing habits would be reported to the service provider.

4.5 Economic sacrifices

Higher price

Consumers also made apparent their concern about higher price, especially related to the sofa and washing machine scenarios.

Figure 2 summarizes the identified value factors in the context of three CE services.

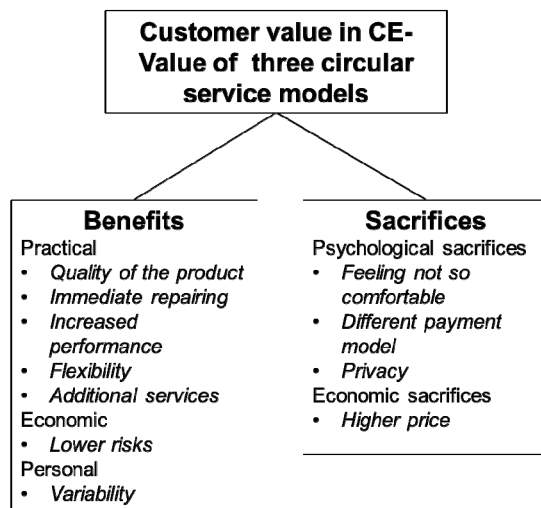


Figure 2: Identified customer values for the three circular service models.

4.6 Comparisons between the cases

Based on our analysis of the consumer data, in the case related to the renting of a washing machine, consumers saw a quick response time for maintenance as particularly beneficial. Both the clothing and washing machine rental models were seen to offer economic benefits, in the form of lower risks of making the wrong choice or breakdown of the product. Based on our results, clothing rental seemed to create value especially in the possibility of obtaining better quality garments for special occasions or to lower the risk of making the wrong choices. All in all, the practical benefits were emphasized in the discussions of the washing machine renting model, while for the sofa model, participants highlighted the personal benefits. The consumers saw a clear value creation opportunity in the increased flexibility that renting a sofa offered for people who liked to move a lot (e.g. students). On the other hand, the sofa and clothing rental models seemed to entail more psychological sacrifices than the washing machine model. The rental model for the sofa raised a lot of discussion about the payment model, the affordability and the close

relationship that some consumers appear to have with their sofas. The monthly payment model was seen as a sacrifice in all scenarios for some consumers, who did not like the idea. Moreover, the feeling of economic sacrifice was common to all cases, with consumers considering the rental model to be potentially more expensive.

5 CONCLUSIONS AND DISCUSSION

5.1 Conclusions

In this study we used the customer value framework as a lens to increase our understanding of how CE-based services create value for consumers. We analysed and compared three cases in consumer group interviews: renting a sofa, a washing machine, and clothing. The washing machine model represented a technical product, in contrast to the other two. All of the cases offered practical, economic and personal benefits but on the other hand economic and psychological sacrifices were also identified.

5.2 Practical implications

When making a decision on renting or owning, the balance between the economic benefits and sacrifices is crucial. If buying is seen as economically favourable, it easily wins out over renting, since it is a more familiar way to act. In the end the most important thing to understand for companies is that in order to make the renting model attractive, the total customer value should be perceived as higher in the renting model compared to owning.

As this paper aimed to show, there are many factors that can add or decrease the customer value in CE-based services. Some of the factors also change based on temporal issues, such as current life situation, and some are more permanent, derived from the consumers' values and attitudes like habits and old routines.

According to our explorative study, consumers seem to find more value in renting if the product is expensive and less personal. With some products, personal and emotional benefits tend to override other factors.

Owning still offers many consumers the feeling of independence, an impression of multiple choices and creativeness, as well as power and a feeling of having control over things (e.g. Tukker 2015). Also, owning might be a status related solution. Likewise, in our study, sacrifices related strongly to the different relationship that consumers have with the products they own rather than with those they do not. One explanation for this is that the relationship with a sofa or one's own clothes is closer than, for example, with a washing machine. Some memories can be linked with specific clothes or furniture. This confirms again that the transition from owning products towards buying solutions requires a change in mindset. At some level, there is a change already going on, for example, car-sharing has become popular especially in big cities, making car ownership unnecessary. Therefore, when new service models are developed it is crucial for businesses to be able to add personalisation and a feeling of co-creation for its customers and avoid the feeling dependence and loss of control.

Moreover, in this study consumers already anticipated extra value in a holistic solution for home interiors. Consequently, the next steps in creating a rental model for

washing machines could be to rent all household appliances. Furthermore, the business of clothing rental can be expanded to include the whole wardrobe, based on one's own style and the season. However, in some cases it might be necessary for companies to take smaller steps towards result-oriented services. Since consumers value personal factors, adding some personalization elements to the services might be a good source of added value. Furthermore, in order to create an in-depth understanding of the current customer mindset on CE-based services, it is important to involve consumers in the service development process from beginning to end.

5.3 Limitations

The study is a qualitative study, as its nature aims to provide a rich, contextualized understanding of the current phenomenon. Thus, instead of providing statistically generalizable results, the study aims to produce analytically generalizable results, i.e. the researcher is aiming to generalize a particular set of results to a broader theory (Yin 2003). Although, the participants represented a heterogenic group, they presumably represent a group that has more positive attitudes towards environmental issues than people in general. Therefore, for example, we might find some novel factors related to sacrifices in further studies.

5.4 Future research paths

This study contributes to the discussion of the circular economy mainly from the perspectives of service business development, consumer research and the creation of customer value. In the transformation towards the circular economy, novel business models are needed. This study offers valuable knowledge especially concerning customer value for circular business model innovation.

This study represents a first step in exploring customer value in the context of sustainable circular economy services. Since this study aims to provide analytically generalizable results the next logical step could be to conduct a quantitative study to also provide statistically generalizable data, which can offer value data, for example on the relationships between customer value factors.

Further research could seek to obtain further qualitative and quantitative data from the same context, as well as to expand the research to include other novel CE services.

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