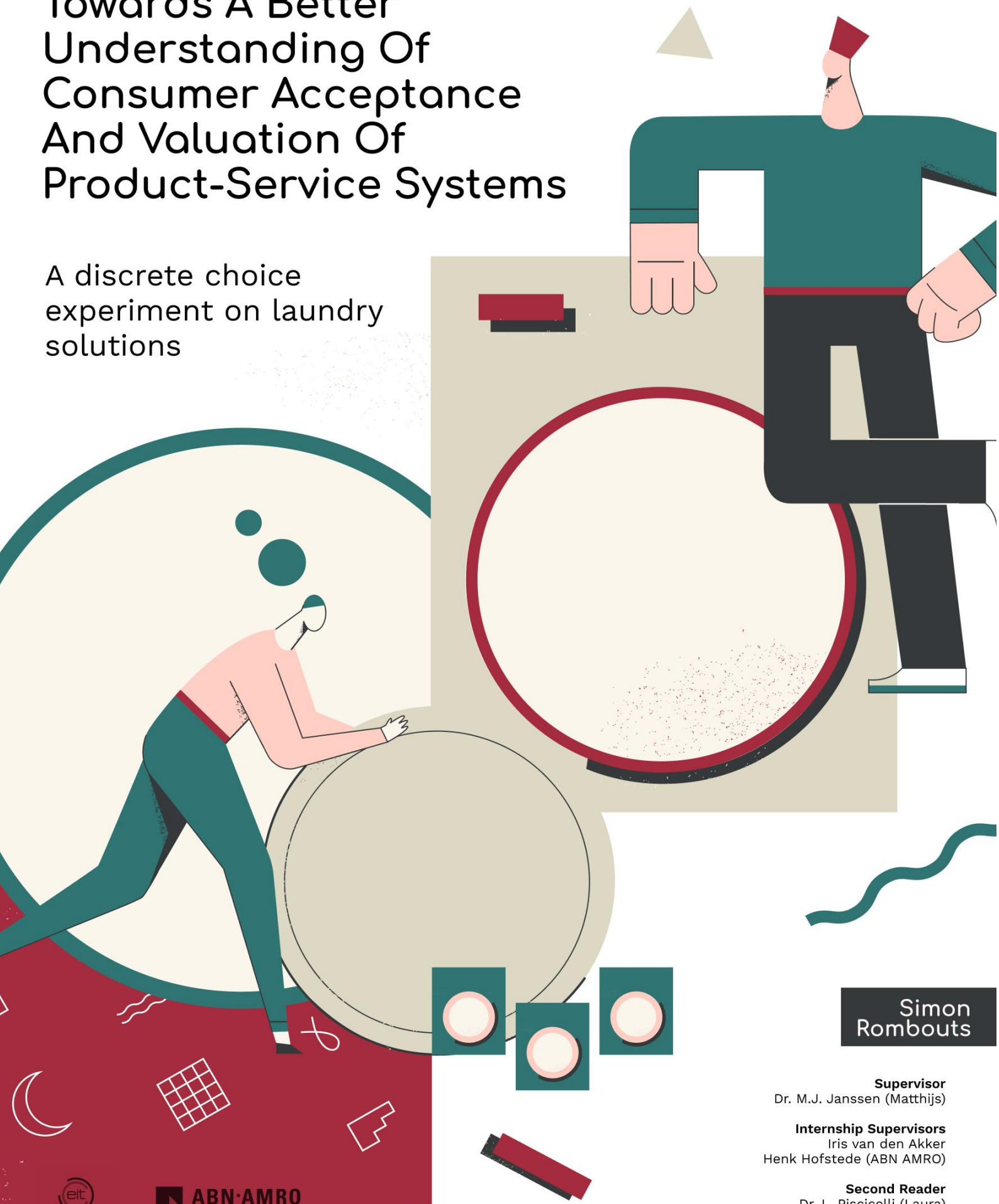
MASTER'S THESIS INTERNSHIP
MASTER SUSTAINABLE BUSINESS AND INNOVATION

Utrecht University

Towards A Better Understanding Of Consumer Acceptance And Valuation Of Product-Service Systems

A discrete choice experiment on laundry solutions



Simon Rombouts

Supervisor
Dr. M.J. Janssen (Matthijs)

Internship Supervisors
Iris van den Akker
Henk Hofstede (ABN AMRO)

Second Reader
Dr. L. Piscicelli (Laura)

Climate-KIC

ABN·AMRO

Abstract

Product-Service Systems (PSS) or Product-as-a-Service (PaaS) have been heralded as one of the ways to achieve sustainable consumption and production. PSS can lower environmental impact and enable the circular economy. However, low consumer acceptance has hindered the success of this business model. This paper analyses what determines consumer acceptance of PSS in the business-to-consumer context. This was done by examining the most important attributes of PSS, how consumers value these attributes and how this is related to their consumers' inherent characteristics. To answer the research questions, 18 interviews were held with PSS experts, that were consecutively complemented with a Discrete Choice Experiment (DCE) among 1061 Dutch consumers. It was found that consumer acceptance of a product-service systems was mainly influenced by eleven attributes of a proposition, whereof only seven were directly included in this study on laundry solutions. To show the influence of preferences for a laundry solution, the attributes were investigated on the basis of utility and importance scores. Furthermore, the discrete choice experiment allowed to test for heterogeneity among preferences for a PSS by identifying latent classes. Five different latent classes of consumers were identified, these were then described according to their characteristics. Lastly, this study investigated which consumer characteristics variables had most effect on the choice for a laundry solution. Future studies should take the utility and importance scores, variables, and latent classes into account, in order to improve the product-market fit with the consumer. This research contributes to the a better alignment of consumer needs' with PSS-propositions. Ultimately benefitting the consumer acceptance and adoption of such propositions, increasing the performance of PSS and potentially contributing to the circular economy.

Executive Summary:

Introduction:

Current patterns of production and consumption are widely understood to be a major cause of modern global environmental challenges. Circular economy and especially circular business models have been heralded as one of the main ways to decouple value creation from resource use and waste generation. This is done by radically transforming production and consumption systems. One of the most frequently mentioned business models that enables the circular economy transition and changes these production and consumption systems is the product-service system (PSS). The central focus of PSS is the shift from selling physical products to providing functionalities and benefits delivered through tangible products and intangible services.

PSS have been widely applied in a business-to-business (B2B) context but have been less successful in a business-to-consumer (B2C) context. One of the main reasons the concept has not been so successful in a B2C-context is because of lack of consumer acceptance. Limited studies have been carried out to find the reasons for consumers to accept PSS and especially which parts of the concept consumers value most. This research examines what determines consumer acceptance in PSS, which attributes of PSS are most important, how consumer value the underlying attributes of PSS, and how these are related to consumers' inherent characteristics. This quantitative study is focused on the *functionality of washed clothes*, and examines the full range of laundry solutions; buying, pay-per-month (PSS), pay-per-use (PSS), and laundry services.

Theory:

Scholars have identified that consumer acceptance is dependent on two main aspects; the attributes associated with the PSS, and the characteristics of the consumer. These characteristics influence how a consumer perceives and values the underlying attributes of the aforementioned laundry solutions, such as the PSS. An elaborate literature review, a unified framework for consumer acceptance, together with 18 expert interviews were consulted to investigate the most important attributes to consumers. These attributes were the payment-model (laundry solution), price, product quality (product class), flexibility (contract period), sustainability (circularity of the product), convenience (services), and the efficiency in use of resources (energy label). Other attributes such as complexity, observability, availability, compatibility and always the 'latest' product were also deemed important. However these were not included in this specific study, because they had less or no direct application to laundry solutions.

Method:

To examine how consumers value these attributes of the laundry solutions (mainly the PSS), and how these are related to consumers' inherent characteristics, a Discrete Choice Experiment (DCE) was conducted. In this DCE, which was completed by 1061 respondents, consumers were asked*; 'If you were to choose a laundry solution, which one of the four choices would you prefer?'*, the buy-option, the pay-per-month option, the pay-per-use option or the laundry services.

These laundry solutions -or options- were given several (alternative specific) attribute levels. These attribute levels[1] (e.g. basic, middle or upper product class) were operationalized by means of literature and real-life offerings, and refined through the earlier mentioned expert interviews.

The consumers in the survey were then asked which of these options they would choose considering the laundry solutions had certain attributes levels. Respondents chose which option they preferred most, or which options gave them most 'utility'.

[1] *The attribute is the price, the attribute level is for example 800 euro for the buy-option, or e.g. 15 euro per month for the pay-per-month options*

They were also able to go for a none-option (they would not choose any of the presented options). The choice between options is a so-called choice-task, shown in figure 1.

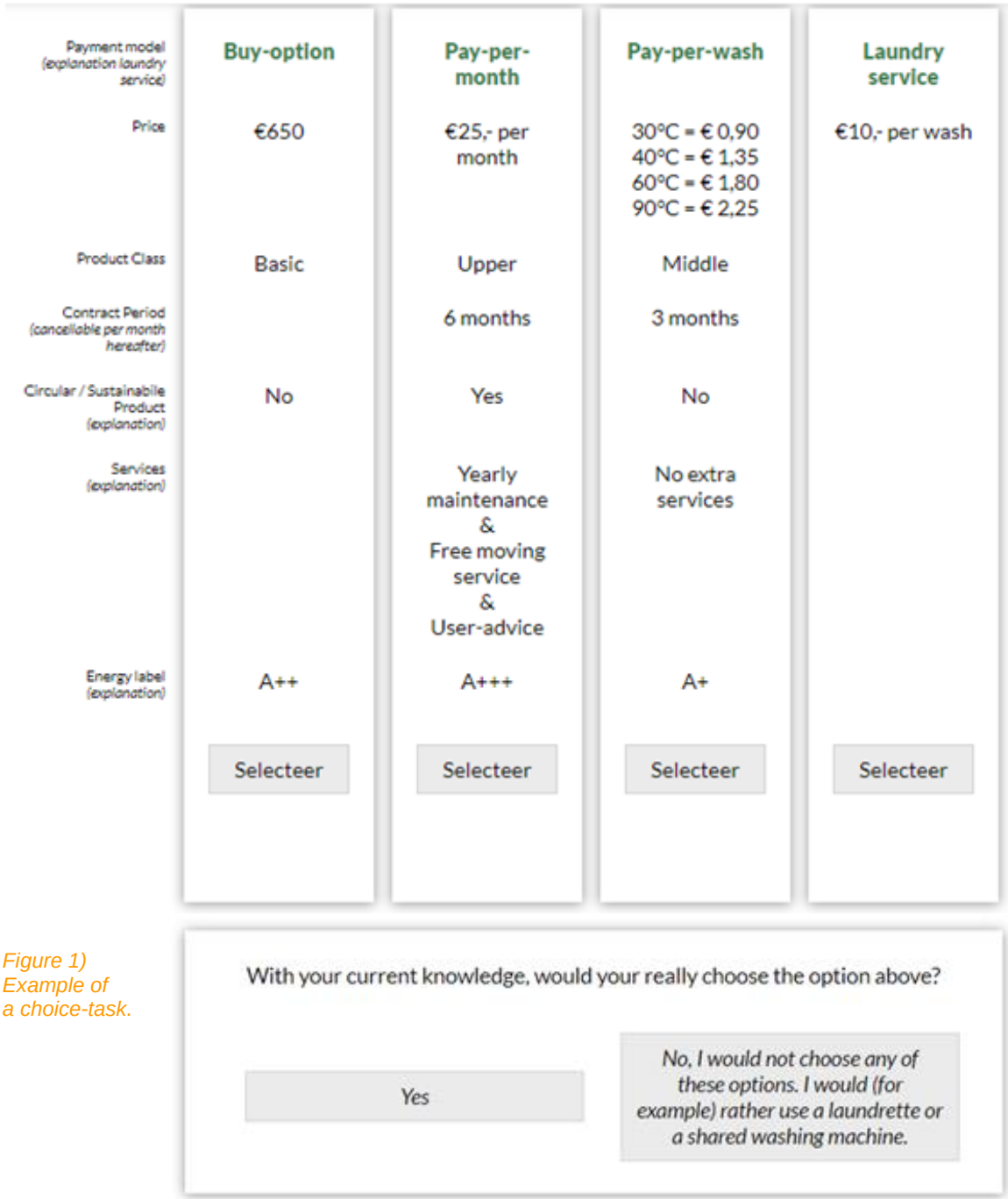


Figure 1) Example of a choice-task.

The respondents were consecutively asked to fill out a new choice-task (ten in total) but then with different attribute levels. The researchers observed which options the consumers preferred and if changes occurred when different attribute levels were presented. By implementing this approach, in a very objective way, it was found what consumers truly valued in each option and what they are willing to pay. Additionally, the survey was extended with questions about the consumers characteristics, this was done to be able to describe a segmentation of latent classes apparent from the choice-behavior[2].

[2] *The consumers (respondents in the survey) were gathered by means of a consumer panel, and through personal connections. Eventually the sample included in this research has a good representation of the Dutch consumer market, with a well-balanced socio-demographic distribution*

Results:

Following the DCE, it was found that consumer (still) chose the buy-option most of the time; 55%, the pay-per-month option 22,7% of the time, the pay-per-use option 18,8% of the time and the laundry services 3,5% of the time. Consumers behaved rationally in a way that they preferred to pay less than more, or they wanted the most premium product over lower product quality. In regard to how they valued each of the individual attributes importance, the total sample of Dutch consumers relatively based most of their choice on the *payment-model* (the type of laundry solution) and the *price* (about 35% both, and 70% in total). However consumers found the *energy label* (8,9%) most important after that. This was closely followed by the *services* (8,4%), showing that consumers in general really valued the convenience of PSS. After that the *product class* (4%) had the most relative influence on choice. The *contract period* (2,4%) was generally deemed less important than the other attributes. Lastly consumers found the *circularity* (1,8%) of the product the least important.

The researcher consequently found nine most important significant variables that would influence the choice for a laundry solution. These are shown in table 1. Furthermore for each business models it was examined what the most important predictor (consumer) characteristics were to choose for each laundry solution. The latter are elaborated upon in section 4.4.2 (see thesis).

Variable (Question)	Relation with choice of payment model
Age	Younger generations choose PSS (PPM & PPU) and LS more often than older generations.
Income	Low income respondents are more likely to choose PSS or the Laundry Service. High income respondents are more likely to choose the buy-option.
Education	Higher educated respondents are more likely to pick PSS, then lower educated respondents.
Usage of the product *(Washes/week)*	Respondents who wash a lot chose for PPM or buy-option more often, those who don't wash that much a week are more likely to choose PPU or LS.
Repairs	Respondents who have had repairs to their machine recently, are more likely to choose for models with use-guarantee such as PSS options.
Moving	Respondent who intend to move within 2 years, are more likely to choose PSS and Laundry service. Those who do not intend to choose the buy-option more often.
Environmental Awareness	Respondents who are concerned about the environment chose the PSS more often, those who are not concerned more likely choose the buy-option or LS.
Sustainability Consideration	Those who say they take sustainability into account in their consumption decisions are more likely to choose the PPU model.
Personal Innovativeness	Those who say of themselves that they are innovative chose PSS and the Laundry service more often than those who are more likely to choose the buy option.

Table 1) Most important variables for the choice of payment model

The aforementioned results are based on a homogenous sample. However, it is well-established that there are different types of consumers. Therefore the consumers were segmented into latent classes based on their choice-patterns. These were consequently described according to their consumer characteristics. It was found that there were five clearly distinctive groups of consumers. The first and biggest group (32%) are the *conservative buyers*, they do not consider any other option that the buy-option. This group is often times older and/or more wealthy than the

average consumer. The second group (11%) are the *conventional but open-minded consumers*, they would initially chose for the buy-option, but are open to other laundry solutions such as PSS given that they have the right attribute levels. This group has a wide variety of consumer characteristics. The third group (26%) are the *unlimited users*, they do not want to pay for each functional-unit (a wash), they are thus open to the buy-option but also to the pay-per-month option but not to the pay-per-wash solutions. Coincidentally this group also uses the product a lot (in this case; washes a lot). The fourth group are the *pay-per-use partisans* (19%). This group likes the pay-per-wash concept a lot, thus favouring mainly the pay-per-use concept but also the laundry services more than other groups. These consumers do not use the product (wash) a lot, and think that a pay-per-use concept will enhance their efficiency in use. The fifth and last group are the *PSS enthusiast* (11%), this group likes both the pay-per-month and pay-per-use concept. This group is identifiable by a lower income and higher sustainability consideration, and can thus be financially or sustainably motivated.

Conclusion & Recommendations:

It was found that the decision phase of consumers before a purchase of a normal products is a well-established field of research by marketeers. However, PSS are more complex since they entail both services and products. The decision phase in regard to PSS is still a neglected area of research. Nevertheless, this area could be a very important aspect for the transition towards more circular business models and ultimately the circular economy. This is the first large-N DCE study within the PSS context. In terms of methodology the DCE approach allows for an investigation into valuation of a whole concept or business model, and not just individual parts of concept. The approach is more objective than most other common research methods. The use of DCE or choice-modelling thus is an interesting way to conduct research, hopefully this method will be used more often in PSS-research.

There are multiple implications for companies currently providing PSS (or PaaS) or companies that want to put PSS on the market. Literature has stated that there is currently a low consumer acceptance for PSS. However, paradoxically this study found that there is actually quite a high percentage of consumers potentially interested in PSS. The counts analysis showed that the buy-option will remain the most important model in the future (>50% of the market), but there is actually a large legitimate market for PSS. Especially the pay-per-month (PPM) and the pay-per-use (PPU) options are forecasted to have a large portion of the current market. Based on this research PPM will have a slightly higher acceptance among consumer than PPU. Washing services seem to have the lowest acceptance of all options. However, with the current trend from ownership towards usage, this could well change in the future.

This study provides insights for PSS providers, and based on the findings it is recommended that these providers take the following into account. It was shown that the price and the payment model are the most important attributes of PSS for consumers. Because of the price sensitivity among consumers, price-setting for PSS is crucial. This might also be due to the fact that consumers find it hard to value the other facets PSS offer (e.g. the convenience (services) or the flexibility). After that, consumer highly valued the energy-label. This means that consumers do care about the energy efficiency of the machine, possibly because this provides direct cost-savings. Providing an energy-efficient machine will be worthwhile for PSS-providers, as this is an attribute consumers will base a decent part of their decision on. Additionally, consumers also value the services PSS provides. It seems that consumers value the convenience aspect of PSS. This is mainly offered through the use-guarantee (repairs & maintenance). There should be no hidden cost for such services, the consumer should be unburdened so that he or she can fully enjoy the functionality of the product.

Moreover, consumers moderately value the quality of the product. Consumers expect a higher quality; a more premium product from a PSS. A PSS provider should try to work with prime products that offer a relative advantage over the conventional offers in the market. Consumers also

moderately value the contract period. The data showed that they did not want to commit for a long time to a PSS-option. Therefore, the flexibility (to quit) in PSS models is highly valued. Consumers would rather pay a little more each month, than engage in a long(er) contract period. Lastly, consumers don't care about the circularity of the product. Selling a PSS on the basis of circularity would not gain much more customers, since this is not directly a factor that consumers base their choice on. For consumers this attribute is a 'nice-to-have'. PSS-providers should still make circularity implicit in their business model to get a more profitable business model in the long run.

This research showed there is a bigger market share possible for PSS than is currently being exploited. However, getting the proposition with corresponding attribute levels right remains a challenge. As was indicated by the interviewees; it is not only what you present to consumers that matters, also communicating your unique value proposition is important. A company that is well equipped to communicate the value of their additional services to the consumer or client, will be better able to excel in this market economy. Consumers also expect more of a PSS than of a normal product. Either this is through the latest product, more premium products or additional services. This is one of the main reasons why consumers would be willing to pay more for PSS than for the conventional purchase option. Together with the aspect that consumers find it hard to take the total-cost of ownership into account, then providers need to be very transparent in their value proposition and the normal total costs of the product over time (e.g. cost of repairs). By communicating this well to consumers, the acceptance and adoption of PSS can be raised.

Because of the segmentation made among consumers, business should be better able to tailor their PSS towards customer-needs. Marketeers can now target a group of consumers specifically on their choice behaviour and characteristics, changing the aforementioned communication and marketing strategy correspondingly. By having insights in the most important variables and predictors even better targeting can be achieved. Inherently PSS business models provide more frequent contact with the customer, which can even help sharpen the PSS-proposition further. PSS-providers are better able to imagine the consumer point-of-view and provide better product-customer fit. Moreover, with the individual HB-utility scores a market simulator can be built. This simulator can test PSS proposition and calculate shares of preference for a specific proposition in a specific market scenario. By being able to check if your proposition is preferred in a real-market scenario, costly business mistakes can be avoided.

Because of PSS, producers should already be financially motivated to develop a product with the least amount of materials. However, the incentive to change a product to increase the efficiency of resource-use (energy, water, detergents, oil) remains low (Manzini & Vezzoli, 2003). A good combination of incentives to increase this, is to make the producer responsible for these costs too. This can be done by aligning usage with the depreciation value of the asset. This way the price-setting is balanced with the depreciation over time, and actual over-usage is discouraged. One way the Dutch company HOMIE- pay-per-use washing machines, is currently doing this is by pricing based on the temperature of washing (like in the DCE) and discouraging usage through gamification. They provide their customers with scores on how sustainable they have washed during each period. They do not want to encourage too much washing, since their assets would last shorter and in the long run are depreciated quicker.

To conclude, the research question on what determines consumer acceptance has been answered by examining two main factors influencing consumer acceptance; the consumer characteristics and attributes. This research has identified which attributes are most important in PSS and how these are valued. Additionally, this study provided insights into which characteristics are most important for the choice of a laundry solution. Furthermore we have identified different latent groups of consumers, to

be better able to target inherently different types of consumers with PSS. To summarize. this research can help align PSS-propositions better to consumer' needs. It was always intended to find a part of the puzzle of helping the transition towards a more sustainable future. *'Consumer behaviour will play an important, if not the most important, role in the shift towards a circular economy'.* Hopefully this research contributed to a part of the understanding of that consumer behaviour.

Context Internship

The context in which this research proposal has been written, is that of a dual interest for circular economy and product-service systems (PSS) or Products-as-a-Service (PaaS) by ABN AMRO Bank and myself. Companies switching from selling a product to providing a product-service system have encountered large challenges for their organization and operations. Since ABN AMRO has a lot of business clients struggling with this issue, they seemed a valuable partner. Additionally, ABN AMRO has set the goals of investing one billion in circular economy projects by 2020. Enabling the development of product-service systems or product-as-a-service (PaaS) could help them achieve this goal.

PSS have been successfully applied in B2B context for decades, while B2C markets remain a largely unexplored area. With current consumptions patterns, the potential for B2C PSS is big. A hunch from both parties (ABN AMRO and me) and a first literature review suggest this could have something to do with the consumer acceptance of PSS. Hence this being the starting point for this research.

ABN AMRO maintains close relations with companies (their clients) that want to put PSS offerings on the market. To get in touch with potential customers for such PSS offerings, ABN AMRO enabled me to make use of a panel of private individuals. The consumer electronics market has been chosen as the product-range for this research since these products are generally suitable for PSS offerings and have the interest of ABN AMRO and me. This case-study is on white-goods, in particular the washing machine and the laundry service. A further detailed explanation is provided in this report.

Readers are advised to look into the survey provided in appendix I before starting to read this research, as it will give a better feel for what is exactly done in this research.

Details of the author:

Name: S.T. Rombouts (Simon)
Student Number: 4173066
Date of acceptation: 22-11-2019
Contact details: simonrombouts@hotmail.com or +31614645321
Adress: Annastraat 64, 5282 MX Boxtel, the Netherlands

Overview of Content

Table of Abbreviations

AAB	*ABN AMRO Bank*
B2B	*Business-to-Business*
B2C	*Business-to-Consumer*
CA	*Consumer Acceptance*
CE	*Circular Economy*
CEM	*Consumer Electronics Market*
CBC	*Choice Based Conjoint*
DCE	*Discrete Choice Experiment*
DOI	*Diffusion of Innovation [theory]*
LS	*Laundry Service*
MECE	*Mutually Exclusive, Collective Exhaustive*
PaaS	*Products-as-a-service*
PO-PSS	*Product-Oriented PSS*
PPM	*Pay-per-month*
PPU	*Pay-per-use*
PSS	*Product-Service Systems*
RO-PSS	*Result-Oriented PSS*
RUT	*Random Utility Theory*
SCT	*Social Construct Theory*
TAM	*Technology Acceptance Model*
TPB	*Theory of Planned Behavior*
TRA	*Theory of Reasoned Action*
UO-PSS	*Use-Oriented PSS*
UTAUT	*Unified Theory of Acceptance and Use of Technology*

Web article - ABN AMRO Bank (Dutch):

This article was composed for the website of ABN AMRO Insights, it is a shortened version of this research, specifically designed for commercial clients of the bank. This article functions as form of executive summary. The goal is to provide insights and inspire entrepreneurs. The article is written as a news item and is composed for external relations. The article can also be assessed via: https://insights.abnamro.nl/2019/11/kansen-voor-paas-in-de-consumentenmarkt-blijven-nog-vaak-onbenut/

Kansen voor PaaS in de consumentenmarkt blijven nog vaak onbenut

Huur van consumentenproducten biedt grote voordelen boven eigen aanschaf. Dit zogenoemde Product-as-a-Service-concept (PaaS) leidt tot duurzamere productie en afvalverwerking, meer spaarzaam gebruik en is in sommige gevallen goedkoper dan eigen bezit van producten. Helaas komt het concept in de consumentenmarkt nog maar mondjesmaat op gang. Door consumenten diverse keuzes te bieden en ze te helpen bij het maken van een goede afweging tussen PaaS en eigen bezit, kunnen aanbieders de acceptatie onder consumenten vergroten.

Dit blijkt uit onderzoek onder 1061 consumenten en 18 geïnterviewde PaaS-experts dat is uitgevoerd door Simon Rombouts van de Universiteit Utrecht in samenwerking met ABN AMRO.

In het onderzoek staan de ontwikkelingen op de markt voor wasmachines centraal. PaaS-concepten worden in die markt aangeboden via een abonnement met vaste betaling of via 'pay-per-use', waarbij de consument betaalt per wasbeurt. Consumenten die betalen per wasbeurt gebruiken minder stroom en wasmiddelen dan consumenten die wasmachines bezitten. De aanbieders nemen de reparaties of vervanging voor hun rekening wanneer de machine kapot gaat. Hierdoor hebben ze er belang bij om kwalitatief goede en duurzame producten te maken die bovendien eenvoudig te recyclen zijn. Experts voorspellen dat PaaS in de komende vijf tot tien jaar goed is voor 20 procent van de totale witgoedmarkt.

Aanbieders kunnen de acceptatie van PaaS vergroten door duidelijker te onderscheiden naar het type PaaS-model, bijvoorbeeld een abonnement of betalen per keer, en door transparant te zijn over de kosten. Van de consumenten die overwegen om voor PaaS te kiezen, zegt 73 procent belang te hechten aan deze twee eigenschappen. De efficiëntie van de machine (9 procent), de extra services (9 procent), de kwaliteit van het product (4 procent) en de contractperiode (3 procent) worden als minder belangrijk gezien.

Uit de enquête blijkt dat consumenten PaaS vaak nog te duur vinden ten opzichte van koop. Consumenten blijken echter niet in staat een goede afweging te maken tussen huur en koop omdat ze de totale kosten van een zelf aangeschaft product over de hele levensduur niet kennen. Ze kunnen daarmee ook de waarde van de extra services zoals onderhoud en reparaties maar moeilijk op waarde schatten. Door meer inzicht te geven in de waarde van de additionele services van PaaS en deze helder af te zetten tegen koop kunnen consumenten een betere afweging maken.

Een groot deel van de consumenten is doorgaans positief over PaaS. Van hen staat 12 procent direct open voor het concept, ongeacht het type. Een groep 26 procent zegt best te willen kiezen voor een abonnement, maar niet zo snel voor betalen per keer. Dit omdat deze groep onbelemmerd van het product gebruik wil maken en niet gefactureerd wil worden op basis van het gebruik. Van de respondenten zegt 19 procent vooral open te staan voor het betalen per keer. Deze groep is

gecharmeerd van de duurzaamheid van het concept en wast relatief weinig, waardoor PaaS zeker voor hen een goedkoop alternatief biedt. Tot slot is 43 procent bereid slechts onder voorwaarden op PaaS over te stappen of de voorkeur te blijven geven aan koop.

Uit een analyse van deze respondenten blijkt dat vooral duurzame consumenten, jongeren, laag opgeleiden of mensen met een lager inkomen vaker geneigd zijn om te kiezen voor PaaS. Ditzelfde geldt voor consumenten die ooit reparaties nodig hebben gehad aan hun wasmachine, tijdelijk in Nederland verblijven of van plan zijn binnenkort te verhuizen. Voor aanbieders van PaaS betekent dit dat ze bij deze doelgroepen het snelst succes kunnen boeken.

Tot slot komt naar voren dat veel consumenten nog onvoldoende bekend zijn met het PaaS-concept, en dan in het bijzonder de betalen per keer optie. Dit kan een van de redenen zijn waarom het succes van PaaS nog achterblijft; onbekend maakt onbemind. Samengevat blijkt op de markt voor consumentenproducten nog veel onbenutte kansen liggen en er veel groeipotentieel is. Bedrijven doen er daarom goed aan om deze nieuwe vorm van gebruik serieus te onderzoeken.

'Depicting sustainable PSS-dreams in themselves will not save the earth.
Understanding what it takes to realize such dreams will'
- Tukker & Tischner, 2006

1. Introduction

Unsustainable patterns of production and consumption in dominant linear economic models are widely understood to be a major cause of modern global environmental challenges (Cherry & Pidgeon, 2018). As the need for a non-linear and more sustainable economy becomes more and more evident (Ghisellini et al., 2016; Rockström et al., 2009), society looks towards new economic models. One alternative is the circular economy (CE) model (Ellen MacArthur Foundation, 2013; Stahel, 2016). CE aims at decoupling value creation from resource use and waste generation by radically transforming aforementioned production and consumption systems (Camacho-Otero et al., 2018; Kirchherr et al., 2017).

Due to the fundamentally different approach of value creation, companies often struggle with implementing CE in their day-to-day business and business models (Lieder & Rashid, 2016; Geissdoerfer et al., 2017; Lewandowski, 2016). One of the solutions that have been proposed to reduce production and consumption levels (Mont & Plepys, 2003), and implement CE principles, is the concept of product-service systems (PSS) or Product-as-a-Service (PaaS) (Bocken et al., 2014; Goedkoop et al., 1999). The central focus of PSS is the shift from selling physical products to providing functionalities and benefits delivered through products and services (Manzini & Vezzoli, 2003).

By focusing on functionality, it could be easier to design for need-fulfillment with lower environmental impacts (Tukker, 2015). The conventional business strategy to increase turnover is to maximize units sold, hence generating more profits. In regard to product-service systems this incentive changes (Ibid.). Firms get paid by the service they deliver, and since the ownership of the product mostly stays with the PSS provider, the materials that play a role in providing these services become a cost factor (Baines et al., 2007; Tietze & Hansen, 2013). This in turn makes it more feasible to implement sustainability design and CE principles (Mont, 2002). Consequently, PSS have been heralded as a practical, effective and economical solution to implement resource-efficient CE (Mont, 2001; Mashhadi et al., 2019).

Research has shown that the main reasons for businesses to engage in PSS are to reduce environmental impact, differentiate from competitors, and to lock in customers (Mont, 2004; Baines et al., 2007). Eminently, businesses need to respond to customers' needs (Lancaster, 1966; Friedman, 2007) therefore it is argued that the real strategic strength of product-service systems is moving away from the conventional mentality of product-concepts towards thinking in fulfilling customers' needs, demands or functions (Tukker & Tischner, 2006; Kirchherr et al., 2018).

So far, the PSS concept has proved viable in the business-to-business (B2B) context, while in the business-to-consumer (B2C) market, it has been less successful (Mont & Plepys, 2003; Camacho-Otero et al., 2017). Even with the thinking from a need's perspective, actual consumer acceptance and adoptions of B2C-PSS remains low (Vezzoli et al., 2012; Piscicelli et al., 2015; Camacho-Otero et al., 2018). One would assume the consumer point-of-view and lack of adoption has been vastly researched upon. However, even though consumers are important to PPS (Catulli & Dodourova, 2013), little is known about consumers' acceptance towards PSS and their reasons for (non-)adoption (Cherry & Pidgeon, 2018).

Consumer acceptance takes place in the complex interplay of decision making processes. It may be influenced by the *attributes* of the PSS, the *trade-off* between other options and the sociodemographic & attitudinal *characteristics* of the consumer (Schmidt et al, 2015a). Characteristic examples of attributes, understood as the components or *properties* of PSS (Estrada & Romero, 2016) are for example; the revenue model or the contract period.

The lack of consumer acceptance has been regarded one of the main barriers for widespread implementation of PSS and the CE-concept accordingly (Mashhadi et al., 2019). Scholars also noted a discrepancy in PSS-provision and consumer acceptance of PSS (Matschewsky et al., 2015; Repo & Anttonen, 2017). A good understanding of acceptance can help create better product-service systems

propositions while at the same time strengthening customer relationships and boosting sales (Baines et al., 2007; Tukker, 2015).

To conclude, limited studies have been carried out to find the reasons for consumers to accept PSS, and to find which attributes consumers value most (Rexfelt & Hiort af Ornäs, 2009; Mont, 2002). Literature so far has under-addressed the consumer point-of-view, as it was mostly focused on the business perspective, underexploring the consumers wishes', beliefs and behavior (Mont et al., 2017; Lewandowski, 2016). Moreover, insights in which attributes of PSS are crucial for consumer acceptance and adoption are lacking (Mont & Plepys, 2003). Therefore, a systemic approach on the concept of consumer acceptance of PSS is needed.

Accordingly, this report will address the research gap for poor PSS acceptance by answering the following research question and sub-questions;

What determines consumer acceptance of product-service systems?

SQ1. What are the most important attributes of a product-service system?

SQ2. How do consumers value these attributes?

SQ3. How is this related to consumers' inherent characteristics?

This research will be applied to the consumer electronics market (CEM), as consumer electronics follow most of the characteristics of Tischner et al. (2002) for products that are highly fit for PSS provision[3], and because these products are easy to identify with for consumers (Roy, 2000; Hankammer & Steiner, 2015). The selected CEM product is the washing machine, as it represents a big variety of PSS models with different attribute levels. Washing machines have already been applied as PSS (Bocken et al., 2018) such as pay-per-month (lease) model or the pay-per-use (wash) model. This research considers all possible ways to achieve the functionality of having *washed clothes*, therefore also the purchase option and the complete laundry service are represented. Concluding that 'laundry' provides a relevant context fitting with the methodology.

First, to determine the consumer acceptance of PSS in the context of washing machines and laundry services, a list of general attributes of PSS that are of importance to consumers will be composed. This list will be based on desk research and interviews. Insights in these attributes can already aid the marketing, commercialization, and customer alignment of PSS.

Second, a quantitative research approach has been chosen for assessing the influence of the identified attributes on PSS acceptance. Quantitative methods have rarely been used in PSS research, but could provide valuable and generalizable results (Reim et al., 2015; Neely, 2008). The consumers' value of the attributes of PSS will be tested by means of a Discrete Choice Experiment (DCE) concerning (PSS-) offerings of washing machines and services. These offerings are based on existing propositions. A DCE enables the researcher to find the utility and importance given to each attribute, and enables for segmentation in consumers (Louviere & Woodworth, 1983).

Finally, a survey based on the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2012) will be used for identifying and categorizing consumers' sociodemographic characteristics and attitudinal behavior in a PSS context. In the end, more knowledge on acceptance and adoption of PSS can help make the PSS-market bigger and more viable, which could contribute to the transition to a more circular and sustainable economy.

This research method of using a DCE (complemented with a survey on sociodemographic characteristics) has not previously been used in the context of assessing PSS acceptance. DCEs have higher validity than normal surveys or contingent valuation methods, and can enable causality statements. Moreover, DCE's allow for calculating willingness-to-pay, and for predicting future acceptance and adoption behavior (Orme, 2012). Practically, this research provides insights in the

[3] *Products that are; expensive, technical advanced (requiring maintenance & repair), easy to transport, infrequently used by the consumer, and not highly influenced by fashion and trends.*

importance of attributes, and the acceptance and adoption of PSS by consumers. It adds to the existing body of literature for PSS and provides insights in how latent consumer groups can be targeted when commercializing PSS. Additionally, it can help shift mindset in consumers from wanting to own products to preferring being happy with the service or functionality (Hou & Neely, 2013).

As several authors have indicated, consumers are not yet fully convinced to adopt PSS (Baines et al., 2007; Catulli, 2012; Halme et al., 2006; Vezzoli et al., 2015). Helping to understand the heterogeneity in consumers can support more tailored PSS and enhance PSS acceptance. There has already been qualitative research on preferences and attitudes towards PSS, however a quantitative approach to find acceptance and the utility given to attributes of PSS has not yet been researched in this context. Investigation of consumer acceptance for PSS is essential in analyzing and promoting whether PSS innovation can really induce a transition towards a more circular society. After all, transitions that fail to address the consumer point-of-view will ultimately be unlikely to result in a successful sustainability transition (Böcker & Meelen, 2017; Kemp & van Lente, 2011; McMeekin & Southerthon, 2012).

In the next chapter the theoretical framework and the provisional attributes of PSS will be elaborated, and most important concepts will be clarified. Chapter 3 contains an explanation of the quantitative research approach, the data collection, and analysis methods. Results are presented in Chapter 4. This research ends with the discussion and the most important conclusions in Chapter 5.

2. Theory

To answer the research questions, three sub-questions have been proposed. As explained, consumer[4] acceptance is dependent on two main aspects; the attributes of PSS and the characteristics of the consumer. After elaborating the different *types of PSS* and the concept of *consumer acceptance*, the *attributes* influencing consumers to accept a certain PSS are outlined. Subsequently the framework to assess *consumer characteristics* and *consumer segments* will be outlined. An overview of the theoretical model used for answering the research question (RQ) and sub-questions (SQ) is shown in figure 1.

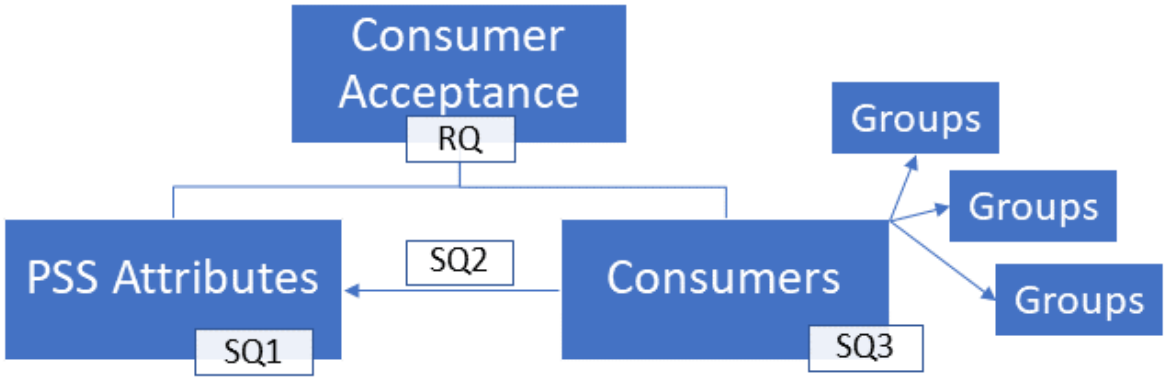


Figure 1 – Overview of the research concepts and their relation to the research questions

2.1.1. Related streams of literature

This research is mostly based on PSS literature, although also other related streams of literature are taken into account. One of the related streams of literature that got increasing attention lately, is access-based consumption (Bardhi & Eckhart, 2012). This field relates to PSS as they define access-based consumption as transactions in which no transfer of ownership takes place. PSS also has some

[4] *Some literature explicitly states customers, however in the business-to-consumer market, a customer can (mostly) be regarded similar as a consumer.*

overlap with collaborative consumption; which *makes use of temporary access non-ownership models of utilizing consumer goods and services* (Belk, 2014). Additionally, PSS is related to *Servitization*; the process of companies switching from selling products to providing services (Baines et al., 2007). Together with PSS literature these research fields were assessed in the search for useful attributes and factors influencing consumer acceptance.

All these streams of literature have some form of non-ownership aspect in common. This research also focusses only on those PSS where ownership remains with the PSS provider. However, to get insight in the whole range of possible decisions by consumers, not only PSS, but also the 'conventional' purchase option and a full service option (laundry service) are taken into account. Additionally this research will focus on individually owned product, sharing business models will thus not included.

2.1.2. Different types of PSS

PSS represent combinations of product and service offerings, it is neither a pure product (purchase) or a pure service. Baines et al. (2007) defined PSS as '*an integrated product and service offering that delivers value in use'.* A definition also capturing the consumer point-of-view, and therefore more useful for our purposes, is the following; '*PSS consists of a mix of tangible products and intangible services designed and combined so that they jointly are capable of fulfilling final customer [consumer] needs'* (Tukker & Tischner, 2006, p. 1552).

PSS's can be placed in a product-service continuum (Oliva & Kallenberg, 2003). In this continuum an offering can be anywhere between a pure product toward pure service (see figure 2).

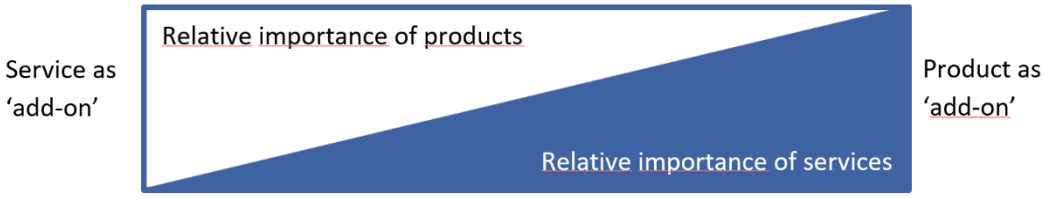


Figure 2 - Product-Service Continuum - Adapted from Oliva & Kallenberg (2003)

According to Tukker (2004) a PSS is a set of product and services that together are fulfilling a customers' need, hence he proposed a service-orientation classification, which was based on the importance of the product and the service offering. Tukker (2004) classified these types into three commonly accepted categories (archetypes): *i) Product-oriented, ii) Use-oriented, and iii) Result-oriented services*.

The first category is the *product-oriented (PO-)PSS,* a category focused on selling the product to the customer, so the customer is still the owner of the product. Additional services can be provided that are directly related to the product, like maintenance and user advice. [5]

The second category are the *use-oriented (UO-)PSS,* in this category the focus shift towards services that involve the usage of the product. The ownership of the product stays with the PSS-provider. In this way the provider is selling the function of the product. Typical UO-systems are leasing, renting and pooling.

The third category are the *result-oriented (RO-)PSS*, in this category the aim is to replace the product with a service, however still a product is provided (other than with pure service). However, the product is no longer part of the consumption. In this case the full ownership remains with the PSS-provider;

[5]*Because ownership is transferred in this type, this category of PSS will not be included in this research. This is done because the sustainability incentives are decreased when the responsibility stays with the user.*

the provision of the service is now outcome based. Typical ways to provide these PSS are with activity management, pay-per-service-unit or per functional result (performance contracts).

These categories provide a way to make a distinction as to where a PSS is on the PSS-continuum. A short overview of the differences of each category are presented in table 1.

Service orientation	**Product-oriented PSS** *Not included in this study*	**Use-oriented PSS**	**Result-oriented PSS**
Level of services provided	*Basic*	*Intermediate*	*Advanced or Integrated*
Type of PSS offering	*Product plus the integration of extra services added to the product.*	*Product and services focused on the product usage.*	*Total service integration, product is no longer part of the consumption.*
Ownership	*Consumer **owns** the PSS*	*Provider owns the PSS*	*Provider owns the PSS*
Revenue model:	*Pay per product (ownership)*	*Pay per period, access or item of product and services (asset utilization)*	*Pay per use or pay per service unit or performance (asset utilization)*

Table 1 - Overview of the differences of the three PSS categories – Based on Tukker (2004) and Neely (2008)

2.2. Concept of Consumer Acceptance

Acceptance is the *affirmative attitude* by subjects, which is dependent on the *reference object* (Schmidt et al., 2015a). Every consumer is influenced by their own values and beliefs (Schmidt et al. 2015a), which are in turn based on the consumer characteristics and the product itself (the attributes). The consumer characteristics are subdivided socio-demographic and attitudinal characteristics. To give an example, price is an attribute, and income is a (socio-demographic) consumer characteristic. It depends on the height of the income if a consumer perceives something as cheap or expensive. This perception about the attributes are the so-called *values* and *beliefs* (figure 3).

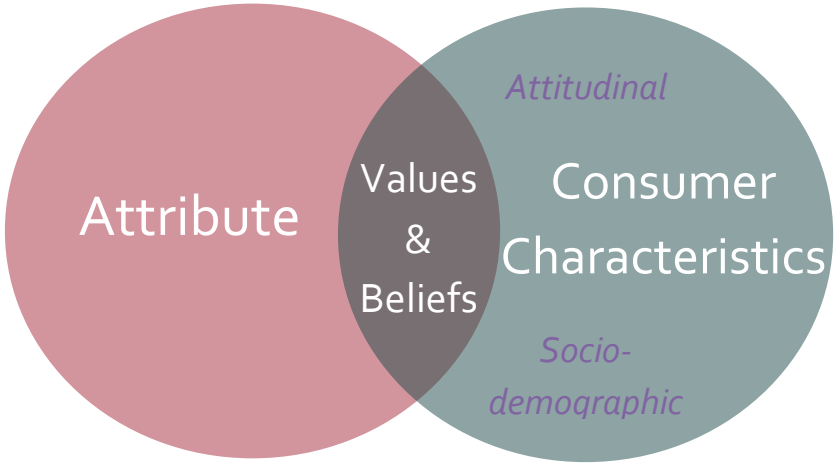


Figure 3 - Concepts used for examining consumer acceptance (based on Schmidt et al., 2015a)

Some scholars define consumer acceptance as a post-adoption concept (Poppelaars et al., 2018), meaning an affirmative attitude after someone has adopted and used a product. This research however uses the pre-adoption definition of considering an alternative as a valid option (Venkatesh et al., 2012; Davis, 1985). Acceptance is used synonymously with the intention to use or adopt a product, as one first has to accept a product before it can be adopted (Schenkl et al., 2014). The two main concepts will be explained in the following paragraphs.

2.3. Attributes of PSS

Attributes of PSS are the main focus of this research as they could provide insights in the specific features of an offering consumers do or do not value. Attributes can be broadly described and labelled as the most important components of a PSS-proposition (Sammer & Wüstenhagen, 2006), since they capture the specific *properties* of the PSS (Estrada & Romero, 2016). Attributes enable the researcher to find out which aspects consumers value most in PSS, and in such manner help future creation of PSS. The attributes have been obtained by measure of a literature review and were further refined by means of interviews with PSS experts (appendix V and complementary material).

Selling a product differs significantly from selling a service (Antikainen et al., 2015; Schotman & Ludden, 2014). Since PSS can be split in closely interlinked but conceptually distinct tangible (product) and intangible (service) components, a better understandig of what is important to consumers can shine light upon the true value of PSS (Tukker & Tischner, 2006). For example, convenience could be more meaningful to some consumers than price (Mont & Plepys, 2003). Tukker (2004) and Bates et al. (2003) argue that an added service component makes the consumer willingness to accept and pay more. Particularly in B2C markets, it has been shown that PSS providers have to provide extra tangible or intangible utilities to the consumer, otherwise they will not accept and adopt PSS due to their perceptions and behaviours (Tukker, 2015). Thus, consumer acceptance plays a key role in creating successful product-service offerings. In previous (empirical) studies, authors have listed attributes and factors that affect consumer acceptance of PSS. These are shown in table 2[6].

Attribute	Definition	Author(s)
Revenue Model / Price *Nested*	Payment structure; cost for the product-service system. *More expensive products more succesful.*	Tukker (2004), Rexfelt & Hiort af Ornäs (2009)
Ownership *Nested*	Becoming owner of the product (only for product-oriented PSS)	Catulli (2013), Rexfelt & Hiort af Ornäs (2009), Cherry & Pidgeon (2018)
5 Perceived Attributes of Innovation	**Relative Advantage**; performance compared to alternatives (usefulness) **Complexity;** ease of learning, ease of use **Compatibility;** how congruent the product is in current life **Trialability;** trial periods **Observability;** visibility of the product	Rogers (2010) Rexfelt & Hiort af Ornäs (2009), Schmidt et al., (2015a)
Quality product	The quality of the product; more premium products enabled	Antikainen & Lammi (2016), Meijkamp (2000)
Reliability	Always working, use guarantee, and durable (long product life-time)	Meijkamp (2000), Venkatesh et al. (2012),
Availability	Available & accessible whenever & wherever needed	Baines et al., (2007), Beuren et al., (2013), Lee et al. (2003)
Convenience	The amount of services provided, unburdening of the customer.	Antikainen et al. (2015), Mont & Plepys (2003), Beuren et al. (2013)
Use of resources in use	The amount of water, energy and other resources in use	Catulli (2013); Baines et al., (2007), Tukker (2015), Ramani et al. (2010)
Length of PSS engagement	Length of contract; contract period	Tukker (2015)
Flexibility	Time it takes to stop PSS engagement and the contract period	Cherry & Pidgeon (2018), Venkatesh et al. (2012)
Sustainable Product	Product produced sustainable and made out of sustainable materials. *'Emissions and resources during productions, material use or other environmental concerns are mitigated'*	Catulli (2013), Cherry & Pidgeon (2018), ThØgersen (1995), Chou et al. (2015)

Table 2 – Previously listed PSS attributes by authors, modified from Rexfelt & Hiort af Ornäs (2009) and Antikainen & Lammi (2016)

[6] *Aestethics of the products have not been included in this research, as they are highly subjective to individual norms and have an unlimited amount of variables included.*

This list of attributes is not yet mutually exclusive and collectively exhaustive. To achieve most parsimonious results, these attributes are further specified and operationalized to fit the relevant context of the washing-machine (see methodology).

2.4. Consumer characteristics

As argued in the introduction, PSS have a large potential for contributing to the circular economy. It was found that that these PSS have not been widely accepted and adopted by consumers. Mashhadi et al. (2019) note that consumer acceptance of PSS has been a barrier to their widespread implementation. When consumers do not accept PSS, they will not adopt PSS, and companies will lack incentives to create them (Barquet et al., 2013).

The root of the problem might lie within consumers' behaviour and their consumption patterns. Companies still must cope with irrational consumers, who are heavily influenced by their perceptions. Consumers tend to go for cheaper or more convenient options, and often perceive PSS as a more expensive alternative (Pettersson, 2000; Mont, 2002; Catulli, 2012). It has been acknowledged that consumers base their choices not only on rational calculations but also on their own values, habits, and knowledge (Thøgersen, 1995; Fishbein & Ajzen, 2011). Ultimately consumers also tend to rely on their emotional and subjective beliefs and attitudes (Davis, 1985). They are not only influenced by the attributes of PSS but also on how they perceive these attributes. This perception is formed by the sociodemographic and attitudinal characteristics of the consumer[7], as was indicated by the values and beliefs in figure 3.

The Technology Acceptance Model (TAM) by Davis (1989) states that actual usage of a technology is governed by intentions, which are determined by beliefs and attitudes (Davis, 1989). Venkatesh et al., (2003) showed that intention can be used synonymously with consumer acceptance, and actual usage of technology with actual adoption. This looks as follows (figure 4):

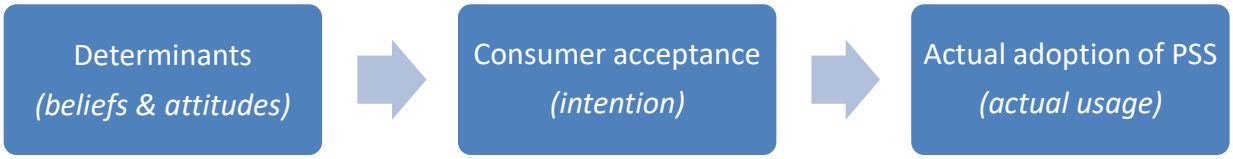


Figure 4 - Determinants influencing acceptance which in turn influences adoption

A more elaborate model of the TAM was proposed by Venkatesh et al. (2003). They called this model the Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh et al. (2003) made a synthesis of eight different acceptance & adoption theories[8], including well-known examples like the TAM, the Theory of Planned Behavior (TPB) and the Diffusion of Innovation (DOI) by Rogers (2010). These three theories were put forward by Rexfelt & Hiort af Ornäs (2009) as useful theories in prescribing factors to be central to acceptance of PSS solutions.

UTAUT originally stems from IT-research, it makes studying acceptance and use of technology in consumer context possible (Venkatesh et al., 2012). The model has high variance explained in consumer acceptance and actual adoption and has been tailored in such a way that it fits the context of consumer technologies.

[7] *Personal characteristics such as; age, salary, their previous experience with this business model or PSS in general, environmental awareness, personal innovativeness, or trust in PSS are included (Agarwal & Prasad, 1998; Hunecke et al., 2001; Pavlou, 2003; Rosen, 2004; Lee & Song, 2013; Slade et al., 2015).*

[8] *The eight models reviewed are TRA, TAM, the motivational model, TPB, a model combining the TAM & TPB, the model of PC utilization, DOI theory, and the SCT.*

An explanation of the constructs and determinants is given in Appendix II. The complete theoretical model (without moderating effects) can be seen in figure 5.

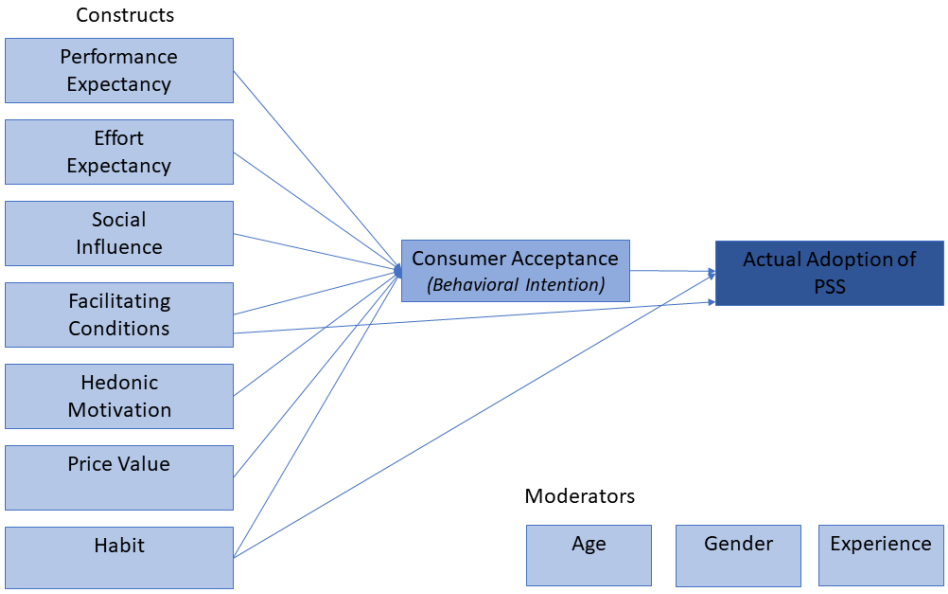


Figure 5 - UTAUT for PSS acceptance and adoption (without moderating effects; see appendix II)

The UTAUT provides an overview of important constructs and moderators into behaviour. However, many of these concepts are abstract and take quite some time to investigate. Taking all constructs into account would be very comprehensive, while this research tries to understand which aspects truly value most to consumers. For this reason the UTAUT model was checked and adapted by interviewing experts within the field of PSS. The interviews provided insights and were eventually decisive in which constructs to include in this specific study on washing-machine based PSS.

Despite an increase popularity of acceptance models, Planing & Britzelmaier (2011) argue that the use of these models alone is not enough. It would be better to apply multiple methods that can triangulate with other frameworks. The UTAUT is therefore a good starting point for acceptance research, but it has to be complemented with other approaches.

Simply asking consumers what they think of a certain PSS proposition will not yield valuable or representative results (Johnson et al., 2013; Chrzan & Orme, 2000). Therefore a research method combining the the objectivity of the trade-offs between alternatives, the attributes of PSS and the consumer characteristics is vital. Conventional approaches to increase consumer acceptance focus solely on influencing the product itself, but forget the trade-off with other alternatives and the perception by the consumers (Schmidt et al., 2015a). When this is better understood this can help influence PSS acceptance and adoption. Therefore avoid biases, and subjective factors (e.g. heuristics) surrounding an adoption-decision, a discrete choice experiment is proposed. This will be elaborated upon in the next chapter.

3. Methods

In this chapter the methodology to answer the research question will be elaborated. This section will consist of seven subparagraphs; unit of analysis, research design, data collection, DCE, additional variables, data analysis and the descriptive statistics of the sample.

3.1. Unit of Analysis and Case Selection

The unit of analysis of this research are consumers in the consumer electronics market (CEM); more specifically the 'white-goods' market. White-goods are small and big electrical household appliances. This research aims to find the acceptance towards PSS from a consumer point-of-view (B2C-market) with the washing-machine as a case-study (Yin, 2017). Specifically, it will attempt to clarify preferences of (fictional) PSS propositions, as a function of variations in its attributes. The washing machine was chosen as a case-study as it would be a good representation of PSS within the whole CEM. All four options of the payment model are currently present in the CEM, it fits the characteristics of a potential interesting PaaS (footnote 1), and the product utilizes resources in use (which makes for the possibility to calculate the cost in use over time). Additionally, this research uses consumer characteristics to cross-analyze the findings over different consumer groups.

3.2. Research Design

3.2.1. Delineation of PSS attributes

For the construction of the DCE, a list of valid attributes concerning the *washing* PSS is important. Well researched attributes and attribute levels of PSS are essential to achieve meaningful results, and to ensure high internal validity (Hensher et al., 2005). At first attributes were distilled from literature (theory section). Subsequently these attributes were evaluated by expert interviews from different fields; like PSS companies (PSS-providers and CEM-manufacturers), academics and advisors. These interviews help shed light on the operationalization of attributes and their levels. The interviews did not only provide insights in attributes, but also in other aspects. Five coding categories were used; attributes, important consumer variables, trade-offs for consumers, methodology related comments, and an 'other' category. An anonymized list of interviewees is shown in table 3.

Nr.	Type of interviewee	Profession:	Length:
1.	Academic	Professor Design for Sustainable Consumer Behaviour	45:31
2.	Academic	Professor User-Centred Design and Technology-Mediated Services	1:03:54
3.	Academic	Professor of Social, Institutional and Cultural dynamics which influence & shape the diffusion PSS. Re-engineering business for sustainability (REBUS)	1:01:51
4.	Academic	PhD-candidate Product Innovation & Management for sustainable consumer behaviour	1:43:54
5.	Manufacturer	Resource Efficiency Manager – Sustainable clothing + lease a jeans provider	35:22
6.	Manufacturer	Manager OPEX & Head Legal Team – White goods appliances manufacturer	1:38:54
7.	Manufacturer	Managing Director/CEO – White goods appliances manufacturer	50:54
8.	Manufacturer	Resource Efficiency Manager – Responsible Phone-as-a-Service pilot	35:54
9.	Manufacturer	Founder & Managing Director – Bike as a service company	32:51
10.	Manufacturer	Founder of Headphones as a Service company	46:44
11.	Manufacturer	Sustainability and Circularity Manager – Bed manufacturer	41:20
12.	Manufacturer	Circular Project Lead the Netherlands– Kitchen, furniture and interior company	44:58
13.	PSS-advisor	Founder & Entrepreneur of a PaaS company	1:15:54
14.	PSS-advisor	Laundry-branch organization representative & Laundry on Demand entrepreneur	55:54
15.	PSS-advisor	Sustainable Finance Specialist – PaaS expert	38:18
16.	Intermediary	Manager Products-as-a-Service – Large online retailer of consumer goods	45:32
17.	Intermediary	Marketing Director – PaaS leasing and logistics company	53:41
18.	Intermediary	Founder & CEO – Pay-per-Use (wash) Laundry company	1:05:59

Table 3 - Anonymized list of interviewees used for attribute refinement

***Intermediaries** = Providers of PSS, but not manufacturers - **Manufacturers** = Direct producers & sellers of PSS-products*

After these interviews the most important attributes of PSS were chosen by combining both literature and interview results. An overview of this process can be seen in figure 6:

Figure 6 - Overview of research process of getting to the final attributes & attribute levels

3.2.2. Attribute refinement

The interviews provided insights in the most important attributes. The outcome of the coding of the interviews, together with anonymized quotes are shown in Appendix V. A summative counting analysis on the codes was performed to find out which attributes were named most often (Hsieh & Shannon, 2005). An overview of the most important attributes is given in figure 7:

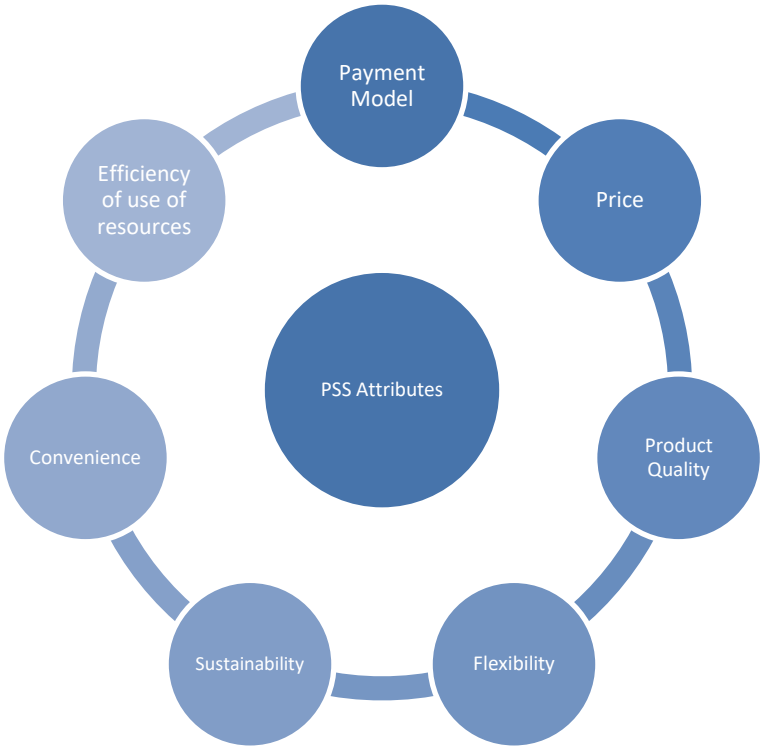


Figure 7 - Attributes selected specifically for washing machines

The attributes for PSS for this *specific* research (the DCE on washing machines) are given. However, the interviewees also named more attribute that were important for PSS in *general*. The researcher decided however that these were not directly applicable to this specific case study, and these were thus not included in this DCE-study (appendix I). To answer SQ1 completely, five general attributes were also mentioned, but not included in this research. These attributes are: complexity, observability, availability, compatibility and always the 'latest' product (see appendix V). These could be considered in future PSS-research. In comparison to the previously found attributes in the literature review; only trialability, and reliability were excluded. Trialability was not mentioned once, and was thus found not so important by the interviewed experts. Reliability was in fact already included in the survey in services (convenience). Because of the unburdening of the consumer through a PSS, the use-guarantee (reliability) was operationalized through services like repair and maintenance.

3.2.3. Operationalization of attributes

After extensive testing and refining only relevant attributes applicable to washing machines were included in the DCE. In this DCE there will be a 'nested' or primary attribute representing the type of payment model. The four types of payment models are: the buy-option, the pay-per-month (PPM), the pay-per-use (PPU) and the laundry service (LS). An explanation of these models can be found in figure 9 or appendix I. In the case of PSS, these models inherently imply that ownership remains with the provider. For the purchase option and the laundry service, ownership is respectively transferred or not applicable. All other attributes have degrees of freedom and vary over several choice-tasks.

An overview of the primary/nested attributes and the attributes with a degree of freedom can be found in Table 3.

General attribute	Operationalized Attribute	Primary / Nested attribute			
Payment model	Payment model	**Buy**	**PPM**	**PPU**	**LS**
	Ownership transfer[9]	*Yes*	*No*	*No*	*N/A*
		Attributes with a degree of freedom:			
Price	Price	Purchase €500 €650 €800 €900 €1100	Pay-per-month €10,- per month €15,- per month €17,50,- / month €20,- per month €25,- per month	Pay-per-wash[10] 30º € 1,00 40º € 1,50 60º € 2,00 90º € 2,50	Pay for LS €10,- per wash €15,- per wash €17,50 / wash €20,- per wash €25,- per wash
Product Quality	Product Class	Basic/Middle/Upper	Basic/Middle/Upper	Basic/Middle/Upper	N/A
Flexibility	Minimal Contract Period *(Cancellable every month after this)*	N/A	3 months 6 months 1 year 2 years 5 years	3 months 6 months 1 year 2 years 5 years	N/A
Sustainability	Circular Product	Yes/No	Yes/No	Yes/No	N/A
Convenience	Services	N/A	No Services or combination of: Yearly Maintenance User Advice Free moving service	No Services or combination of: Yearly Maintenance User Advice Free moving service	N/A
Efficiency in use of resources in use	Energy Label	B A A+ A++ A+++	B A A+ A++ A+++	B A A+ A++ A+++	N/A

Table 3 – Full overview of all attributes and their levels included in the DCE.

[9] *Inherent characteristic: implicit to each primary attribute.*

[10] *The attribute levels are these prices minus 20%, -10%, + 10%, and +20%. As can be seen the price is dependent on the temperature of washing.*

As can be seen from table 3, **payment model** and **price** are operationalized exactly as the general attributes. All levels included were extracted from real offerings[11]. However the laundry services were made a 25% cheaper than current offerings, since multiple interviewees expressed their concern about the currently existing options being too expensive.

Product quality was operationalized as product class, since current providers made a differentiation in mainly three classes; basic class, middle class and upper class. This attribute represents the possibility to get a more premium product with certain options.

Flexibility was operationalized as the minimal contract period, as this was the length of period a consumer needed to commit to one option. Flexibility however is also dependent on how 'easy' someone is able to quit the PSS after the minimal contract period expires. For both PSS models (PPM & PPU) a cancellation period of one month was used, this was clearly explained in the explanation page.

The **sustainability** of the product was operationalized as circularity, since this attribute focused only on the materials and design of the product. This attribute was explained as the product being produced with sustainable materials and designed for refurbishment or recycling.

Convenience is operationalized as the services a PSS-provider adds to its proposition. It is a combination of reliability (use-guarantee) and unburdening through maintenance and repairs. Futhermore additional convenience was provided throuh user advice and free moving services. The user advice is both focused on how consumers can wash more efficient and save resource and to provide knowledge on how to wash certain laundry.

The efficiency of use of resources is operationalized as the energy label. A washing machine uses three resources in use; water, detergents and electricity. Since the water and detergent are only minor parts of the cost and less important factors for consumers to base their decision on. This attribute was operationalized as the energy-label of the washing machine.[12]

Respondents of the survey had to read through an explanation page to clarify the different options, this explanation page is shown in figure 9 (also shown in the full survey of appendix I).

[11] *Companies used for the development of attribute levels are for the purchase: Coolblue & Bluemovement (Purchase & PPM), HOMIE & Bundles (PPU), Wassie & Dobbie & Miele Laundry Club (Laundry Service).*

[12] *Washing machines nowadays have an energy label higher than A+++ (e.g. indicated with A+++ 20%). It was chosen not to overcomplicate these levels, so a more easily understood normalized range between energy class B & A+++ was chosen.*

Please read the following options very carefully!

Imagine you are about to choose a new washing machine. You can either buy a machine, pay per month for a machine or use a machine in which you pay per wash (PPU). In all models water, electricity and detergent cost are at your expense. Nowadays you can even choose for laundry services. In the following section we provide these options, and we will ask you to choose which one of these has your preference.

The options are:

1. **Buy-option**

- You buy the machine at once as your own investment
- You receive 2 years guarantee, the appliance will last 8 years.
- You will be the owner of the machine, and thus responsible for maintenance and repairs[1].

2. Pay-per-month / Lease

- You pay a specified amount each month for the duration of the contract (e.g. one year). After that, it is cancellable each month.
- You don't need any investment (initial purchase amount).
- You are not (or will be) the owner of the machine.
- If the machine breaks down, it will be fixed or replaced for free within 48 hours.

3. Pay-per-wash / pay-per-use

- You have your *own* washing machine, but you pay per wash for the duration of the contract (e.g. one year).
- You don't need any investment, the cost of each wash are dependent on the temperature you wash at.
- You are not (or will be) the owner of the machine. U will receive periodic (software) updates, so you always wash most efficiently.
- If the machine breaks down a replacement or repair will be provided within 48 hours.

All the washing machines mentioned above have the same characteristics and features.
In all models water, electricity and detergents are at your own expense.

Furthermore it is possible to have your laundry done for you:

4. Laundry-service

- Your (unsorted) laundry (up to 6kg; one wash) will be picked up in a laundry-bag, washed, ironed, folded and delivered back home. This will unburden you completely.
- You do not need a washing machine, or even the space/ connection for that.

At all times you can go back to this page. At the bottom of each page; click on 'explanation page 4' to get back here.

[1] *In case respondents had questions about the options, underlined words were provided with some additional information if respondents hoovered over them.*

Figure 9 - Explanation page of the four payment models included in the survey

3.3. Data Collection

The major part of the data-collection was done through a survey that combined the DCE with additional questions on consumer characteristics. In the following paragraphs survey will be explained.

3.3.1. Sample

The respondents gathered were all potential consumers of PSS. Most of the respondents (N=950) were collected through a representative panel provided by Dynata. The other respondents (N=111) and those from the pilot-study (N=20) were gathered through personal networks of the researcher. A large sample size enhanced the external validity and the representativeness of the results. For consumer research overall Dutch population (17 million), a sample size of at least 400 consumers must be reached (with a confidence interval of 95% and a margin of error of 5%) to achieve significant and representative results (SurveyGizmo, n.d.; Bryman, 2012). This research (after cleaning) eventually reached 1016 respondents that completed the survey, and 45 partially completed surveys. Hence it is arguable that the sample size is sufficiently representative for Dutch consumers.

3.3.2. The choice-task

To get a feel for the discrete choice experiment (DCE) in the survey an example choice-task is shown (figure 10). Before a potential consumer is about to make a choice, they will be presented with the following introduction: *'If you were to choose a laundry solution, which one of the four choices would you prefer?'*

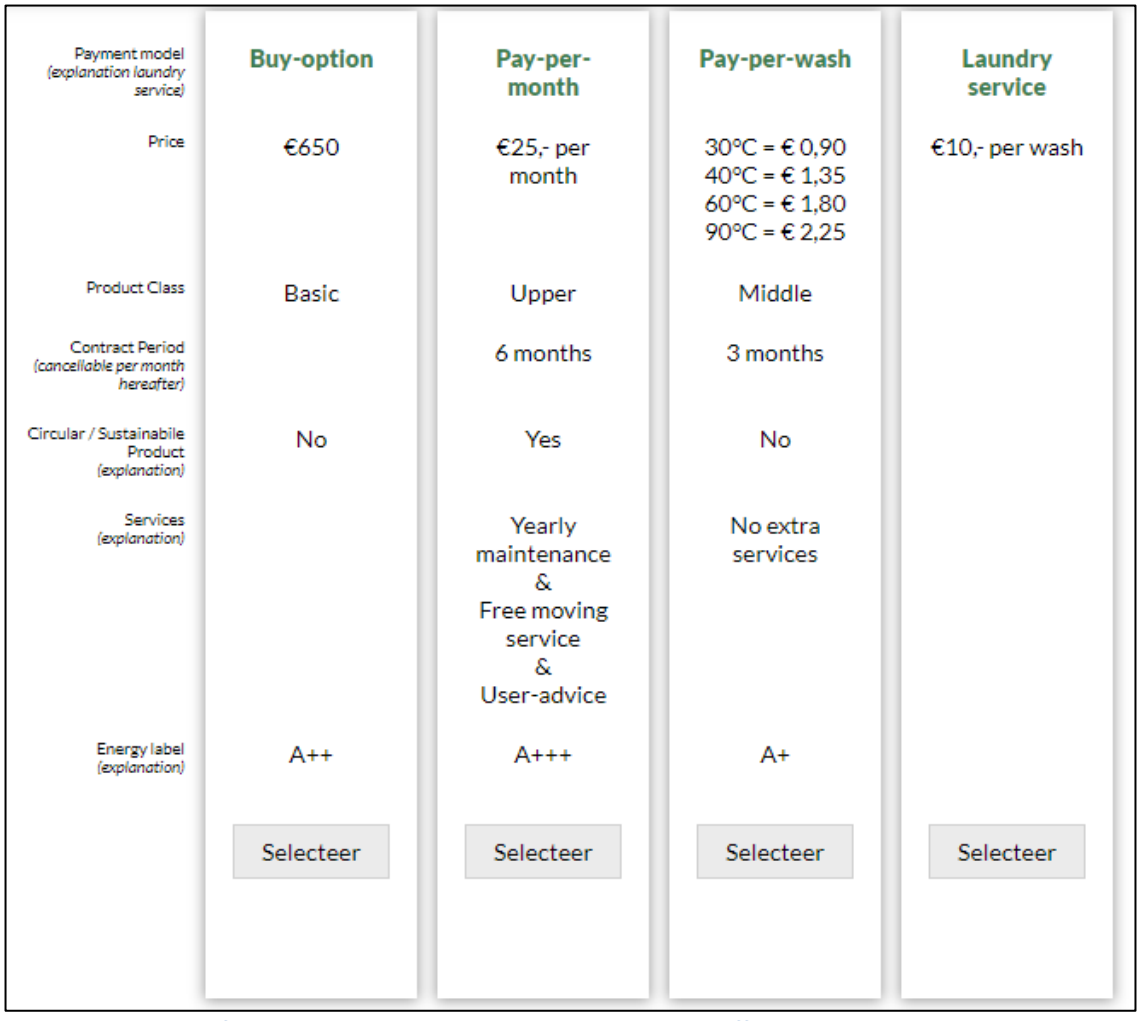


Figure 10 - An example of a choice-task set in the DCE (based on real PSS offerings)

3.3.3. Testing the survey (pilot-study)

The authors have investigated terminology and attribute levels used by consumers in a short pilot-study (N=20). This pilot study helped further testing the DCE-survey' user-friendliness, unclarities, spelling and the length. More insights in the attribute levels were gained and the number of attributes were limited. In this pilot-study the attribute levels were specified further, and unnecessary attributes levels were deleted.

The pilot-study made sure that consumers could identify with the terminology used. This was done because of possible incorrect beliefs by the researchers that did not echo in the population (Ajzen, 1991). These results can give insights in things overlooked or to determine other pressing issues, which can be tackled with beforehand. Some questions, and attributes were adjusted minorly because of the pilot-study. An overview of changes made to the initial survey can be found in appendix IV. A short visualization on how the attributes were investigated & refined is provided in figure 11.

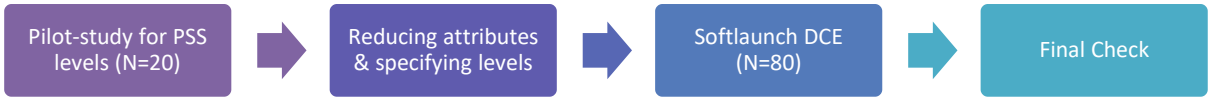


Figure 11- Overview of research process

An overview of the test-surveys in the pilot study are shown in table 4:

Test-Round	Number of tests	Average completion time	Way of testing
1	1 respondent	22 min	Manual - hardcopy
2	3 respondents	19 min	Manual - hardcopy
3	5 respondents	17 min	Manual - hardcopy
4	5 respondents	15 min	Manual - hardcopy
5	6 respondents	10 min	Online – Dynata employees

Table 4- Overview of completion time over different test-rounds

After the final check, when all research, testing and limiting has been done, the final DCE-survey can be sent out. This survey will consist of two main parts. One part will consist of the DCE with ten choice- tasks, and the other part consist of questions about the attitudinal and socio-demographic characteristics of the consumer (see full survey in Appendix I). When all respondents were gathered after the full launch, the dataset was cleaned to include only useful respondents (see figure 12).

Figure 12 - Overview of the data gathering and cleaning process

Around 10% of the respondents were discarded because of inconsistency in their answers, or because they had a total completion time of under 3,5 minutes (speeders). The latter was deemed implausible since the researchers (with prior knowledge) couldn't complete the survey themselves within 3 minutes. A median time between 10-12 minutes was predicted by means of the 20 pilot surveys, eventually a median of 9:53 was found. This progression in completion time was mainly because the survey was now fully digital compared to manually tested hard-copies.

3.4. The Discrete Choice Experiment

As has been explained, for measuring the importance of the attributes of specific PSS offerings, a Discrete Choice Experiment (DCE) is used (Louviere & Woodworth, 1983; Green & Srinivasan, 1990; Johnson et al., 2013)[13]. A DCE can measure preferences of consumers, and it has several advantages compared to regular methods like a normal survey (Swait & Adamowic, 2001; Caussade et al., 2005; Bennett & Blamey, 2001). Firstly, through a DCE a respondent must make a trade-off between certain options. This allows the researches to expose the utility[14] and importance score attached to each attribute. Secondly, compared to a normal survey, a more experimental design allows for a higher internal validity without the so called 'common method bias's (Podsakoff et al., 2003; Johnson et al., 2013). In a contingent valuation method people might answer in a socially acceptable way[15], often overstating their willingness-to-pay (Schlereth et al., 2012). Lastly, a DCE allows for the identification of latent customers groups, giving more insights in different ways of customization and marketing to latent groups of customers (Johnson et al., 2013). The DCE methodology also provide input for market-simulators, that enable 'what-if' scenario making (Orme, 2006).

In a DCE, potential consumers are provided with a series of PSS choice sets that vary in attribute levels, this will result in a so-called choice-task experiment (Carson et al., 1994; Adamowics et al., 1998). These attributes partly represent the factors that consumer think about when making their adoption decision. DCE is an overarching term for separate forms of conjoint analysis (Louviere, 1988), which is a contamination of (features) considered jointly (Con-Joint). The specific form of the DCE used in this research is called a 'Choice-Based Conjoint' (Hauser, 2007; Green & Srinivasan, 1990). The scientific base and working of the DCE is explained in paragraph 3.4.

In the proposed DCE, every respondent was asked ten choice tasks, each comprising of four choice options (the payment-models), always including one purchase option (buy), one pay-per-month option (UO-PPS), one pay-per-use/wash option (RO-PSS) and one laundry service option. When respondents are forced to make difficult trade-offs, researchers learn what they truly value. The amount of 10 choice-tasks has been chosen as it gives the maximum amount of cognitive load to a respondent without a significant decrease in attention and validity (Simon, 1955; Swait & Adamowicz, 2001a; Hensher, 2006; Rose et al., 2009).

Choice-tasks are not real product offerings, they are hypothetical simulations of composed PSSs with different attribute levels. These PSS are designed so they will mimic different real PSS business-models and are based on existing PSS offerings. In this research the DCE is designed in such a way that the respondents are in a scenario where they are just about to adopt a washing machine. They have different ways of eventually obtaining the functionality of clean clothes. After the DCE, we will include the option for respondents to state if they would have gone for the 'none' option instead (see paragraph 3.4.3; *Using the DCE; Dual Response*).

---

[13] DCEs are known for investigating willingness-to-pay with customers (Schlereth et al., 2012; Rose et al., 2009), and are mostly used in healthcare science research (Louviere, 1988; Ryan & Gerard, 2003; Train, 2009).

[14] Utility is a measure of value, it is the desirability of an aspect of one option shown in the DCE.

[15] According to Surveygizmo.com; 'simply asking users to state which factors are important to them may do more to unearth consumers' hidden biases than reveal valuable marketing info'.

To avoid errors due to correlations between the attributes, a fractional orthogonal design[16] will be used, where the *primary/nested* attributes (the payment models) will stay locked, and the attributes with a *degree of freedom* will be varied. In a design with many attributes and attribute levels not all options can be tested. A fractional design allows for only a smaller, much more manageable subset of attributes combinations to be tested. The levels of the attributes (*with degree of freedom*) vary systematically over the choice tasks and between the different surveys. Thus, each respondent will receive only a fraction of the total number of choice tasks.

3.4.1. Theoretical basis of a DCE

The Discrete Choice Experiment (DCE) is mainly based on two theories; the theory of random utility (RUT) (Manski, 1977) and the Theory of Value (Hanley et al., 1998). These two theories provide an understanding to the amount of utility (U) or Utility function that a consumer (c) attaches to an alternative or concept (a). In this case $U_{(ca)}$ comprises an observed $V_{(ca)}$ and an unobserved component $E_{(ca)}$. This makes the following formula:

$$U_{(ca)} = V_{(ca)} + E_{(ca)}$$

$V_{(ca)}$ represents the observed components of PSS attributes that are associated with the PSS alternative (a) and individual characteristics (c) that explains the choice. Additionally, there is the error component $E_{(ca)}$, which captures the unobserved factors that might influence choice. This way, based on the similarities between choices, a categorization of respondents into *latent classes* can be made (Magidson & Vermunt, 2002).

3.4.2. Alternative Specific Design

As the keen observer might have noted, not all the attributes are present in all options. The Alternative Specific Design (ASD) method enables for options (alternatives) where only some of the attributes have effect on some options (alternative specificity) (Bliemer & Rose, 2005). For example, the contract period is only relevant for the pay-per-month (PPM) and the pay-per-use (PPU) option. These attributes are therefore linked to a primary/nested attribute, in this case the payment-model. This method allowed for a design without adding specific prohibitions, that would normally mess up the orthogonal design. For this design the attribute and concepts' order were fixed to decrease cognitive capacity.

[16] *Fractional; every respondents only sees a fraction of the total number of possibilities. Orthogonal; every level is shown an equal number of times and every level is shown with other levels an equal numbers of times.*

3.4.3. Using the DCE

When starting the DCE, a short introduction about the method and an explanation of all options was given. It is important that every option and attribute was explained in detail before a respondent is subjected to the choice-task (Orme, 2006). If necessary the respondent was able to consult the explanation again. Consequently, the respondents were given ten choice-task in which they were 'forced' to choose which one of the options they preferred.

The DCE used in this research is specifically called a choice-based conjoint (CBC) analysis, because a none-option is included. This means that the respondent can choose not to go for the preferred option and choose the option not to adopt; the so-called 'free choice'. A dual response consists of a forced choice-tasks questions first, and then the 'no purchase' or 'free choice' option afterwards asking the respondents if they would go for the most preferred option above or if they rather opt-out. The latter option was chosen if none of the options provided enough utility to the respondent to justify a 'purchase' (Schlereth et al., 2012). This is done to provide a realistic scenario; if a respondent doesn't like the options available, he/she would not even adopt the most favourable one in real-life. This option is called the *dual response none-option* (Hensher, 1993; Schlereth & Skiera, 2016), and ensures that even if consumers would not prefer one option, their choice in the forced block still provided information on the relative attractiveness of attributes.

The none option directly followed each choice-task and looked as follows (figure 13).

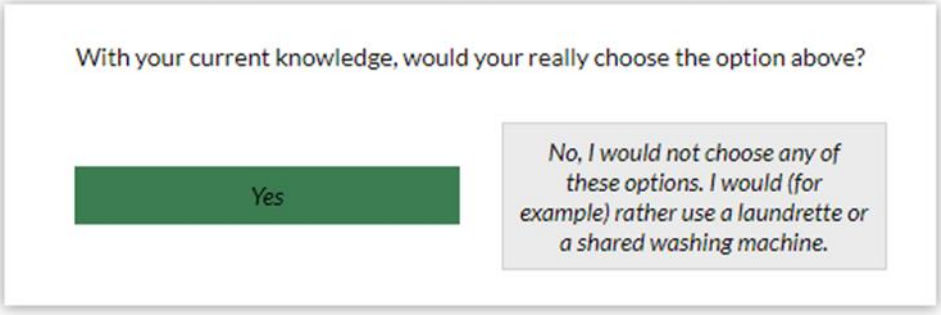


Figure 13 – The dual-response none option

3.5. Consumer characteristic variables

Directly after the DCE choice-tasks, further socio-demographic and attitudinal characteristics were asked that could be used as covariates or to describe certain groups of consumers. These characteristics may influence the preference for a PSS business-model. For example, younger generations could be more open to new business models (such as PSS or LS) than older more conservative generations. The basis for these questions were inspired by literature, the UTAUT and the interviews (see appendix II, III, IV & V), and will help explain preference tendencies which lead to insight in the acceptance of PSS.

This will in turn help solve a part of the puzzle of low consumer acceptance and preferences for PSS, as an attribute itself is not so relevant alone but the perception of that attribute by the consumer is. A short overview of all variables in the chronological order included in the survey given in figure 14. Socio-demographic variables are blue and attitudinal variables are green.

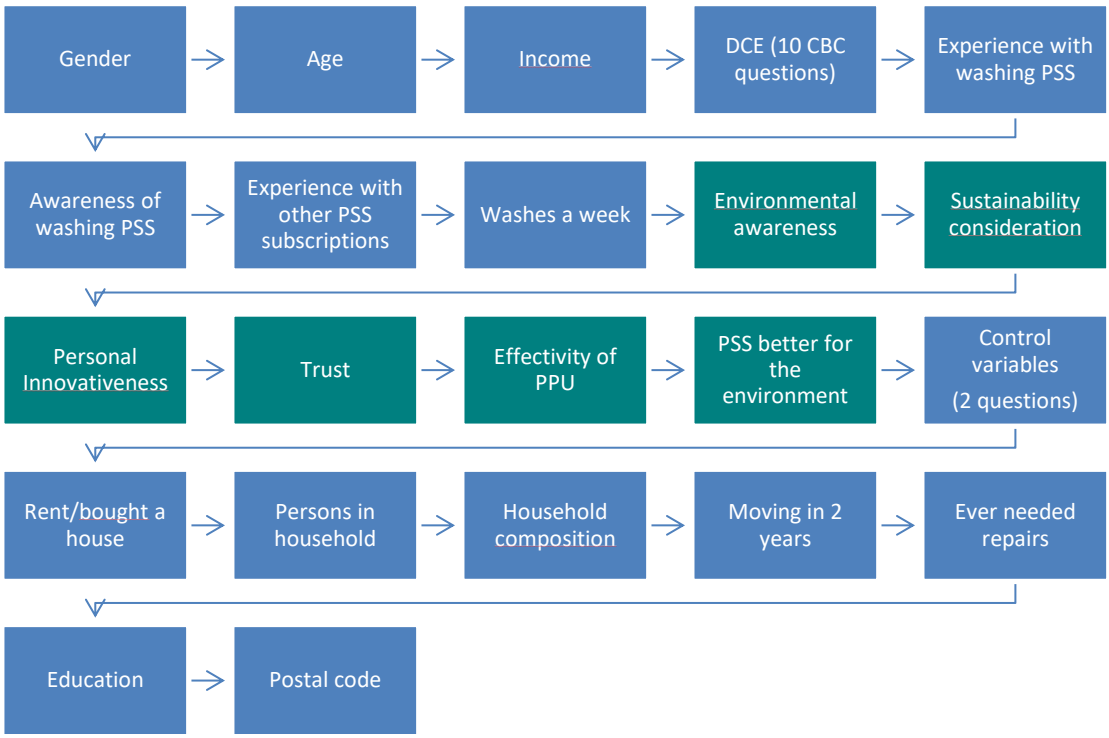


Figure 14 – Chronological order of included questions (consumer characteristic variables) in the survey.

As can be seen two control variables were asked, to see if respondents would never consider one of the options (no matter the price) or which one they would adopt if price was not an issue (Bryman, 2012). There was the option to write down remarks on the survey, and two skip-logic questions were included. Firstly, if people currently used a washing machine they were asked if they had enough space for doing the laundry (to see if that would make them more likely to go for laundry services). Secondly, if people were currently using laundry services they were asked if they thought it was good value for money.

3.6. Data analysis

To analyse the data several approaches are followed. First, to check if the dataset produced meaning results, a validity check by means of multinomial aggregate logit was performed. Secondly, to check how many times each option was chosen, a descriptive counting analysis was done. Thirdly, by analysing the relative preference of attributes to each other a utility value per attribute can be obtained. To get insights in the utility and importance scores a Hierarchical Bayes (HB) analysis was executed. This information can already help future marketing efforts of product-service systems, and possibly enhance PSS success (Ajzen, 1991). Lastly, a segmentation among the heterogenous respondents is needed to achieve better applicability of PSS to more specific homogenous groups. This was achieved by a Latent Class Analysis. This segmentation allowed for cross-analysis between preferred attributes, and the inherent consumer characteristics.

The latent classes of consumers are composed of respondents that provided similar answers in the choice-tasks, furthermore some of the covariates could be one of the main factors for the latent classes (Haughton et al., 2009; Magidson & Vermunt, 2002; Swait & Adamowicz, 2001a). Through the program of Sawtooth Software, a specialized software for discrete choice experiments., the most parsimonious outcomes can be calculated, and other statistical tricks can be used to achieve significant results (Orme & Howell, 2009; Schwarz, 1978). Lastly a utility coefficient can be assigned by the consumers to the absolute importance of each attribute, and each attribute level within each group. This information will then be investigated, analysed, and discussed in the results.

An overview of all outputs of the DCE are shown in figure 15:

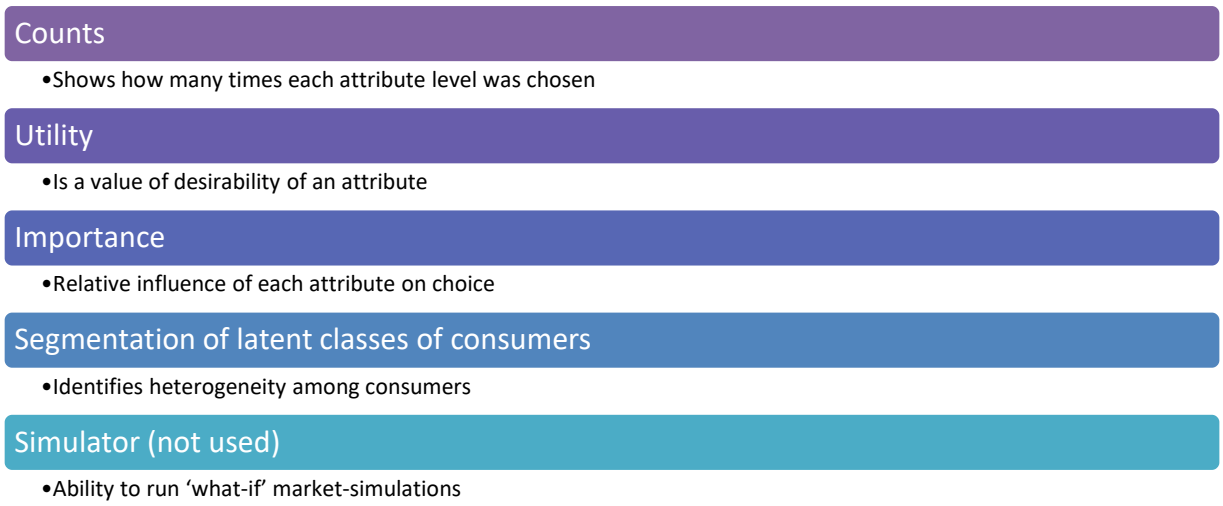


Figure 15 - Overview of all outputs of the DCE.

3.7. Descriptive statistics of the sample

In total 1061 respondents were considered. 46 respondents out of the 1061 did not complete the survey, but still gave several answers to the choice-tasks, hence these answers were still included in the count, the multinomial logit and Hierarchical Bayes (HB) analyses since these still provided valuable utility scores and insights. For the Latent Class analysis, only the 1015 completes were taken into account, since additional information on individual respondents was needed for further identification and description of subgroups.

A descriptive overview of the socio-demographic characteristics is shown in Table 5:

Variables/Covariates	Descriptive Statistics	Average in Total (N=1061)
Gender	**Male:**	57,5%
	Female:	42,5%
Age	**18-35 years:**	21,9%
	36-50 years:	23,0%
	51-65 years:	26,6%
	66 years or older:	28,6%
Gross Income of Household (year)	**€ 0-20k:**	25%
	€ 20-40k:	27,5%
	€ 40-60k:	25,2%
	€ 60k+:	22,3%
Education	**University:**	15,5%
	Higher Education:	33,1%
	Practical Education:	31,5%
	High School:	17,7%
	Other:	2,2%
Usage / Experience Washing PSS	**No usage/experience:**	92,1%
	Usage/experience:	7,9%
Awareness of Washing PSS	**No awareness:**	86,2%
	Awareness	13,8%
Experience with (other) subscriptions/PSS *(0 subscriptions/PSS = 1, 1 subscription/PSS = 2, 2 or 3 subscriptions/PSS = 3, 4+ subscription/PSS = 4)*	**No experience: (1)**	53,3%
	Little experience: (2)	36,2%
	Experience: (3)	8,8%
	A lot of experience: (3)	1,9%
Amount of washing a week	**Less than once:**	9,8%
	1 to 2 times:	38,5%
	2 to 3 times:	25,4%
	3 to 4 times:	15,0%
	5+ times:	11,2%
Do you like to do the laundry?	**Yes:**	57,3%
	No:	42.7%
Experience no lack of space for the laundry	**Yes, no lack of space**	90,0%
	No, experience a lack of space	9,2%
Rent or Bought house/apartment	**Rent:**	41,2%
	Bought:	58,8%
Persons in Household	**One person:**	28,2%
	Two persons:	45,3%
	Three persons:	10,7%
	Four persons:	10,6%
	Five (+) persons:	5,1%
Household Composition	**Young Kids:**	10,8%
	Kids (12+ years):	15,1%
	All employed:	48,7%
	Students:	2,4%
	Mix:	2,3%
	None of the above:	20,8%
Is planning to move within 2 years:	**Yes:**	23,4%
	No:	76,6%
Has ever needed repairs for their washing machine	**No, never:**	51,0%
	Yes, in the last 5 years:	21,9%
	Yes, but that's 5+ years ago:	21,7%
	I can't remember:	5,4%

Table 5 – Descriptive statistics of the sample

As can be seen in table 5, there is a nice distribution of age and salary levels. This was mainly since quotas were put in place on these questions to create a balanced sample. This was done because these variables were hypothesized to have a big effect on consumer acceptance and preference for PSS. The sample is slightly male dominant, but further T-test analysis showed that there was no big difference in choice-patterns between genders.

A small number of respondents (7,5%) had previous experience with washing PSS (pay-per-month or pay-per-use) washing machine, although a substantial larger number (49%) had (little) experiences with other PSS or subscriptions (PaaS). This might show the (beginning of a) trend away from ownership towards usage, as was mentioned by a lot of the interviewees (4-9, 12, 16 and 18). Respondents came from different layers of society, with a large variety in education levels, and households which makes this sample a decent representation of consumers in the Netherlands.

4. Results – Analysis

The results section is structured as follows: in the first section the data quality and validity of the sample will be checked. Followed by a section on the attribute importance for payment model preference. This will be investigated by means of the attribute level counts, the attribute utilities and the attribute importance scores. The third section will elaborate on the important consumer characteristic, it lists the most important general variables for choice of payment model, and the relative importance of predictors per payment model individually. The fourth section provides a choice-based segmentation of consumer groups. It explains how the consumer groups are determined and how the consumer groups can be characterized based on their utility and importance scores, and their descriptive statistics. The last section will provide other insights gained from the interviews with PSS experts.

4.1.1. Data quality of sample (N=1061)

To ensure only valid responses to the survey, speeders (with a completion time < 3,5 minutes) and respondents that did not take more than 20 seconds to read the instruction page of the survey were deleted. Extreme response behaviour in which respondents chose the buy-option or the none-option all the time, are still included in the sample. This provides a more realistic real-world scenario as some of the respondents are just not in the market to buy, have other reasons for non-adoption, or indeed extreme preference for one-option.

4.1.2. Data validity check

To check if the cleaned dataset provides meaningful results, the answers are compared to the random-choice baseline percentage.

If all the respondents were looked at as one respondent (assuming homogeneity) who performed all choice-tasks, this would result in the following multinomial aggregate logit model (table 6):

Number of Respondents	*1061*	
Iteration	Chi-Square	Fit Statistic (RLH)
6	7437,64647	0,28179

Table 6 – Multinomial Aggregate Logit Model

After six iterations convergence was achieved, meaning that another iteration would not have resulted in a significant absolute gain of 0.0001 RLH fit-statistic. This result can be interpreted as follows; every respondent had the choice between four options and a none-response option. A total of effectively five choices implies that a random guess would be right 100/5 = 20 percent of the time (0.20). We achieve a slightly higher RLH/Root Likelihood Fit statistic, meaning that this simplistic model is already able to predict the outcome of a choice-tasks correctly 28,18% of the time. Since this is higher than the random chance probability of 20%, it can be concluded that this model makes statistical sense. However, the model assumes homogeneity among respondents, which in real-life is not necessarily the case (see the HB-analysis and latent class analysis).

4.2. Attribute level counts

Although only representing a kind of descriptive statistics, counts analysis are still an interesting form of results. Counts provide a quick and automatic calculation of the amount a certain payment model or attribute level was chosen. It calculates the amount of 'wins' for each level, based on how many times an option including that level is chosen of the amount of times it appeared in a choice-task (Orme, 2016; Sawtooth Software Manual). This study presents a short summary of all the counts-analysis performed. The elaborate counts analysis is included in appendix VIII.

4.2.1. Payment model

In the adjacent table the counts of the primary attribute, the payment model, are shown. The total of the count's values adds up to one, because the primary attribute was shown in every option (not alternative specific). A score of for instance 0.227 means the attribute level 'Pay per month' was chosen 22.7% of the time it was shown

All respondents together choose the **buy-option 55%** (0.55) of the time, the **pay-per-month option 22,7%** (0.227), the **pay-per-use option 18,8%** (0.188) of the time and **the laundry service 3,5%** (0.035) of the time. Many of the respondents are thus oriented on the buy-option, at the same time respondents do have an eye for the service-based options. It is notable that the interest of respondents declines when the options become more service-oriented.

Payment Model	
	Total (100%)
Buy-option	0,550 (55%)
Pay per Month	0,227 (22,7%)
Pay per Use	0,188 (18,8%)
Laundry Service	0,035 (3,5%)
Within Att. Chi-Square	5826,887
Degrees of Freedom (D.F)	3
Significance	**p < .01**

Table 7 - Counts of the payment model

4.2.2. Price Attributes

There is a significant decline in the amount of times an attribute level is chosen when price increases; respondents prefer to pay less than more. This provides further proof for validity of the data.

Price Buy-option		**Price PPM**		**Price PPU***		**Price Laundry Service (LS)**	
€500	*0,665*	€10,- /Month	*0,322*	-20% /wash	*0,208*	€10,- /wash	*0,062*
€650	*0,631*	€15,- /Month	*0,260*	-10% /wash	*0,198*	€15,- /wash	*0,040*
€800	*0,559*	€17,50 /Month	*0,209*	Normal /wash	*0,180*	€17,50 /wash	*0,028*
€950	*0,495*	€20,- /Month	*0,190*	+10% /wash	*0,186*	€20,- /wash	*0,023*
€1100	*0,403*	€25,- /Month	*0,152*	+20% /wash	*0,170*	€25,- /wash	*0,020*
Within Att. X^2	166,251		159,567		9,839		68,942
D.F.	4		4		4		4
Significance	**p < .01**		**p < .01**		**p < .05**		**p < .01**

= *price dependent on temperature of washing.

Table 8 - Counts of the price attribute

4.2.3. Product Class *(shown with Buy, PPM, PPU)*

There is a significant increase in preference for higher product class: when a more premium product is shown this is more likely to be chosen.

4.2.4. Minimal Contract Period *(shown with PPM, PPU)*

Contract period indicates the period you would minimally have to 'rent' the product. There is the possibility to cancel each month after that period. There is a non-significant inconsistent choice-pattern on this attribute. A shorter contract period should have been preferred as it is the period you are 'committed' to that product. If consumers want the PSS longer, they lengthen the contract on a monthly basis. This could have been misunderstood by respondents. To mitigate this and make analysis possible, this attribute was coded linearly in further analysis. This means that a single utility coefficient is fit to the attribute. This is normal in quantitative attributes with clear preference order such as price, speed, weight, or in this case the contract-period.

4.2.5. Circular product *(shown with Buy, PPM, PPU)*

There is a small significant preference for a circular product. The circular option was chosen 32,9% of the time it was shown, just slightly more than the non-circular option (31,5%). The remainder is due to the possible double occurrence of 'yes' or 'no' between the PPM, PPU and the buy-option, and the no-occurrence with laundry services and the none-option.

4.2.6. Energy label *(shown with Buy, PPM, PPU)*

There is a logical significant increase in the amount of times a higher energy label is chosen (so the machine becomes more energy-saving). Respondents choose machines with a higher energy-efficiency more often.

4.2.7. Services – convenience *(shown with PPM, PPU)*

This is an attribute with 8 different levels. Again, the percentage they were chosen compared to how many time they were shown is stated. Only the pay-per-month and the pay-per-use models had additional services included. With two options having additional services this alternative specific attribute can result in relatively high count-scores for most the service-levels.

Product Class	
Basic class	0,296
Middle class	0,315
Upper class	0,355
Within Att. Chi-Square	58,178
D.F.	2
Significance	p < .01

Minimal contract period	
3 months	0,207
6 months	0,213
1 year	0,211
2 years	0,207
5 years	0,199
Within Att. Chi-Square	2,248
D.F.	4
Significance	not sig

Circular Product	
Yes	0,329
No	0,315
Within Att. Chi-Square	4,329
D.F.	1
Significance	p < .05

Energy-label[17]	
B	0,252
A	0,287
A+	0,319
A++	0,354
A+++	0,397
Within Att. Chi-Square	245,345
D.F.	4
Significance	p < .01

Table 9 - Counts of attributes

Services - convenience	
No services	0,190
Moving-service	0,191
User - advice	0,197
Yearly Maintenance	0,219
Moving service and User - Advice	0,207
Yearly maintenance and User - advice	0,211
Yearly Maintenance and Moving - Service	0,221
Yearly maintenance and User - advice and Moving Service	0,223
Within Att. Chi-Square	16,034
D.F.	7
Significance	p < .05

Table 10 - Counts of services

[17] *This attribute was normalized. Nowadays, energy labels are A+++ (20%, 30%, 40%, or 50%). This percentage means the percentage energy saved (efficiency) compared to the A+++ label. Since these are harder to understand for consumers A+++ was normalized to B, A+++ (20%) to A, A+++ (30%) to A+, A+++ (40%) to A++, A+++ (50%) to A+++.*

4.2.8. The none-option

As explained earlier, there was also the possibility that none of the options showed provided sufficient utility to the respondents to justify a potential purchase or adoption decision. In that case the respondents selected the none-option, meaning they do not prefer any of the options shown. Maybe the respondents were just not 'in market' for these propositions at that specific point. Or the respondent was primed by previous choice-sets and found other choice-task fitted their preferences better, hence choosing the none-option. This none-option would also be available when shopping in real-life. Furthermore, it provides that respondents are not forced to select an unacceptable option, and this consequently improves data quality, as respondent opt out when there is no alternative they would consider (Johnson & Orme, 2003).

The none-option was chosen a total of 14% of the time over all choice-tasks, which is within the typical range of 5%-15% of CBC studies (Johnson & Orme, 2003). This percentage is mostly derived from a group of 72,3% of this 14%. This group of in total 149 respondents chose the none-option at least 5, up to 10 times of the total ten provided choice-task. 68% of all respondents (722 out of 1061) never chose the none option.

4.2.9. Conclusion on data quality and validity

It can be concluded that the data shows consistent patterns and displays that enough respondents answered the questionnaire to get significant increases and decreases in counts on attributes levels, affirming that respondents answered mostly rationally. This provides further proof for well-chosen attribute levels, and high-quality data and validity.

4.3. Utilities and importance scores

4.3.1. Need for individual utility scores

The counts analysis only provided limited information. More information is gathered through *utility scores* and *importance scores*. To answer sub-question two, on the importance of each attribute, a Hierarchical Bayes (HB) analysis with covariates was performed. Utility was defined as the measure of value, it is the desirability of an aspect (attribute) of one option. Importance scores however are the influence of how much difference each attribute could make in the total utility of a product (Orme, 2006). The difference is the range in the attribute's utility values, these scores are therefore relative, and the values add up to 100 percent (Orme & Howell, 2009). For example, a circular product can be more attractive than a non-circular product, but not so important for the total utility of a product.

If all the respondent's answers are compiled and considered to be from one respondent that has done all the choice-tasks, this is called the multinomial aggregate logit model. However, we know that consumers are not homogenous, and different consumers value different attributes and have different backgrounds, attitudes and socio-demographics. To mimic real world behaviour in a competitive market scenario, researchers must look at individual utility scores. Imagine the following example: two different respondents prefer 6 out of the 7 attributes the same way, however they differ among one attribute; e.g. the payment-model. Then in real-life they would make a different choice, although on paper it seems like they are about 85% the same. Therefore, an analysis based on individual estimates should be made. These individual scores are used to compile a list of total average attribute (part-worth) utility scores to better represent the real-world. This is done by first computing averages on individual levels and then extrapolating these to utility scores for the whole group. Scholars agree that analysis for each individual is more realistic and more informative (Orme, 2016).

For this reason, Hierarchical-Bayes (HB) analysis is considered the gold standard within CBC-analysis (Hauser, 2007; Gaskin et al., 2007). In short, HB allows the researcher to estimate parameters on individual levels. This provides enormous value to those who want to leverage part-worth utilities for further targeting of specific consumers in what-if simulations (Orme & Howell, 2009). Hierarchical Bayes (HB) was proven most stable and accurate in predicting choice (Orme, 2006).

4.3.2. Analysis process

First an analysis was run with all attributes coded as 'part-worth' utilities, which means there is no imposed hierarchy in attribute levels[18]. This is done create a base-case scenario to review how the utility and importance scores pan out, and to compare this HB-run with linear coded attributes[19]. If no changes occur when coding linearly versus with part-worth utilities than the linear coding has no effect. The only attributes that have a very clear quantitative order of preference were all four price attributes, hence these were coded linearly to benefit the model. The researchers also checked if excluding individual attributes had effect on the model-fit (to check for influence on choice-behaviour), but all attributes turned out to be useful.

A third HB-run was executed with the four price-attributes coded linearly and the other six attributes coded as part-worth's. After 500k iterations no convergence had yet occurred. After consulting with the Sawtooth Software support team, the linearly coded attributes were adapted to

[18] *e.g .the software perceives €500 as good as an option as €1100 for the buy-option.*

[19] *Linear coded attributes (in comparison to part-worths) are scores where the software does take the natural preference order of price into account, for example €500 should be preferred over €1100.*

numbers around '1' (meaning that €1100,- was now coded as €1,1) to quicken convergence. With 700k iterations in total this eventually resulted in a converged data-set useful for further analysis.

With this new calculated HB-dataset numerous other analysis were run to check for interaction effects and to run the model with constraints. The interaction effects gave some significant interactions, however these didn't result in any predictive gain in the model of more than 1%-point, so these were excluded (Orme, 2012; Orme & Howell, 2009). Since a small reversal in count-scores was noted in the attribute 'contract-period', this attribute was constrained, meaning that the software automatically imposed a preference on the utilities. The software enforced that 3 months of contract-period should have been preferred to 6 months (6 months to one year etc.). Adding constraints can lower model-fit, but since the sample seemed of sufficient quantity and quality this decision is justified (Orme, 2006).

These results with individual utility scores were imported into SPSS statistical analysis software to perform individual ANOVA (Analysis of Variance) with each other variable included in the survey (such as usage, behavioural/attitudinal segments, demographics etc.). This data was used to check if any covariates needed to be included in the model that significantly affect the HB-model. By performing an ANOVA-analysis on each variable, nine covariates were found to have a strong effect on the model.[20] The HB-model was run for a fifth and last time with these covariates.

Covariates can be explained as additional explanatory variables that enhance the way HB leverages information from the total population in estimating each individuals' utilities (Orme, 2006). So instead of assuming that respondents are drawn from a single, multivariate normal distribution, covariates draw from respondents with the same characteristic-specific location in the population distribution (Orme, 2016). In layman's terms; the software 'normally' borrows information from any other respondent to compile a complete image of an individual respondent (who has not seen all possible combinations of choice-tasks). By applying covariates, you force the software to borrow information only from those respondents in the same category as that respondent. So, males only borrow from males, for example. Adding this information can improve the quality and predictive ability of the part-worth estimates. The results of the HB-analysis with covariates which will be presented next[22].

4.3.3. Goodness of Fit

The HB-analysis had a Root Likelihood (RLH)[23] of 0.717, which is the geometric mean of likelihoods across all respondent's tasks. This is on the edge of overfitting the data. A rule of thumb by Sawtooth Software being 0.77 as the maximum before possible overfitting is reached (Orme & Howell, 2009). Furthermore, a Percent Certainty of 0.789 was found, which is also a measure of fit statistic that indicates how much better the solution is than chance. This means that this model can predict the choice of a respondent right 78,9% of the time, which can be considered high. It can be concluded that even with an Alternative Specific Design (ASD), which conventionally needs a large sample size, sufficient respondents were gathered to

Percent Certainty:	0.789
Fit Statistic (RLH):	0.717
Avg. Variance:	7.237
Parameter RMS[21]:	4.107
Time Elapsed:	148:21:16
Iterations:	25.000 (15k burn iterations)

Table 11 – HB fit-statistics

[20] *The covariates that were found to be of importance were: Age, Income, Education, Washes/week, Repairs, Moving, Environmental Awareness, Sustainability Consideration and Personal Innovativeness.*

[21] *RMS is the root mean square of all part worth estimates, across all part-worth's and over all respondents.*

[22] *This model ran twice for 6 days each.*

[23] *This could be considered the same as the McFadden pseudo-R^2 coefficient.*

make a model with predictive ability. The final analysis had the following fit-statistic scores (table 11):

4.3.4. Average Utility Scores

Provided is the overview of average utilities and importance scores (with std. deviation) for all respondents included in the survey. A negative utility score does not mean an attribute level is unattractive. It could be acceptable to most respondents, however all else being equal other attribute levels are considered better (Orme, 2006). The utilities were effect coded, which meant that all utilities are scaled to sum to zero (zero-centred diffs) within each attribute (Orme, 2006). Clear preference orders can be seen within attributes[24].

Attribute	Attribute level	Average Utilities	Standard Deviation
Payment Model	Buy-option	128,08230	129,83040
	Pay-per-month	32,66079	73,88882
	Pay-per-use (wash)	-15,16663	105,61317
	Laundry Service	-145,57646	80,76762
Price	Price buy-option	-231,90839	143,88569
	Price per month	-79,44071	48,07056
	Price per wash	-58,92631	87,63840
	Price laundry service	-17,78742	70,70662
Product Class	Basic class	-13,28412	20,24309
	Middle class	-0,97969	11,11817
	Upper class	14,26382	19,60675
Contract Period	3 months	10,28582	12,08727
	6 months	6,35846	9,79931
	1 year	2,27272	9,64725
	2 years	-4,75722	11,49290
	5 years	-14,15979	17,43502
Circular Product	Circular Product - Yes	4,84925	11,00645
	Circular Product - No	-4,84925	11,00645
Services	No services	-1,47200	30,90649
	Users' advice	-0,81822	25,10152
	Moving services	-20,32577	25,57059
	Yearly maintenance	2,64119	24,02560
	Yearly maintenance & Users' advice	-2,80679	32,68991
	Yearly maintenance & Moving services	8,15154	25,73832
	Moving services & Users' advice	-3,86763	25,90530
	Yearly maintenance, Moving services, Users' advice	18,49769	28,91565
Energy label	Energy Label - B	-39,18935	34,17404
	Energy Label - A	-15,92908	23,10085
	Energy Label - A+	3,40066	14,80862
	Energy Label - A++	15,76875	22,84931
	Energy Label - A+++	35,94903	32,50467

Table 12 – Average utility scores from the HB-analysis

Consumers have a highest desirability for the buy-option, followed by the PPM option and the PPU option, consumer have the lowest desirability for the laundry service. This was already affirmed by the count's analysis. In general consumers have a low desirability to pay any price, but since you cannot really compare paying €800 euro for the purchase option to paying €1 euro per wash in the

[24] *A word of caution; utilities of different attributes cannot be compared across attributes. Utilities are interval scaled (no ratio operations are possible). Utilities are relative (negatives aren't inherently bad, positives aren't inherently good). Importance scores are directly related to the levels included in the exercise.*

pay-per-use option, this utility score is less relevant. The *relative importance score* of this attribute however, are useful. Higher class products are preferred over lower-class product, a shorter contract-period is preferred over a longer contract period, a circular product is preferred over a non-circular product, more services are preferred over less services and a higher energy-label is preferred over a lower energy label. These utility scores show coherent patterns in desirability.

Looking at the standard deviations in table 12, the values can be considered high as they are mostly higher in absolute value than the average utility scores. This emphasizes that there is potentially big difference among respondent, which suggests the need of a Latent Class Analysis (see section 4.5).

4.3.5. Importance scores

As can be seen in table 13, the most important attribute for the respondents is the payment model. Although all options provide the same functionality, consumers do care about the type of laundry solution. The second and third most important attributes are the price for the buy-option and the price for the pay-per-month option. This might indicate that consumers are especially price sensitive for these models. The fourth and fifth important attributes are the energy label and the price of laundry services. This indicates that consumers like energy-efficiency and are price sensitive to laundry services too, as both could provide them with direct money saving.

Attribute	Average Importances (%)	Standard Deviation
Payment model	34,72	9,87
Price buy-option	14,68	7,24
Price per month	12,79	5,51
Price laundry service	8,84	6,44
Price per wash	3,50	2,36
Energy Label	8,87	5,33
Services	8,44	3,69
Product Class	3,95	2,93
Contract Period	2,44	2,70
Circular Product	1,76	1,64

Table 13 – Importance scores with payment model

The sixth important attribute are the services. This attribute was only provided to the PSS options (PPM & PPU). Although there is a high degree of variance within this attribute' level average utilities, consumer tend to find an important part of the added value of PSS in these services. More services tend to be preferred over less services. This might indicate that consumer like the convenience aspect PSS bring. The seventh attribute, which is moderately important, is the product class. Consumers find the quality of the product, in other words a more premium product, an important factor in their decision making. Consumers especially expect a higher product class, or a relative advantage from PSS (Tunn et al., 2019). The importance of the product class was also affirmed by interviewee 4, who stated that the relative advantage of the product, or the ability to provide a more premium product, could be one of the major aspects to choose for a PSS. After the product class, the price of pay-per-use is moderately important. Indicating that for this payment model consumers are not so price sensitive[25].

The ninth attribute, the contract period, has a relatively low importance, which is contrary to what most of the interviewees and literature reported (Antikainen & Lammi, 2015). As they explained that flexibility of a business model, the freedom to quit a PSS, was one of the most important attributes of PSS. Finally, consumers find the circularity the least important. Consumers find energy label more important than the circularity of the product. This might be because the energy label can provide direct cost saving where the circularity of the product does not provide any advantages to the consumer. A possible explanation could also be that consumers already expect a more circular

[25] *It should be noted that importance is dependent on the range between attributes. The range between the lowest and highest price for PPU was only 50% higher. Where in the other options the range from lowest to highest was 120-150%.*

washing machine in the pay-per-month and pay-per-use/wash option, since these inherently give the responsibility for the product to the PSS providers.

4.3.6. Insights from the counts, utilities and importance scores

Overall, we see a dominance by the business model and price, as was expected. However, we also see that there is quite some room for business models such as PPM and PPU, and to a lesser extent some room for the laundry service in the current market. There clearly is more potential for service-based proposition than is currently being utilized. This might supportive of the trend from ownership towards usage-based business models. Lastly, this research did not find much evidence to support that consumers would prefer unburdening through the laundry service. Which is contrasting to the suggestion by interviewee 14 who foresees an ever-increasing trend for more laundry services: '*The market potential for washing services (B2B and B2C) will double in the next 5 years. A huge growth is expected within the B2C washing services context.'.* A possible reason that this option was not chosen more often could be due the novelty of the concept, the high cost associated with one wash, or an unawareness of the concept in general. Consumers might have been unaware that they do not need a washing machine anymore, they don't have to come up with the investment and they do not have the cost associated with washing; such as time input, a place for the washing machine, drainage, installation of the machine, cost of resources in use (electricity, water and detergent) and cost for maintenance and repairs. Interviewee 14 hypothesized that consumers are not able to oversee most of these aspects.

4.4. Important Consumer Characteristics

4.4.1. Important general variables for the choice of payment model

A crosstabulation on the counts of choice of payment model was performed. The full cross-tabulation is provided in appendix VIII. In this analysis the choice for payment model was investigated over all other questions involved in the survey (consumer characteristics variables). These questions provide insight in the different aspects of consumers that need to be addressed to increase consumer acceptance for PSS. The nine most important significant variables from the count's analysis are given in table 14:

Variable (Question)	Relation with choice of payment model
Age	Younger generations choose PSS (PPM & PPU) and LS more often than older generations.
Income	Low income respondents are more likely to choose PSS or the Laundry Service. High income respondents are more likely to choose the buy-option.
Education	Higher educated respondents are more likely to pick PSS, then lower educated respondents.
Usage of the product *(Washes/week)*	Respondents who wash a lot chose for PPM or buy-option more often, those who don't wash that much a week are more likely to choose PPU or LS.
Repairs	Respondents who have had repairs to their machine recently, are more likely to choose for models with use-guarantee such as PSS options.
Moving	Respondent who intend to move within 2 years, are more likely to choose PSS and Laundry service. Those who do not intend to choose the buy-option more often.
Environmental Awareness	Respondents who are concerned about the environment chose the PSS more often, those who are not concerned more likely choose the buy-option or LS.
Sustainability Consideration	Those who say they take sustainability into account in their consumption decisions are more like to choose the PPU model.
Personal Innovativeness	Those who say of themselves that they are innovative chose PSS and the Laundry service more often than those who are more likely to choose the buy option.

Table 14 – Most important variables for the choice of payment model

It is important to notice that there might be some collinearity among variables and some variables might be confounding (like age and salary). Some variables could be positively important for one payment model and negatively important for another payment model. Hence a *driver analysis* on the predictor variables of each payment model was performed.

4.4.2. Relative important predictors per BM (payment model)

The counts crosstabulation provided insights into which consumer characteristics in general are important for choice of a payment-option. However, this analysis does not provide what consumer characteristics variables are predictors of preference when all variables together are considered. To find out which variables had most influence and predictive power on the preference for a specific business model, a driver analysis on each payment model was performed (Johnson, 2000; Yang, 2013). Driver analysis quantifies the importance of a series of predictor variables in predicting an outcome variable, in this case the average individual utility score for each business model (Yang, 2013). These predictors are also commonly referred to as drivers. Driver analysis helps to answer questions like; What is the best way to improve preference for a payment option?

The driver analysis was done in SPSS by means of the automatic linear regression modelling (Yang, 2013). This method allowed for some insights in confounding variables that have some form of collinearity. For example, older people earn more money than younger people. An overview of the ten most important predictor variables of each payment model are given in the next bar-charts. The following explanation will elaborate if these are positive or negative predictors.

4.4.2.1. Purchase option

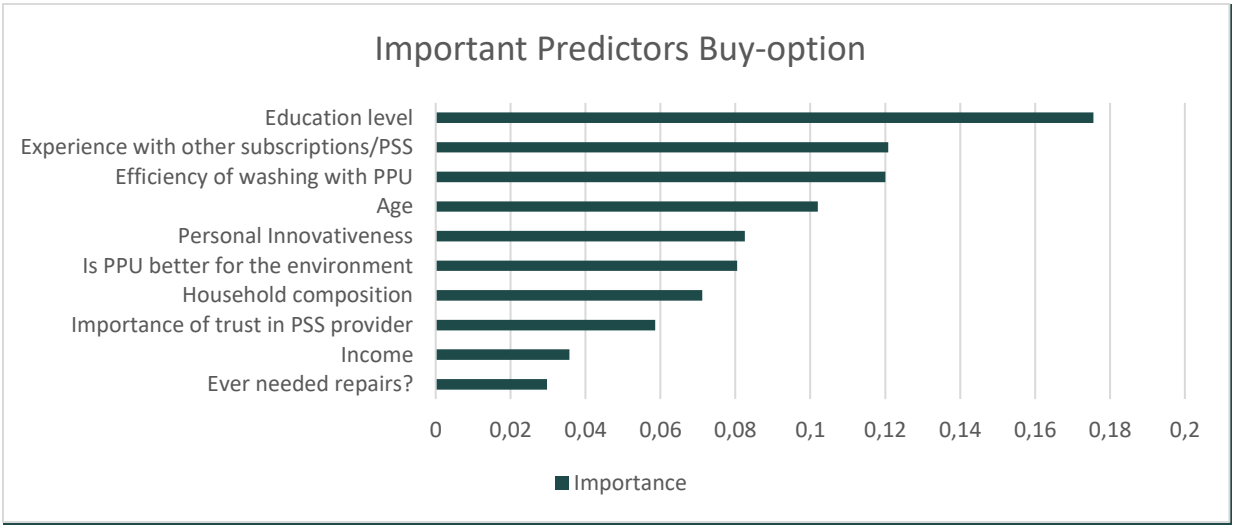


Figure 16 – Most important predictor variables for the preference of the buy-option

The following predictor variables for this payment model stand out. Firstly, the education level; this has a negative effect on the preference for the buy-option. The higher educated a respondent is, the less likely respondents prefer this option. This might be because higher educated consumers are better equipped to see the added value of the other options. Consequently, the opposite is also true; the lower the education level, the higher the preference. This reversal is also the case for the next predictors. Secondly, the experience with PSS; it was shown that little experience with PSS was a positive predictor of preference for the buy-option. If respondents are used to buying, they are more likely to continue buying. Thirdly, the efficiency of washing with PPU; respondents who do not think that *pay-per-use* will enhance their efficiency in washing (smarter washer, fuller drums, colder

temperatures, no unnecessary washing) are more likely to prefer *buy-option.* These consumers are thus not convinced that paying per wash will make them more efficient in doing laundry. Lastly, age; older respondents are more likely to prefer the buy-option. This could be since older generations have been used to buying their whole life. Since the other payment models are relatively new, they might be hesitant towards these unfamiliar models.

4.4.2.2. Pay-per-month option

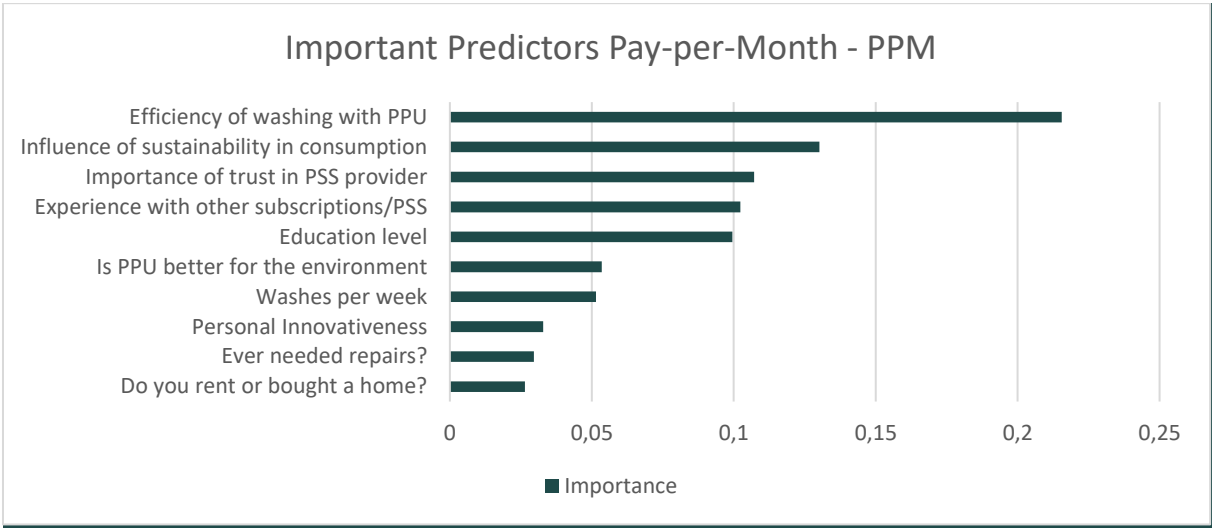


Figure 17 – Most important predictor variables for the preference of the pay-per-month option

There are five clearly distinctive predictors for the pay-per-month payment model. Firstly, the efficiency of washing with PPU. Respondents who do not think that *pay-per-use* will enhance their efficiency in washing are more likely to prefer *pay-per-month*, this might be because of the aforementioned reasons in the buy-option. Consequently, those who do think that PPU will enhance their washing efficiency are less likely to prefer PPM. This reversal is also true for the next predictors.

Secondly, respondents who let sustainability considerations guide their consumption are less likely to prefer the PPM model. This might be due to the unlimited washing aspect, if consumers are invoiced on the amount of washes they do, they will be more deliberate in their washing. Ultimately saving energy and resources and contributing to sustainability. Sustainable consumers thus seem to value the prevention of over-usage of a machine.

Thirdly, trust; respondents who find trust not so important are more likely to prefer the PPM model. Since uncertainty is an important factor surrounding PSS (e.g. will the PSS provider deliver on their promises of repairs or other services), a decreased trust has an influence on the preference for the PPM model.

Fourthly, experience with other subscriptions/PSS; respondents that do not have experience with another subscription/PSS are less likely to prefer the PPM model. If consumers are not familiar with subscriptions, they will be less likely to prefer this model, since this unfamiliarity might induce uncertainty and risk surrounding the model. Lastly, respondents with a lower level of education are more likely to prefer the PPM option.

4.4.2.3. *Pay-per-use option*

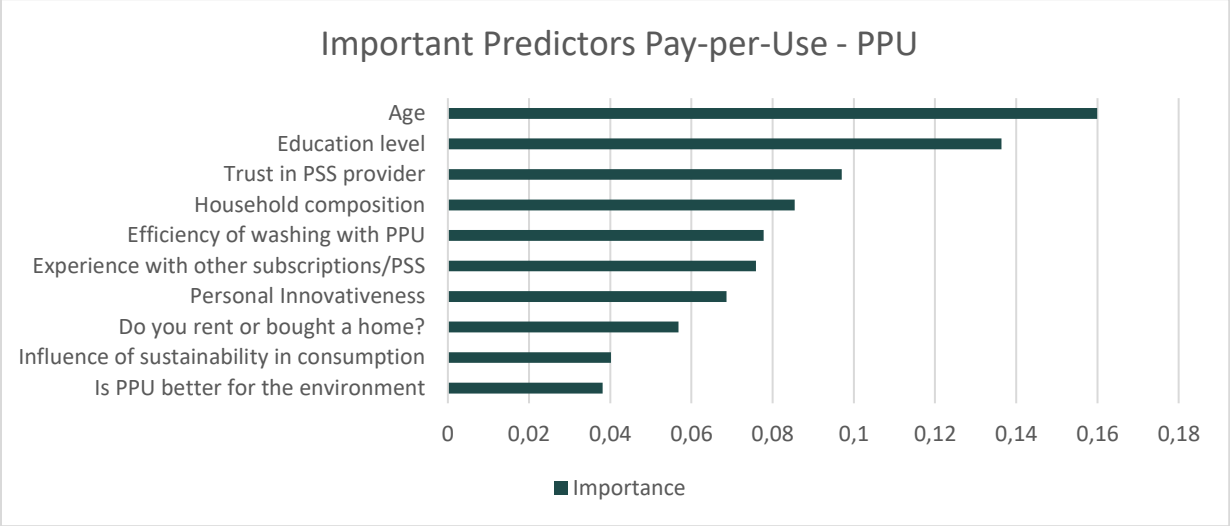


Figure 18 – Most important predictor variables for the preference of the pay-per-use option

The following predictor variables for this payment model stand out. Firstly, age: younger consumers are more likely to prefer the PPU model then older consumers. The preference for the PPU option could be because younger respondents do not have the investment to buy a washing machine. Another explanation would be that younger consumer value the convenience (added services) more than the older generation, or that they are more familiar with subscription or PSS in general. Consequently, older respondents are less likely to prefer the buy-option, this reversal is also true for the next predictors. Secondly, the education level; respondents who are higher educated are more likely to prefer the PPU model, this might be because higher educated consumers are better equipped to see the added value of the other options (as was mentioned earlier). Lastly, trust in PSS provider; respondents for who trust is not so important, are likely to prefer the PPU model, those who find trust less important are less likely to prefer PPU. This follows the same reasoning as for the PPM model.

4.4.2.4. *Pay-per-month option*

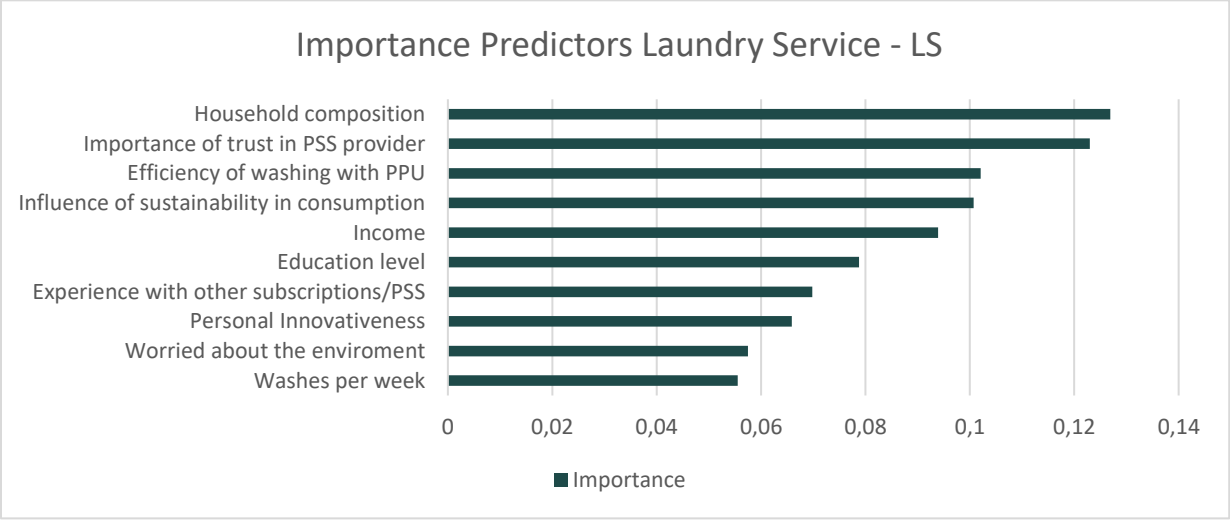


Figure 19 – Most important predictor variables for the preference of the laundry-service

There are five clearly distinctive predictors for the laundry service. Firstly, the household composition. Families with children are more likely to prefer this option. Why is yet unclear, this could

be since they also do a lot of washing, and it is therefore a big chore in the household. On the other hand, if you have a lot of washing, laundry services are also an expensive option. Secondly, the importance of trust; respondents who find trust less important are more likely to prefer LS. The aforementioned logic can be followed for this predictor. Thirdly, the efficiency of washing with PPU, those respondents who think that PPU will enhance their washing efficiency are also more likely to prefer for LS. Both options have the pay-per-wash concept in common (although in a different form), this could mean that the consumers value that part of the payment model. Fourthly, the influence of sustainability in consumption: those with little sustainability consideration are more likely to prefer LS. This could be due to the fact that in this model, again unnecessary washing is discouraged, and only washing will be done when there is a need for it. Lastly, income; respondents who earn more money are more likely to prefer laundry services than respondents who earn less money. Since laundry services are quite an expensive service, only those who can easily afford it would prefer this option.

4.5. Overall findings

We can conclude from the driver analysis that different business models have different predictor variables. This shows that there is indeed a difference in preferences based on the differences in the circumstances of a respondent (the consumer characteristics). Hence often a segmentation in the respondents is made. This segmentation is useful for interpretability, because marketeers can tailor business proposition towards different segments of consumers. Such segmentation is explored by the Latent Class Analysis (LCA), which will be explained in the next chapter.

4.6. Choice-based consumer segmentation

4.6.1. Determining the consumer groups

To answer sub-question 3, and to account for heterogeneity among consumers, a Latent-Class Analysis (LCA) was performed[26]. Latent Class Analysis identifies groups based on similar choice-behaviour (Orme, 2012). Since LCA is highly dependent on the starting seed number, four different analysis were run and compared. Very minor changes were recorded among the different analyses. Showing that the analysis was done properly, and convergence was achieved. The last run with the lowest convergence limit (0.0005) is included for further analysis, since this run had the best overall estimator-values combined with group size (table 15).

Groups	Replication	Log-likelihood	Pct. Cert.	AIC	CAIC	BIC	ABIC	Chi-Square	Relative Chi-Square
2	9	-12821,75	31,39	25737,49	26131,23	26084,23	25934,87	11731,77	249,61
3	1	-11685,92	37,47	23513,83	24108,63	24037,63	23812,00	14003,43	197,23
4	8	-11178,37	40,18	22546,73	23342,59	23247,59	22945,69	15018,53	158,09
5	**3**	**-10827,53**	**42,06**	**21893,06**	**22889,97**	**22770,97**	**22392,80**	**15720,20**	**132,10**
6	4	-10538,95	43,60	21363,89	22561,86	22418,86	21964,42	16297,37	113,97
7	8	-10373.95	44.49	21081.90	22480.91	22313.91	21783.21	16627.37	99.57
8	6	-10216.95	45.33	20815.90	22415.98	22224.98	21618.00	16941.36	88.70

Table 15 – Overview of the estimator values of the LCA

The optimal fit was achieved in five-group scenarios. The six, seven and eight groups scenario had lower (=better) estimator scores, these groups had undesirable segment sizes of between 2 and 6%. This was considered too small for clear recommendations and practical use (Orme, 2006). As a rule of thumb segment sizes of higher than 10% of the total sample size are considered relevant and interpretable options (Orme & Howell, 2009). In the five-group scenario all segments are larger than 10%, which make the segments quantitatively well differentiated.

The AIC, CAIC, BIC and ABIC scores reveal that five latent classes fit the data well (Orme, 2012; Sawtooth Software Manual). Increasing the number of segments lowers these estimators scores but will also makes for smaller group sizes. Increasing the number of segments also makes less statistical sense, since more groups move more towards HB-analysis (in which every respondent is their own 'group'). For practical implication, and not to overcomplicate results, a five-group differentiation resulted in most preferable and parsimonious results. The Percent Certainty[27] of 42.06, suggest a good fit for the choice model and provides significant improvement to the one, two, three and four class models (Orme, 2016).

It is important to notice that Latent Class Analysis reports segments, but this does not imply that a respondent is fully in one group or another. Instead respondents are considered to have a non-zero probability of belonging to each group (Orme, 2012). Since the data fits the solutions very well, these probabilities approach one. The average maximum membership probability is 0.945, meaning that there is a 94,5% probability that any respondents belongs to the group he/she was assigned to.

[26] *A fifth LCA-run was done excluding the price per business model, but this did not result in significantly different outcomes. This might have been the case because there is in essence some overlap between the payment-model and the price.*
[27] *Equivalent to the McFadden-R²*

The following tables show the results of the latent class analysis. Table 16 shows the attribute importance of each attribute per segment/group, which confirms the notion of heterogeneity with the segments, as these significantly differ from each other. The nature of identified groups and the importance scores will be elaborated upon later in the chapter.

4.6.2. Attribute Importance per segment (in %)

Segment	*1*	*2*	*3*	*4*	*5*
Attribute | Segment Size	*11.1%*	*32.1%*	*11.1%*	*19.4%*	*26.3%*
Payment Model	18,86	37,93	**40,75**	30,57	26,63
Price buy-option	**23,98**	15,98	21,77	16,62	16,45
Price per month	14,42	**20,62**	11,18	10,95	10,58
Price per use/wash	0,73	1,98	1,09	3,86	**4,12**
Price Laundry Service	15,86	10,71	5,63	**24,29**	21,73
Product Class	**5,00**	1,57	2,33	1,55	4,21
Contract period	0,37	0,15	0,86	0,67	**2,77**
Circular product	0,66	0,06	**1,45**	0,96	1,08
Services	**7,59**	4,77	2,73	3,16	4,17
Energy label	**12,53**	6,22	12,22	7,38	8,25

Bold *= highest importance score in the row*

Table 16 – Overview of the estimator values of the LCA-runs.

The next table shows the difference in part-worth utility-scores (rescaled for comparability) attached to each attribute per segment. Price and contract period were coded linearly, hence there is no sub-segmentation in attribute levels there. Furthermore, the significance is shown per attribute level. Almost every level is significant for at least one of the groups/segments. If an attribute level is not significant in absolute terms, ($p > 0.05$), that doesn't necessarily mean that that level doesn't impact choice, it can still have an influence for some of the respondents. This is because these utilities are zero-centred within each attribute, the significance means that the attribute level is not significantly different from zero, but it still could have a big impact on choice behaviour.

A similar argumentation can be followed for negative utility-coefficient scores. A negative utility value does not mean that that attribute level was unattractive. In fact, it could have been acceptable to all the respondents. However, all else being equal, the other levels were just better and provided more utility.

4.6.3. Utility scores and significance by segment:

The following scores are Part-Worth Utilities Rescaled for Comparability (table 17):

	Segment		1		2		3		4		5	
Attribute	**Segment Sizes**		11.1%		32.1%		11.1%		19.4%		26.3%	
	Part-Worth Utility scores	Attribute LL [28]	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
	Attribute levels:											
Business/ Payment Model	Buy-option	-15939,33 ***	-114,86	***	**226,79**	***	189,73	***	29,71	***	93,26	***
	Pay-per-month		73,74	***	-30,58	**	37,28	***	26,32	***	**105,83**	***
	Pay-per-use (wash)		52,06	***	-43,67	***	-9,21		**124,83**	***	-38,61	***
	Laundry Service		**-10,94**		-152,53	***	-217,80	***	-180,87	***	-160,49	***
Price	Price buy-option	-11461,17 ***	-399,63	***	**-266,30**	***	-362,76	***	-277,05	***	-274,23	***
	Price per month		-96,13	***	-137,49	***	-74,56	***	-73,00	***	**-70,53**	***
	Price per wash		**-18,22**		-49,61		-27,26		-96,46	***	-103,02	**
	Price Laundry Service		-105,71	***	-71,39	*	**-37,56**		-161,95	***	-144,87	***
Class (Relative Advantage)	Basic	-10890.94 *	-20,40	*	**-8,44**	*	-8,93	*	-8,67	***	-19,15	***
	Middle		-9,20		1,16		-5,45		**1,79**		-3,81	
	Upper		**29,61**	***	7,28	*	14,38	***	6,87	**	22,96	***
Contract Period	Minimal contract period	-10834,02 *	-0,78		-0,32		**1,78**		-1,42		-5,83	***
Circular Product	Yes	-10835,92 *	3,31		-0,29		**7,24**	*	4,73	**	5,42	**
	No		-3,31		**0,29**		-7,24	*	-4,73	**	-5,42	**
Services	Yearly maintenance	-10858,69 **	**17,11**		15,40		-3,32		12,08	*	7,00	
	Moving services		-27,51		-22,85	*	**-10,27**		-11,86	*	-22,78	**
	Users' advice		-6,97		-18,26		**7,13**		-7,18		-11,10	
	Yearly maintenance & Moving services		**43,64**	*	-11,50		11,79		14,73	*	3,73	
	Yearly maintenance & Users' advice		**14,53**		-3,16		-2,19		-1,09		11,14	
	Yearly maintenance, Moving services & Users' advice		14,74		**19,65**	*	15,06		7,63		18,91	**
	Moving services & Users' advice		-23,29		-4,13		-5,97		2,52		**10,59**	
	No services		-32,25	*	**24,86**	*	-12,22		-16,83	*	-17,51	*
Energy Label	B	-11121,62 ***	-65,13	***	**-33,38**	***	-59,81	***	-37,10	***	-42,49	***
	A		-26,98	*	**-11,85**	***	-22,76	***	-27,01	***	-12,36	**
	A+		2,14	-	**8,70**		-9,12		8,42	*	-1,46	
	A++		**29,77**	**	7,70		29,30	***	19,03	***	16,33	***
	A+++		60,20	***	28,83	***	**62,40**	***	36,66	***	39,98	***
	NONE		**304,72**	***	-10,25		256,96	***	-97,18	***	-123,84	***

Significance: **** = p < 0.001, ** = p < 0.01, * = p< 0.05.* ***Bold*** *= highest utility coefficient score in each row or the lowest negative utility in each row.*

Table 17 – Full overview of the utilities and significance of each identified segment

4.6.4. Descriptive statistics of consumer characteristics of segmented groups

Variables/Covariates *Pearson Chi Square statistics -0,95% confidence interval*	**Descriptive Statistics** Persons in each subgroup (+ % of the group):	**Average in Total Sample (N=1061)**	**Group 1 (N=118)**	**Group 2 (N=346)**	**Group 3 (N=118)**	**Group 4 (N=201)**	**Group 5 (N=275)**
Gender	**Male:**	57,5%	52,5%	**60,4%**	51,7%	57,2%	58,6%
Chi Square = 4.161, D.F = 4, sign. = 0.385 (not sign.)	**Female:**	42,5%	47,5%	39,6%	***48,3%***	42,8%	41,4%
Age	**18-35 years:**	21,9%	**33.1%**	15,6%	22,9%	24,9%	22,3%
Chi Square = 39.349, D.F = 12, sign. = 0.000 (***)	**36-50 years:**	23,0%	23.7%	18,2%	**29,7%**	25,9%	23,7%
	51-65 years:	26,6%	17,8%	**29,8%**	25,4%	28,4%	25,5%
	66 years or older:	28,6%	25,4%	**36,4%**	22%	20,9%	28,4%
Gross Income of Household (year)	**€ 0-20k:**	25%	29,7%	21,4%	20,3%	**34,4%**	22,7%
Chi Square = 28.948, D.F = 12, sign. = 0.004 (**)	**€ 20-40k:**	27,5%	**29,7%**	28,0%	28,8%	27,9%	25,2%
	€ 40-60k:	25,2%	23,7%	24,6%	20,3%	22,4%	**30,6%**
	€ 60k+:	22,3%	16,9%	26,0%	**30,5%**	15,4%	21,6%
Education	**University:**	15,5%	15,2%	10,8%	14,8%	**19,8%**	18,5%
Chi Square = 29.964, D.F = 16, sign. = 0.018 (*)	**Higher Education**:	33,1%	33%	**35,5%**	33,9%	33%	29,7%
	Practical Education:	31,5%	37,5%	27,4%	**39,1%**	29,9%	32%
	High School:	17,7%	12,5%	**22,6%**	11,3%	16,2%	17,8%
	Other:	2,2%	1,8%	**3,6%**	0,9%	1%	1,9%
Usage / Experience Washing PSS	**No usage/experience:**	92,1%	82,1%	99,4%	**98,3%**	83,8%	90,8%
Chi Square = 65.382, D.F = 4, sign. = 0.000 (***)	**Usage/experience:**	7,9%	**17,9%**	0,6%	1,7%	15,9%	8,6%
Awareness of Washing PSS	**No awareness:**	86,2%	72,9%	**96,1%**	89,6%	75,1%	84.6%
Chi Square = 57.828, D.F = 4, sign. = 0.000 (***)	**Awareness**	13,8%	22,1%	3,9%	10,4%	**24,9%**	**15**,4%
Experience with (other) subscriptions/PSS	**No experience: (1)**	53,3%	48,3%	**63,4%**	60%	47,2%	43,8%
(0 subscriptions/PSS = 1, 1 subscription/PSS = 2, 2 or 3	**Little experience: (2)**	36,2%	34,7%	30,9%	37,4%	34%	**44,6%**
subscriptions/PSS = 3, 4+ subscription/PSS = 4)	**Experience: (3)**	8,8%	**15,2%**	5,4%	1,7%	13,2%	10%
Chi Square = 62.235, D.F = 12, sign. = 0.000 (***)	**A lot of experience: (3)**	1,9%	1,8%	0,9%	0,9%	**5,6%**	1,5%
Amount of washing a week	**Less than once:**	9,8%	10,7%	9%	7%	**18,3%**	5,4%
Chi Square = 67.154, D.F = 16, sign. = 0.000 (***)	**1 to 2 times:**	38,5%	41,1%	34,8%	31,3%	**51,8%**	35,4%
	2 to 3 times:	25,4%	25%	26,4%	**33,9%**	19,3%	25%
	3 to 4 times:	15,0%	14,3%	17,1%	17.4%	5,6%	**18.8%**
	5+ times:	11,2%	8,9%	12.6%	10.4%	5.1%	**15,4%**
Do you like to do the laundry?	**Yes:**	57,3%	58,9%	**61,3%**	42,6%	55,8%	59,2 %
Chi Square = 12.972, D.F = 4, sign. = 0.011 (*)	**No:**	42.7%	41,1%	38.7%	**57,4%**	44,2%	40,8%
Experience no lack of space for the laundry *	**Yes, no lack of space**	90,0%	74,7%	**94,3%**	92,8%	89,2%	89,7%
Chi Square = 37.519, D.F = 8, sign. = 0.000 (***)	**No, experience a lack of space**	9,2%	**22,2%**	5.1%	6,3%	9,7%	10,3%
Rent or Bought house/apartment	**Rent:**	41,2%	35,7%	37,3%	33,0%	**52,3%**	43,6%
Chi Square = 17.205, D.F = 4, sign. = 0.002 (**)	**Bought:**	58,8%	64,3%	62,7%	**67,0%**	47,7%	56,4%
Persons in Household	**One person:**	28,2%	25,9%	27,4%	19,1%	**42,6%**	23,2%
Chi Square = 55.570, D.F = 16, sign. = 0.000 (***)	**Two persons:**	45,3%	45,5%	**53,6%**	47,0%	32%	44%
	Three persons:	10,7%	**15,2%**	7,5%	14,8%	11,7%	10,4%
	Four persons:	10,6%	7,1%	7,5%	13,9%	10,2%	**15,1%**
	Five (+) persons:	5,1%	6,3%	3,9%	5,2%	3,6%	**7,3%**

Household Composition	**Young Kids:**	10,8%	**17,9%**	5,7%	13%	13,7%	11,2%
Chi Square = 40.761, D.F = 20, sign. = 0.004 (**)	**Kids (12+ years):**	15,1%	**18,8%**	12%	18,3%	12,2%	18,1%
	All employed:	48,7%	40,2%	**56,6%**	45,2%	46,2%	45,6%
	Students:	2,4%	**4,5%**	1,5%	4,3%	2,0%	1,9%
	Mix:	2,3%	1,8%	1,5%	0,9%	**4,1%**	2,7%
	None of the above:	20,8%	17%	**22,6%**	18,3%	21,8%	20,5%
Is planning to move within 2 years:	**Yes:**	23,4%	27,7%	17,2%	15,7%	**33,5%**	25,5%
Chi Square = 23.995, D.F = 4, sign. = 0.000 (***)	**No:**	76,6%	72,3%	82,8%	**84,3%**	66,5%	74,5%
Has ever needed repairs for their washing machine	**No, never:**	51,0%	48,2%	**59,9%**	52,5%	46,2%	44%
	Yes, in the last 5 years:	21,9%	23,2%	14,8%	21,7%	24,4%	**28,6%**
Chi Square = 27.774, D.F =12 sign. = 0.006 (**)	**Yes, but that's 5+ years ago**:	21,7%	21,4%	18,7%	22,6%	**24,4%**	23,2%
	I can't remember:	5,4%	**7,1%**	6,6%	3,5%	5,1%	4,2%
Sustainability influence on consumption behaviour (7-point Likert scale)	**No influence = 1**	(1): 6,4%	0,9%	**9,6%**	7,0%	4,6%	5,8%
		(2): 8,8%	10,7%	9,9%	**12,2%**	3,6%	8,9%
Chi Square = 42,696, D.F = 24 sign. = 0.011 (*)		(3): 14,6%	11,6%	14,7%	11,3%	15,2%	**16,6%**
	Medium influence = 4	(4): 14,5%	**17,9%**	16,2%	11,3%	14,7%	12%
		(5): 31,8%	28,6%	31,8%	**35,7%**	31%	32%
		(6): 17,4%	19,6%	14,4%	17,4%	**21,8%**	17%
	A lot of influence = 7	(7): 6,6%	**10,7%**	3,3%	5,2%	9,1%	7,7%
Environmental awareness (7-point Likert scale)	**No influence = 1**	(1): 3,8%	0,9%	5,4%	**6,1%**	2,0%	3,5%
		(2): 5,0%	**9,8%**	5,7%	1,7%	2,0%	5,8%
Chi Square = 60.568, D.F = 24 sign. = 0.000 (***)		(3): 9,5%	9,8%	**10,5%**	10,4%	8,6%	8,5%
	Medium influence = 4	(4): 13,6%	**16,1%**	14,1%	14,8%	10,2%	13,9%
		(5): 28,4%	30,4%	**34,2%**	22,6%	26,4%	24,3%
		(6): 26,9%	18,8%	21,6%	**33,9%**	28,9%	32,4%
	A lot of influence = 7	(7): 12,7%	14,3%	8,4%	10,4%	**21,8%**	11,6%
Personal Innovativeness (7-point Likert scale)	**No influence = 1**	(1): 15,7%	14,3%	**17,7%**	15,7%	16,8%	13,1%
		(2): 19,6%	14,3%	22,5%	20,0%	12,7%	**23,2%**
Chi Square = 34.995, D.F = 24 sign. = 0.068 (not sign.)		(3): 21,2%	21,4%	20,1%	21,7%	21,3%	**22,0%**
	Medium influence = 4	(4): 15,6%	**21,4%**	17,4%	13,9%	12,2%	14,3%
		(5): 16,2%	14,3%	13,5%	20,0%	**20,8%**	15,4%
		(6): 8,0%	10,7%	5,4%	7,0%	**12,7%**	6,9%
	A lot of influence = 7	(7): 3,6%	3,6%	3,3%	1,7%	3,6%	**5,0%**
Control variable (which one option wouldn't you choose, even for an affordable price):	**Not the buy option:**	12,3%	**16,1%**	11,7%	7,8%	13,7%	12,4%
	Not the Pay per month:	40,7%	31,3%	**60,1%**	53,0%	34,0%	19,7%
	Not the Pay per use/wash:	50,4%	42,9%	**66,4%**	62,6%	17,3%	53,3%
	Not the laundry service:	59,9%	36,6%	**71,8%**	60,9%	53,3%	59,5%
	None, I would use it all:	21,7%	27,3%	17,1%	**28,6%**	22,9%	20,0%

= none of the above option available (variable not 100% cumulative) , **Bold = Highest percentage in the row.*

Table 18 – Full overview of descriptive statistics of each identified segment.

Segmentation of consumers was done on similar choice patterns between consumers, however by using the consumer characteristic variables included in the survey we can describe the type of consumer in each group. To increase clarity, an overview of all groups is provided, this is followed by an elaborate explanation of each segment (in which will be referred to table 17 and 18).

4.6.5. Short summary of segmented groups:

1st group (11%) - PSS enthusiast : prefer the PPM and the PPU option.

2nd group (32%) - Conservative Buyers: prefer to buy, do not consider PSS at all.

3rd group (11%) - Conventional open-minded consumers: prefer to buy but are open to PSS.

4th group (19%) - PPU partisans: prefer the PPU option.

5th group (26%) - Unlimited users: prefer the buy or PPM option.

4.7. Segment One - 'PSS enthusiasts'

4.7.1. Key Characteristics (Utilities)

This segment (11.1%) is one of the two smaller groups and is characterized with the least preference for the buy-option, they have a relatively high preference for the PPM and PPU option, and the highest preference for the washing-services. This group can be considered very open to new types of business models such as PSS compared to other groups

Furthermore, this group is highly sensitive to the class of the washing machine and prefer the upper-segments of products. Since these newer business models, like PSS, are mostly based upon more premium products, this seems a logical explanation. Presumably because respondents also tend to expect a more premium product in these models.

Thirdly this is also the group that is sensitive to the PSS being a circular product, and they are also highly influenced by the energy-label preferring more energy-efficient appliances. Fourth, this group has the biggest variety in services, indicating that they do value some of the services. This might be since PSS allow for additional services to be provided. Compared to other groups these consumers value the maintenance component of the services the most, since this groups scores the highest utilities of all groups on this attribute level. Furthermore, this group finds no services to be undesirable.

Lastly, this group has the highest score for the none-option. Indicating that this group is not afraid to reject the propositions if none of them provided them with enough utility. This can interpret as respondents know what they want and what they are willing to pay for it. This could also be interpreted as that some of the respondents are just not in the market to buy, this can potentially be confirmed by the relatively high percentage of extreme response behaviour for the none option by this group.

4.7.2. Importance scores

These scores understood as: 'which attribute are most likely to influence choice behaviour for this group or segment'. The importance scores are relative and can be explained as percentages ranking up to 100% (see table 16). When we look at these importance scores, which are closely related the utility scores, we see that this group scores have the lowest between group importance on payment model and price PPU, but the highest importance for the price of the buy-option. This means that this group is less price sensitive for the PSS models, but more price sensitive to the buy option. This group has the highest between-group importance on class, services and the energy label. This group seems

like they really value the aspect inherent to PSS, such as the quality of the product (class), the convenience (services) and the energy-label (a more energy-efficient machine). The in-group differences on importance show that this group is the only group that doesn't have the payment model as most important attribute, which could mean that this groups puts less emphasis on the exact payment model but more on the other attributes provided. These consumers could therefore be quite willing to switch between models if other propositions provide them with more utility.

4.7.3. Characteristics

This group can further be specified on their responses to the additional questions in the survey. This group is relatively well-spread in gender; however, respondents have on average a higher chance to be in the age-category between 18-35 years and earn a lower income (€0-40k a year). This group also has higher than average chance to have had practical education. Furthermore, this group already has the highest experience with washing PSS, has a high awareness of these models and the group has quite some experience with other PSS/subscriptions. Which can explain part of the preference for the PSS-models and Laundry Service.

These consumers wash mostly 1-3 time a week and are often from relatively smaller household with mostly employed members of the household. There is also a reasonably high chance these consumers are planning to move within 2 years, which reaffirms their preference for PSS as these provide them with possible flexibility. About half of this group has needed repairs for their washing machine once in their life, which reaffirms their preference for the maintenance service. Also, this group has a high chance to let sustainability consideration guide their purchases, as this group contains the largest relative portion of respondents that let sustainability consideration (7) influence their consumption a lot. This also confirms the notion that possible PSS users find sustainability important. When looking at the control variable, this groups is also the most likely not to choose buy-option even if this option is available for an affordable price.

4.8. Segment Two - 'Conservative Buyers'

4.8.1. Key Characteristics (Utilities)

This is the largest group (32,1%) with almost a third (346) of the respondents. This group can be identified with having the highest preference for the buy-option and they have the lowest preference (part-worth utility) scores on the PPM and PPU models. Furthermore, they have a relatively low utility score for laundry services as well. Implying that this groups highly favours the 'old' way of consuming as they show little interest in the new business models.

This group doesn't value the class of the washing machine as much as most other groups, indicating that they do not necessarily value higher quality products. They are indifferent about contract period and circular product, and do not gain much utility from these attributes. They do however highly differ in preferences for services, as this is the only group that has a positive utility-score for no services. This might be due to the fact that services are an alternative specific attribute (bound to PPM and PPU models), and these were already options that this group would not consider. Interestingly, this group gains least utility of all groups from the energy-label, indicating that they do not find this so important (which is reaffirmed by the importance score). However, they still prefer more energy saving machines, but less so than the other groups. Furthermore, does not have a high utility score for the none-option. This could be that at least one of the options provided sufficient utility, presumably this is the buy-option.

4.8.2. Importance Score

The importance scores for this group show that the payment model is of highest in-group importance, furthermore this score is relatively high compared to all other groups, surpassed only by group 3. Secondly the importance for price of the buy-option is lowest between the groups, whereas price per month is the highest importance between groups. Indicating that they do value the payment model, and especially the buy-option, but give less importance to the price of the buy-option, whereas they do care more about price in the pay per month option. Lastly the price for the pay per wash has a low importance score, while the laundry services have a low between-group importance score showing that they do not care that much about the price of PPU and the laundry services.

Furthermore, this group does not find class of the washing machine of importance. They also have the lowest between-group importance on contract period (which could be explained by their preference for the buy-option), energy label and circular product, potentially indicating less environmentally conscious consumers. This was affirmed with the lowest scores on the sustainability considerations variable. In contrast this group scores relatively high on services, but keep in mind that this group also has a high utility score for no services. To conclude this group can be identified with extreme response behaviour for the buy-option. This was affirmed with the control variable to the question: 'Which one of the options would you choose if the price was not an issue?'. In which 277 out of 324 (85.4%) answered the buy-option. Furthermore, this group does not think that the PPU-model will enhance their efficiency in washing, providing further evidence for non-consideration of PSS models and the preference of the buy-option.

4.8.3. Characteristics

This group can further be specified on their responses to the additional questions in the survey: this group identifies with a higher chance of the respondent being male, more importantly this group is of the older generations, with more than 66% being older than 50+. Which confirms the conservative nature of these consumers. The income variety is balanced, and they have on average more chance to be practically educated. Almost everyone has no experience with the washing PSS (PPM & PPU) presented. Furthermore, they also have little to no awareness or experience with subscription or PSS in general. Most people in this group bought a house, and have small households, consisting of mostly working people. This group does not intend to move within two years and most of them have never needed repairs for their washing machine. The latter could mean that these consumers thus are not able to appreciate the unburdening aspect PSS provide. This group don't let sustainability guide their consumption decisions. To summarize, this group therefore identifies as a group that is conservative in their consumption pattern and prefers the buy-option.

4.9. Segment Three - 'Conventional but open-minded consumers'

4.9.1. Key Characteristics (Utilities)

This group (11.1%) is one of the two smaller groups in the sample and is the same size as group one. This group has a high preference (part-worth utility) for the buy-option. They have the second highest preference for this compared to the other segments, only being surpassed by segment two. Furthermore, these consumers also have some preference for the PPM-model. This group has a lower utility score for the PPU-option, and they have the lowest utility value for the Laundry Service of all groups. Meaning that they do not really consider the laundry services, or the pay-per-use, since the buy-option and the pay-per-month option provided them with more utility.

This group is highly sensitive to the price of the buy-option, and less so to the PPM and the PPU option. The PPU has the second lowest negative utility value of the five groups. Indicating that price is less of an issue for this business model. Also, this group has the lowest negative utility score of all groups on the price of laundry services. This might be because this group doesn't even consider laundry services to start off with. Furthermore, this groups do value a higher product class, but not so much as segment one and five. However, this group does value the contract period of the PPM and PPU models. This group has the highest and only positive utility score on the contract period. Since this attribute was linearly-coded this group gains either more utility from longer contract-periods, which could mean that they are just insensitive to the contract period, or that this group is only willing to commit for longer periods to a PSS-model.

This groups do have the highest utility scores for a circular product and the higher energy labels; potentially indicating that these are in fact environmentally conscious consumers. They also have changing preferences in the services provided, with the highest between group preference for moving services and for users' advice. Lastly this group has the second highest preference for the none-option. Indicating that this group clearly knows which options they like and which they don't like. Hence this group is not afraid to reject the propositions if none of them provided them with enough utility. It could be respondents know what they want and what they are willing to pay for it.

4.9.2. Importance Scores

This group has the highest between group importance for the payment-model, they clearly have a strong preference on how a laundry solution is provided, they like the buy-option and PPM, and they have low desirability for the laundry service. Furthermore, they have a high importance score for the price of the buy-option. This group has a relatively low importance for price-per-month and for the price-per-wash compared to the other groups. However, this group has by far the lowest importance to the price of laundry services of all groups. They have an average importance score for class and contract period compared to the other groups. These consumers do have the highest preference of all groups for the circularity of the product, and the second highest importance score for the energy label, being the third most important attribute for this group. This means that this group is in fact quite sustainable oriented. Lastly this group has the services as lowest importance of all groups, which could mean that these consumer care less about service, and more about what payment model is used.

4.9.3. Characteristics

This group can further be specified on their responses to the additional questions in the survey. This group identifies with a reasonably balanced gender and age ratio. There is a higher chance of the respondents being middle aged (36-50 years). Furthermore, there is also some variety in their income, as this group has the highest income (60k+) group relatively. This group has received Higher or Practical Education 72% of the time, and most of them have no or little experience or awareness with washing PSS, or other PSS/subscriptions. 72% washes on average wash 1-3 times a week, but most of them don't enjoy doing the laundry. They experience no lack of space, and most bought a house. They have on average the most chance to be in a two-person household and they are all employed and do not intend to move within 2 years (highest % of all groups).The latter could mean that they would not choose a PSS for the flexibility component.

Lastly most of this group have never needed repairs for their washing machine and only a small majority of this group lets sustainability guide their consumption behaviour, however most are concerned about the environment. Furthermore, the majority of this group does not necessarily think that PPM and PPU will be better for the environment or that this will enhance their efficiency in washing. We can conclude that this group surely has their preferences, and their main choice will still be the buy-option. Nonetheless this group is willing to look into new business models in some cases, such as the PPM model and to lesser extend also the PPU model. This group has no interest in the washing-services, indicating that this group still wants to do their own laundry. Therefore, this group is in some ways conventional in their choices, but open-minded to also sometimes choose other business models. If these models have the right combination of attributes that provide them with sufficient utility. This was reaffirmed by the control variable stating that most of this group (28,6%, the highest between-group score) would consider all options if they were provided for an affordable price. To conclude this group considers most new PSS business models but will first consider the conventional buying option.

4.10. Segment Four - 'Pay-per-Use partisans'

4.10.1. Key Characteristics (Utilities)

This group (19,4%) identifies by their preference for the pay-per-use (PPU) model. This group has the second lowest preference for the buy-option, only surpassed by group one (the PSS enthusiast). Furthermore, they have some preference for the pay-per-month model as well, but not to the level as group one, three and five. Lastly, they have the second lowest preference for the laundry services among the groups.

They significantly are more sensitive to the price of the buy-option and the price of laundry services than to the price per month and the price-per wash. However, in general this group can be considered price sensitive on all price attributes. This group has the lowest preference for class of washing machine compared to the other groups. This group has the second lowest utility for the contract period. Furthermore, they prefer a circular product, and for a more energy efficient machine. Additionally, this group of respondents have different part-worth utilities for the services, and in general they do have preference for services. This group is potentially fond of these services as they are only added with the business models PPU and PPM (alternative specific). Lastly this group has a high negative part-worth utility for the none-option indicating that most of the times at least one of the presented options provided them with sufficient utility to justify a purchase or adoption.

4.10.2. Importance Score

When looking at the importance scores we see that, like in most segments, the payment model has the highest attribute importance score (30,56%), closely followed by the importance of price. This group has the highest between-group importance for the laundry services, and this groups also gains very little utility out of this option. The price for the buy option and the price for the PPM option are relatively important within this group. They have second highest importance of all groups among the price per use/wash. This indicates that this group has a significant preference for the PPU-model (utility) but are also price-sensitive.

Additionally, this group has the lowest between-group score on the class of the product. This shows that the relative advantage of a more premium machine doesn't resonate with them. They have a relative low importance for the contract-period; potentially showing that they are willing to go for PPM and PPU, even though there are contract periods attached to that. This group does care about

the circularity of the product compared to other groups, and they also give a high importance to the energy label. Meaning that these consumers do care about sustainability. This is in line with the inherent nature of the preferred PPU model. Lastly, this group gains limited importance to services compared to the other groups.

4.10.3. Characteristics

This group can further be specified on their responses to the additional questions in the survey: This group identifies by having a majority in males, but this is not different from the averages among segments. Furthermore, there is a nice balance between ages, being slightly underrepresented in the 66+ category. There is however is a clear income disparity. This group mostly has low(er) earning respondents in them, which might suggest that this group prefers the PPU-model out of financial reasons.

About 63% has finished Higher or Practical education, and 19,8% has finished a university degree, making it the highest number among all groups. Higher educated consumers also seem to value the PPU model more (see paragraph 4.4), this confirms that. This group has had relatively reasonable experience with washing-PSS (15,9%), some awareness of washing PSS (24,9%) and also significant experience with other PSS or subscriptions (totalling 52,8%). Therefore, this group could be more known with these new business models such as PPM and PPU.

A majority of 70% of this group only washes 0-2 times a week, which could provide further evidence for their preference for the PPU-model, since quantity in washing a week is discouraged here. In this range of washing per week a PPU-model would be cheaper than the PPM-model, and it makes the return-on-investment a lot longer in comparison to the buy-option. Additionally, most of this group likes doing the laundry, and 9,7% experience a lack of space while doing the laundry. This is also the only group that has a majority of people renting a house, which could also require flexibility in business models or suggest potential financial incentives. The latter is also suggested by the fact that 37,6% of these respondents would choose the buy-option if price wasn't an issue.

Almost 75% comes from a one or two-person household, in which most of the persons are employed. In this group 33,5% (around 1/3rd) thinks that they will move within the next 2 years, this is the largest number among groups. This could be another indicator for the preference for PSS, as these models provide flexibility. Additionally, 48,8% of the people have had repairs to their washing machine. This could potentially be why this group values unburdening and use-guarantee that the PPU and the PPM option provide. Lastly this group has a higher chance to let sustainability guide their consumption behaviour. Further emphasizing the preference for the PPM and PPU business model, since especially the latter will, according to them, significantly enhance their efficiency in washing.

The preference for the PPU model was further affirmed by the control variable, stating that this group would <u>not</u> consider the PPU option only 17,3% of the time. Which is a very big difference compared to the other groups, that are between 42,9% and 66,4% on this variable.

4.11. Segment Five – 'Unlimited washers'

4.11.1. Key Characteristics (Utilities)

This is the second biggest group (26,3%), it identifies with the highest preference for the pay-per-month model. Interestingly this is the highest among groups but also the highest within the group score. Furthermore, this group also has a relatively high score for the buy-option but a lesser part-

worth utility on both pay-per-use and laundry services. Potentially indicating that this group doesn't like the concept of paying per wash.

When we look at the part-worth utilities for the prices, this group has the lowest negative score for the price-per-month, also compared to the other groups. Indicating that they are less price sensitive in regard to this model. They have the lowest negative part-worth for the PPU model of all groups, and the second lowest negative part-worth for the price of laundry services. Indicating that they are more price sensitive for these business models.

This group has the second highest part-worth utilities for class indicating that they do care for a more premium product. This group washes on average quite a lot, so possibly for this reason they also tend to prefer more high-end products. This group has by far the lowest negative utility on the contract period. Showing that this group is sensitive to the contract length. However, this group likes to have a circular product, and does value services in the PSS-proposition. Furthermore, this group also clearly values a high energy label. Lastly this group has the lowest part-worth utility for the none-option. Showing that the options showed provided sufficient utility for these respondents to justify a purchase or adoption decision.

4.11.2. Importance Scores

This group has the second lowest importance for the payment-model, only being surpassed by group one. They also have low importance on the price for the buy-option and the price for the pay-per-month option compared to the other groups. This group however does have the highest importance for the price of the PPU model and also the second highest importance to the price of laundry services. Indicating that they do put emphasis on the possibility to wash unlimitedly. Secondly, they have the second highest importance for the class of the washing machine, potentially indicating that they do value more premium products. Thirdly this group has by far the highest importance for the contract period (PPM/PPU model). This group only gives limited importance to the circularity of the product, being right in the middle of all groups. Additionally, this group also has average importance (being the middle score out of all groups) on the importance of services and the energy label. Overall this group finds most attributes important, given the relatively high balanced scores among all attributes.

4.11.3. Characteristics

This group can further be specified on their responses to the additional questions in the survey: it identifies as the second biggest group with 26,3% of the people in here. The persons in this group have a higher chance of being of older generations. Furthermore, this group are high earners, with most of this group (52,2%) earning more than 40k gross a year. Additionally, this group has little experience with washing PSS (8,6%), but already a little more awareness about washing PSS (15,4%). This group however remains little experienced with other PSS or subscriptions with more than 88,4% of the people having no to little experience with PSS.

They on average have a highest chance of washing more than 3 times a week, explaining their preference for the PPM and buy-option. This allows to wash unlimitedly without any additional cost (other than water, electricity and detergent). Most of this group enjoy washing, experience no lack of space while doing the laundry and live in a bought house/apartment 56,4% of the time. These respondents are within the larger families or household, with persons that are mostly employed. The large person household (largest among all segments) could be one of the reasons for the amount of washing, and the preference for the buy or the PPM option.

Almost 75% of this group does not intend to move within 2 years. 51,8% of the persons in this group has needed repairs[29] to their washing machines somewhere in their life, potentially implicating another reason for their preference for the PPM-model. Moreover, this group has a slight chance of letting sustainability consideration guide their consumption behaviour. If price wouldn't matter this group would prefer to buy a washing machine, which could indicate that there are some financial incentives in place here. Lastly, this group would not consider PPU (53%) or Laundry services (59%) even if they were available for an affordable price. Further affirming the results from the part-worth utilities and the importance scores for this group. To conclude, this groups would like to purchase a washing machine or the PPM model, as long as the amount of washing is not discouraged.

4.12. Other insights from the expert interviews

The interviews also provided additional insights, firstly in the fact that current awareness of PSS is low among consumers. This means that some consumers were probably not aware of the existence of PSS options, which could in turn influence acceptance (unknown makes unloved). Secondly, the interviews showed the importance of practicalities of consumers to enter into a PSS. Practicalities are all things that have to be arranged before you can start using the PSS. If to much practicalities are present, consumer acceptance of PSS will be low. It is hypothesized by the experts that current successful PSS's manage to decrease these practicalities well. Thirdly, according to most interviewees (loss of) ownership also remained an important factor that influenced the consumer acceptance of PSS. In this research however a loss of ownership is inherent to PSS, so this could have resulted in some extreme response behaviour towards the purchase option. Fourthly, interviewees argued that consumer found transparency in the value proposition important (no hidden cost or deposits), as consumers do not want to get involved in a win-lose relationship with a company. Fifth, the company clearly needs to provide convenience or unburdening through a combination of services. This convenience seeking by consumers will be an important sales-factor of PSS in the future. Sixth, interviewees explained that flexibility in some cases trumps price. Although price setting is important, consumers would rather pay a little more, than having to commit to a PSS for a longer contract period. Lastly consumers also expect more from PSS, either that is through the access to a high-quality product (more premium, durable, sustainable and efficient), the latest model or through services. Lastly interviewees demonstrated there is sufficient basis to conclude that there is indeed a trend from ownership towards usage.

In regard to the trade-offs consumers make, the interviews provided understanding into the inability of consumers to assess the Total-Cost of Ownership (TCO). Still too often choice-considerations remained a pure financial calculation based on the break-even point; often under-valuing the service aspect. Some experts even added that PSS should not even be compared to the buy-option, as this would be *'comparing apples to oranges'* (Interviewee 10). As it stands now, a large part of the consumers would not consider the laundry service. A reason for this is the unknown TCO of a washing machine (Interviewee 14): *'There are quite some hidden cost to washing machines. People are forgetting these hidden costs of washing. For example, the space they need for the washing machine itself, that is already quite costly. People also spent 5 hours a week on doing the laundry (when living in a house of 4). You could have spent that time much better'.* It is these types of considerations that could not have been found if only a quantitative approach to consumer acceptance was taken.

[29] *This segment also has the largest between-group section of respondents that needed repairs to their washing machine within the last 5 years: 28,6%.*

5. Conclusions

In this chapter the results are summarized and reflected upon. Theoretical and practical implications will be presented, as well as limitations and recommendations for future research.

5.1. Discussion

This research aims to explain what determines consumer acceptance of PSS, by assessing their most important attributes, how these attributes are valued by consumers and how these consumers are segmented according to their preferences. It addresses the research gaps of meagre knowledge on the consumer acceptance of PSS and the reasons for (non-)adoption.

5.1.1. Summary of the results

It was found that the decision phase of consumers before a purchase of a normal products is a well-established field of research by marketeers (Ajzen, 1991; Davis, 1985). However, PSS are more complex since they entail both services and products (Tunn et al., 2019). The decision phase in regard to PSS is still a neglected area of research. Nevertheless, this area could be a very important aspect for the transition towards more circular business models (Mont, 2001; Mashhadi et al., 2019). The starting point of this research are two main factors important for PSS acceptance; the attributes and the consumer specific characteristics (socio-demographic and attitudinal characteristics).

The attributes that were found most important for this study (sub-question 1) were: the payment-model (implicitly stating ownership), price, product class (quality), contract period (flexibility), energy-label (efficiency of use of resources), circularity (sustainability) and services (convenience).

The consumer characteristics that were found most important in influencing choice for a payment model were (sub-question 3): age, income, education, number of washes per week (usage), if they ever had needed repairs, intention to move, environmental awareness, sustainability consideration in consumption, and personal innovativeness. Further driver analysis found different important predictor variables per payment model (business model). This emphasizes the need for good alignment with potential customers for PSS providers.

This study presented how consumer value the attributes of PSS (sub-question 2). The payment-model and the price, as they are (still) the most important attributes. These are closely followed by the energy label, services, product class, contract period and circularity.

Consumers are predominantly focused on the buy-market (55%), followed by the pay-per-month model (22,7%), and the pay-per-use model (18,8%). Only 3,5% of the respondents would at this point consider the laundry services.

This research showed that there are five typical groups of consumers; 1) *PSS enthusiast*, 2) *Conservative Buyers*, 3) *Conventional open-minded consumers*, 4) *Pay-per-Use partisans*, and 5) *Unlimited washers*. All these groups were described by their inherent characteristics (sub-question 3).

Aforementioned gave a brief summary of the most important results that helped answer the main research question: *'What determines consumer acceptance of product-service systems?'.* The implications of this research will be discussed in the next parts.

5.2. Theoretical implications

An increasing stream of literature argues that PSS are crucial in achieving circular business models and the circular economy (CE) (Bocken et al., 2014; Lewandowski, 2016). Research has been mostly focused on companies' challenges in implementing PSS (Baines et al., 2007), the sustainability of PSS (Mont, 2004) or design challenges associated with PSS (Rexfelt & Hiort af Ornäs, 2009). Most of the focus is on the B2B-market, as this is a more successful market for PSS (Mont & Plepys, 2003). However, with current unsustainable patterns of consumption, the B2C-market also requires more attention (Cherry & Pidgeon, 2018). An increasing body of literature is now focusing on the consumer side of circular business models such as PSS.

Just over a decade ago a low consumer acceptance was hypothesized as one of the main reasons for poor PSS adoption (Rexfelt & Hiort af Ornäs, 2009). More and more research has tried to understand the reasons for this low consumer acceptance. However limited research has adopted the approach to look at the total decision process behind consumer acceptance. This research is one of only a handful studies that takes this point-of-view into account. A good understanding of this decision processes can guide the widespread implementation of PSS and thus the CE-concept accordingly (Mashhadi et al., 2019; Tukker, 2015).

One of the ways that this research assessed (low) consumer acceptance for PSS was by using the UTAUT as initial guiding framework to find determinants for acceptance. This framework had not been applied to PSS context before, hence it was adapted to fit the PSS consumer context by adding sociodemographic and attitudinal variables. It was found that the UTAUT was an interesting model to conduct research into acceptance. More researchers are advised to take note of this yet underexposed model.

Furthermore, an increasingly growing amount of literature is focused on the potential of PSS in the transition towards a more sustainable future. However little research is focused on ways to actually achieve higher acceptance and adoption of PSS. Knowing how to influence consumer acceptance can contribute to more circular consumption, as acceptance is seen as a barrier to the success and expansion of PSS (Vezzoli et al., 2012). This research shows which consumer characteristics should be targeted to increase the success of each PSS model, furthermore it provides an overview of which attributes are most important for consumers in general and specific consumer groups. This again, is of value to PSS providers.

This research did not find any particularly new attributes, as most attributes gathered by the interviews were already present in the literature (Antikainen & Lammi, 2015). However, this research was not intended to deliver new insightful attributes, rather it was designed for the quantification of importance of these attributes. Therefore, the methodological approach (DCE) is were most of the theoretical contribution of this research lies.

The DCE approach allows for an investigation into valuation of a whole concept or business model, and not just individual parts of concept (Johnson & Orme, 2009). The approach is more objective than most common research methods, such as contingent valuation or stated preference models (Orme, 2006). Compared to these conventional models, a DCE also has greater control and rigour over the information. This research helps spreading the usefulness of this type of research, as more insights can be uncovered by adopting the DCE research design in any complex choice investigation. Thus, the use of DCE or choice-modelling is an interesting way to conduct research, hopefully this method will be used more often in PSS-research.

For the construction of the attribute included the DCE, a trade-off between parsimony and specificity is imminent. Increasing the number of attributes or the amount of levels, will decrease the simplicity and will go at the expense of the quality and consistency of respondents' answers. Because this research applied a combination of interviews and a literature review to refine the attributes and their levels, a more exhaustive and parsimonious list could be composed.

DCEs measure intended preference behaviour, not actual behaviour. A well-known problem in sustainable consumption ls the attitude-behaviour gap. Respondents could have chosen socially accepted options they would actually not adopt in real life. Nevertheless, studies have shown that DCEs can be used to forecast actual behaviour (Hoyos, 2010; Harrison, 2006). This specific method has successfully been used in other complex decisions, for instance in knowledge acquisition strategies of SMEs (van Rijnsoever et al., 2014), but has rarely been applied to the PSS-context.

Quantitative PSS-studies are already relatively rare (Reim et al., 2015), furthermore large-N studies are relatively rare within the field of circular economy (Kircherr et al., 2018). Reim et al. (2015) already noted that *'more quantitative studies are needed to empirically examine different business models.* To the researcher's knowledge only two DCEs on PSS have yet been published (of which one is still forthcoming). It is therefore safe to say, that a *large-N, quantitative DCE-study* (*N=1061 and 18 expert interviews) within the field of PSS*, can be considered unique.

5.3. Practical implications / societal relevance

There are multiple implication for companies currently providing PSS (or PaaS) or companies that want to put PSS on the market. Literature has stated that there is currently a low consumer acceptance for PSS. However, paradoxically this study found that there is actually quite a high percentage of consumers potentially interested in PSS. The counts analysis showed that the buy-option will remain the most important model in the future (>50% of the market), but there is actually a large legitimate market for PSS. Especially the pay-per-month (PPM) and the pay-per-use (PPU) options are forecasted to have a large portion of the current market. Based on this research PPM will have a slightly higher acceptance among consumer than PPU. Washing services seem to have the lowest acceptance of all options. However, with the current trend from ownership towards usage, this could well change in the future.

This research provides some good starting points for PSS providers. It was shown that the price and the payment model are the most important attributes of PSS for consumers. Because of the price sensitivity among consumers that price-setting for PSS is crucial. This might also be due to the fact that consumers find it hard to value the other aspects PSS offer. After that, consumer highly valued the energy-label. This means that consumers do care about the energy efficiency of the machine, possibly because this provides direct cost-savings for the consumers. Providing an energy-efficient machine will be worthwhile for PSS-providers, as this is an attribute consumers will base a decent part of their decision on. Additionally, consumer also value the services PSS provides. It seems that consumer value the convenience aspect of PSS. This is offered through the use-guarantee (repairs & maintenance). There should be no hidden cost for such services, the consumer should be unburdened so that he or she can fully enjoy the functionality of the product. Moreover, consumer moderately value the quality of the product. Consumer expect a higher quality; a more premium product from a PSS. A PSS provider should try to work with prime products that offer a relative advantage over the conventional offers in the market. Consumer also moderately value the contract-period. The data showed that they did not want to commit for a long time to a PSS option.

Therefore, the flexibility (to quit) in PSS models is highly valued. Consumers would rather pay a little more each month, than engage in a long(er) contract period. Lastly, consumers don't care about the circularity of the product. Selling a PSS on the basis of circularity would not gain much more customers, since this is not directly a factor that consumer base their choice on. For consumers this attribute is a 'nice-to-have'. PSS-providers should still make circularity implicit in their business model to get a more profitable business model in the long run.

This research showed there is a bigger market share possible for PSS than is currently being exploited. However, getting the proposition with corresponding attribute levels right remains a challenge. As was indicated by the interviewees; it is not only what you present to consumers that matters, also communicating your unique value proposition is important. A company that is well equipped to communicate the value of their additional services to the consumer or client, will be better able to excel in this market economy. Consumers also expect more of a PSS than of a normal product. Either this is through the latest product, more premium products or additional services. This is one of the main reasons why consumers would be willing to pay more for PSS than for the conventional purchase option. Together with the aspect that consumers find it hard to take the total-cost of ownership into account, then providers need to be very transparent in their value proposition and the normal total costs of the product over time (e.g. cost of repairs). By communicating this well to consumers, the acceptance and adoption of PSS can be raised.

Because of the segmentation made among consumers, business should be better able to tailor their PSS towards customer-needs. Marketeers can now target a group of consumers specifically on their choice behaviour, changing the aforementioned communication and marketing strategy correspondingly. By having insights in the most important variables and predictors even better targeting can be achieved. Inherently PSS business models already provide more frequent contact with the customer, which can even further help sharpen the PSS-proposition. PSS-providers are better able to imagine the consumer point-of-view and provide better product-customer fit. Moreover, with the individual HB-utility scores a market simulator can be built. This simulator can test PSS proposition and calculate shares of preference for a specific proposition in a specific market scenario. By being able to check if your proposition is preferred in a real-market scenario, costly business mistakes can be avoided.

Because of PSS, producers are already financially motivated to develop a product with the least amount of materials, the incentive to change a product to reduce the efficiency of resources use (energy, water, detergents, oil) remains low (Manzini & Vezzoli, 2003). A good combination of incentives to increase this, is to make the producer responsible for these costs too. This can be done by aligning usage with the depreciation value of the asset. This way the price-setting is balanced with the depreciation over time, and actual over-usage is discouraged. One way the Dutch company HOMIE - pay-per-use washing machines, is currently doing this is by pricing based on the temperature of washing (like in the DCE) and discouraging usage through gamification. They provide their customers with scores on how sustainable they have washed during each period. They do not want to encourage too much washing, since their assets would last shorter and in the long run are depreciated quicker.

5.4. Limitations

This research has several limitations. Firstly, because it could be the first time that most respondents have done a DCE (CBC) survey. The method is quite complex and cognitively demanding, and for some option it could be the first-time respondents see them (like the PPU and LS options). This could lead to extreme response behaviour, as unknown options are often less desired. Furthermore, there is the possibility that attributes could be misunderstood.[30] Although a very elaborate explanation page was given to counteract these effects, they are not completely eradicated.

Secondly, not all PSS are Sustainable-PSS (SPSS) (Vezzoli et al., 2012). Moreover, PSS are not always more sustainable, Tukker (2004) already showed that not all PSS types will result in environmental improvements. Even in PPU-models there will still be the incentive for the provider to ensure that the user is consuming as much as possible. That will in the end result in most profit for the company. A good balance in profit, environmental gain and customer satisfaction is needed (Baines et al., 2007). Mont (2004) therefore already argued in her thesis that PSS should only be called PSS if it involved some form of resource-efficiency. Unfortunately, over the last decade this voice seems to be forgotten by some recent PSS providers. This research also has focused on PSS in general and not SPSS, this was done to make results applicable to a broader context. The researchers hope that these results will be used to encourage resource-efficient PSS and help show that PSS really do have a large sustainability potential. To conclude this paragraph, this research investigated PSS models that entail individual usage. While shared business models are (often) better for resource use and thus better for the environment (Schotman & Ludden, 2014).

Thirdly, the data gathered was restricted to the Dutch consumers only, although a balanced sample was enabled through quotas, this still makes the generalizability of the results to a worldwide population difficult. The data-quality itself was considered high, since the cleaning was done thoroughly and several checks on the data validity were done throughout the research. Because a DCE is one of the most subjective methods of research, without the common method bias (Podsakoff et al., 2003) the findings are applicable to the real world. Although this research was done with the washing-machine as a case study the interviews provided that the results are also representative for other white-goods and CEM-products. It became clear however, that results of the PSS are not transferrable to mobility-as-a-service concepts (Bardhi & Eckhardt, 2012). The results could be interesting for other types of PSS, as long as all important attributes are considered.

Fourthly, the definition of acceptance varies over literature. Acceptance according to different authors can be a positive attitude towards something; pre-adoption (Mashhadi et al., 2019), or a positive attitude post-adoption (Poppelaars et al., 2018). This difference in definition makes the interpretation of acceptance literature more difficult. A better working-definition of consumer acceptance should therefore be proposed and commonly adopted by researchers. In the future it would be advised to use the term adoption, since that is a more distinctive term.

Fifthly, although we are working with a DCE, which is shown to mimic realistic behaviour (Schlereth et al., 2012), there still might be an attitude-practice gap. People might prefer something in the survey that they do not actually buy in real-life. Although also with the dual response none option this is decreased, there still might be some bias towards socially acceptable answers. Furthermore, this study assumes that consumers are able to make rational decisions between choices. The decisions

[30] *Like was the case with the contract period, as explained in section 4.2.4.*

made might be less rational as there might have been too much or not enough information, people did not have much time, or there might have been other restriction. Nevertheless, it is acknowledged that consumer still always try to choose an option that best suit their needs and provide them the most value or utility.

Lastly, there is a limitation in the financial motive of consumers, since they now have the possibility to access products that they otherwise could not have afforded. In some way this is a good thing, because this can level out inequalities in society. On the other hand, this might also be less sustainable because of the rebound-effects. People will now start adopting things they would not have gotten if it were for the buy option. In that case the buy-option is quite sustainable, since consumers can only spend their money on a product once. So, they have less money for other products, instead consumers can adopt multiple PSS's because they can spread the investments over time. Furthermore, it could be quite easy for consumers to then lose track of all the subscriptions and PSS they have got, which could lead to actually unused products and thus more unnecessary consumption and unsustainable behaviour.

5.5. Recommendations for further research

There are lots of starting points for further research derived from this research. Firstly, some disparities between the interviews and gather data were found. Some interviewees argued that flexibility would be really important to consumers. However, this research showed that flexibility, operationalized as contract period, was not as important as anticipated. More research could be done on why this discrepancy is present. Additionally, more insights should be gained on the willingness to pay for each proposition. Currently, it is not known when a consumer would adopt and when a consumer rejects a proposition. A better understanding of the tipping-points within PSS, can provide true understanding on when (and at what attribute levels) consumer switch from one business model to another.

Secondly, the data gathered have more research applications than are currently being utilized. For example, this research also asked for the postal code of the respondents. This was done to get insights in the fact if people lived in an urban or rural area. This data could be combined with CBS (National Statistical Agency) to find average house price. A deeper understanding of the respondents can be reached when further diving into this variable and comparing rural versus urban consumers, or to cross-analyse the results over the average house price. This study did not include any analysis on this variable since only 40% of the respondents gave their postal-code. Furthermore, current qualitative data was only used for additional insights into consumers, the attributes they value, the important variables and the trade-offs they make. However more qualitative research on the thought-processes by consumers, their heuristics, should also be considered. These could provide insights in the short-cuts in though-patterns consumers make when making a decision. Future research should adopt triangulation of research methods, incorporating a qualitative research stage to find elicit beliefs toward behaviour, followed by a quantitative method such as a survey or a DCE. Planing & Britzelmaier (2011) have already argued that 'if *scholars in the field of innovation acceptance direct their future research according to these guidelines, the results of their work will promise new insights into the process of individual technology adoption beyond what is already known today' (p. 240).*

Thirdly, the DCE has been shown to be a useful tool for investigating consumer behaviour. This tool can easily be adapted to suite other PSS fields such as e.g. Furniture-as-a-Service or Mobility-as-a-Service. The researcher encourages scholars to start using this method in future research. Currently even more elaborate versions of DCE studies are available such as: Adaptive-CBC, Build-Your-Own concept or choice-tournaments.

Fourthly, Camacho-Otero et al. (2017) already suggested some points for a research agenda. One of which is to provide definitions of acceptance in the context of circular economy. This research argues that this can be extended further to a uniform definition of consumer acceptance for PSS. Additionally, more research can be done on the factors that have a positive impact on acceptance, since this research is not fully exhaustive on this matter. Furthermore, some literature argues that researcher need to look at why consumers are choosing for a circular business model or PSS in the first place. Is this because of ecological reasons or more because of financial or practical considerations?

Another angle for further research is that banks are still hesitant to finance PSS business models because the pre-funding will remain on the balance sheets of the funded companies, resulting in a medium to high risk profile. This is partly due to the uncertainty surrounding PSS business models and the fluctuating return on investment each month. More research could be done on the effects on the on-balance, off balance discussion associated with the provision PSS.

For policy makers that want to enable the circular economy, or more resource efficient consumption, implementing policies that help enable PSS are needed. It has been noted that current awareness of PSS is low and that there is still a lot of attention needed for PSS and their potential sustainability benefits. Governments can help stimulate awareness by means of campaigns, but more importantly by changing tax-laws. Currently a lot of companies struggle with implementing PSS because of the increase in labour involved (Bianchi et al., 2009; Vezzoli et al., 2015). Since labour is an expensive cost to companies, the transition towards more PSS or other forms of circular business models (like life-time extension through refurbishment) are often hard to make. Therefore, a shift in lower taxes for labour and higher taxes for (virgin) resources seems like an important step to enable these business models (Groothuis, 2018; Ex'Tax Project).

Lastly, there is currently a blossoming of PSS in the market. For almost every product there seems to be an 'as-a-service' variety popping up. Research can already focus on the reasons for PSS providers to start with these service proposition, because the researchers would argue that not all of these PSS will be a success and contribute to the sustainability transition. Therefore, more research on which types of products are most suitable to be (sustainable) PSS is therefore important. One of the interviewees, a PSS professor from the UK, even argued that temporary medical appliance PSS, designed for elderly, are still an underserved and under-researched group.

To conclude, this research can help align PSS with perceived consumer needs. It was always intended to find a part of the puzzle of helping the transition towards a more sustainable future. As Planing (2015, p.7) said it*: 'Consumer behaviour will play an important, if not the most important, role in the shift towards a circular economy'.* Hopefully this research contributed to a part of the understanding of that consumer behavior.

6. Acknowledgement

This research would not have been possible without the help of the University of Utrecht, Climate-KIC and ABN AMRO Bank. Thanks to ABN AMRO for their time & resources spend on this study, and for the opportunity to explore more of the PSS or Product-as-a-Service business model. Firstly, I want to thank all the interviewees respondents and experts that gave their time and collaboration to this project.

Secondly, I want to give special thanks to Matthijs Janssen for his support during my thesis. Your patience and critique were of huge value to this project, and your guidance made me stay on track. Thirdly, I would like to thank Iris van den Akker, former commercial manager product-as-a-service for the interesting internship I had the privilege to enroll in. Lastly, I want to say a huge thanks to Sharon, who supported me throughout this journey. It was nice knowing that I always had your encouragement and company to count on.

7. References

Adamowicz, W., Boxall, P., Williams, M., & Louviere, J. (1998). Stated preference approaches for measuring passive use values: choice experiments and contingent valuation. *American journal of agricultural economics*, *80*(1), 64-75

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS quarterly*, 227-247.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211.

Ajzen, I. (2011). The theory of planned behaviour: reactions and reflections. *Psychology & Health*, 26(9), 1113-1127,

Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information systems research*, *9*(2), 204-215.

Antikainen, M., Lammi, M., Paloheimo, H., Rüppel, T., & Valkokari, K. (2015, December). Towards circular economy business models: Consumer acceptance of novel services. In *ISPIM Innovation Symposium* (p. 1). The International Society for Professional Innovation Management (ISPIM).

Antikainen, M., & Lammi, M. (2016). Consumer acceptance of novel sustainable circular services. In ISPIM Conference Proceedings (p. 1). The International Society for Professional Innovation Management (ISPIM).

Baines, T. S., Lightfoot, H. W., Evans, S., Neely, A., Greenough, R., Peppard, J., ... & Alcock, J. R. (2007). State-of-the-art in product-service systems. *Proceedings of the Institution of Mechanical Engineers, Part B: journal of engineering manufacture*, *221*(10), 1543-1552.

Bates, K., Bates, H., & Johnston, R. (2003). Linking service to profit: the business case for service excellence. *International Journal of Service Industry Management*, *14*(2), 173-183.

Bardhi, F., & Eckhardt, G. M. (2012). Access-based consumption: The case of car sharing. *Journal of consumer research*, *39*(4), 881-898.

Barquet, A. P. B., de Oliveira, M. G., Amigo, C. R., Cunha, V. P., & Rozenfeld, H. (2013). Employing the business model concept to support the adoption of product–service systems (PSS). *Industrial Marketing Management*, *42*(5), 693-704.

Bennett, J., & Blamey, R. (Eds.). (2001). *The choice modelling approach to environmental valuation*. Edward Elgar Publishing.

Belk, R. (2014). You are what you can access: Sharing and collaborative consumption online. *Journal of business research*, *67*(8), 1595-1600.

Beuren, F. H., Ferreira, M. G. G., & Miguel, P. A. C. (2013). Product-service systems: a literature review on integrated products and services. Journal of cleaner production, 47, 222-231.

Bliemer, M. C., & Rose, J. M. (2005). Efficient designs for alternative specific choice experiments

Bocken, N. M., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of cleaner production*, *65*, 42-56.

Bocken, N. M., Mugge, R., Bom, C. A., & Lemstra, H. J. (2018). Pay-per-use business models as a driver for sustainable consumption: Evidence from the case of HOMIE. *Journal of Cleaner Production*, 198, 498-510.

Böcker, L., & Meelen, T. (2017). Sharing for people, planet or profit? Analysing motivations for intended sharing economy participation. *Environmental Innovation and Societal Transitions*, *23*, 28-39.

Brown, S. A., & Venkatesh, V. (2005). Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle. *MIS quarterly*, 399-426.

Bryman, A. (2012). *Social research methods*. Oxford university press. 4th Edition. New York

Caussade, S., de Dios Ortúzar, J., Rizzi, L. I., & Hensher, D. A. (2005). Assessing the influence of design dimensions on stated choice experiment estimates. *Transportation research part B: Methodological*, *39*(7), 621-640.

Camacho-Otero, J., Pettersen, I. N., & Boks, C. (2017). Consumer and user acceptance in the circular economy: what are researchers missing?. *PLATE: Product Lifetimes And The Environment*.

Camacho-Otero, J., Boks, C., & Pettersen, I. (2018). Consumption in the circular economy: A literature review. *Sustainability*, *10*(8), 2758.

Carson, R. T., Louviere, J. J., Anderson, D. A., Arabie, P., Bunch, D. S., Hensher, D. A., ... & Timmermans, H. (1994). Experimental analysis of choice. Marketing letters, 5(4), 351-367.

Catulli, M. (2012). What uncertainty? Further insight into why consumers might be distrustful of product service systems. *Journal of Manufacturing Technology Management*, *23*(6), 780-793.

Catulli, M., Lindley, J. K., Reed, N. B., Green, A., Hyseni, H., & Kiri, S. (2013). What is Mine is NOT Yours: Further insight on what access-based consumption says about consumers. In *Consumer Culture Theory* (pp. 185-208). Emerald Group Publishing Limited.

Catulli, M., & Dodourova, M. (2013). Innovation for a Circular Economy: Exploring the Product Service Systems Concept. In *Procs XXIV ISPIM Conference–Innovating in Global Markets*. International Society for Professional Innovation Management (ISPIM).

Cherry, C., & Pidgeon, N. (2018). Why Is Ownership an Issue? Exploring Factors That Determine Public Acceptance of Product-Service Systems. *Sustainability*, *10*(7), 2289.

Chou, C. J., Chen, C. W., & Conley, C. (2015). An approach to assessing sustainable product-service systems. *Journal of Cleaner Production*, *86*, 277-284

Chrzan, K., & Orme, B. (2000). An overview and comparison of design strategies for choice-based conjoint analysis. *Sawtooth software research paper series*, *98382*.

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS quarterly*, 189-211.

Compeau, D., Higgins, C. A., & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: A longitudinal study. *MIS quarterly*, 145-158.

Davis, F. D. (1985). *A technology acceptance model for empirically testing new end-user information systems: Theory and results* (Doctoral dissertation, Massachusetts Institute of Technology).

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management science*, *35*(8), 982-1003.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace 1. *Journal of applied social psychology*, *22*(14), 1111-1132.

Estrada, A., & Romero, D. (2016). A system quality attributes ontology for product-service systems functional measurement based on a holistic approach. *Procedia CIRP*, 47, 78-83.

Farooq, M. S., Salam, M., Jaafar, N., Fayolle, A., Ayupp, K., Radovic-Markovic, M., & Sajid, A. (2017). Acceptance and use of lecture capture system (LCS) in executive business studies: extending UTAUT2. *Interactive Technology and Smart Education*, *14*(4), 329-348.

Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention and behavior: An introduction to theory and research.

Fishbein, M. (1979). A theory of reasoned action: Some applications and implications

Fishbein, M., & Ajzen, I. (2011). *Predicting and changing behavior: The reasoned action approach*. Psychology Press.

Friedman, M. (2007). The social responsibility of business is to increase its profits. In *Corporate ethics and corporate governance* (pp. 173-178). Springer, Berlin, Heidelberg.

Gaskin, S., Evgeniou, T., Bailiff, D., & Hauser, J. (2007, October). Two-stage models: Identifying non-compensatory heuristics for the consideration set then adaptive polyhedral methods within the consideration set. In *Proceedings of the Sawtooth Software Conference* (Vol. 13, pp. 67-83).

Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy–A new sustainability paradigm?. *Journal of cleaner production*, *143*, 757-768.

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner production*, *114*, 11-32.

Goedkoop, M.J., van Halen, C. J. G., Riele, H. R. M., & Rommens, P. J. M. (1999). Product Service-Systems, ecological and economic basics. *Report for Dutch Ministries of Environment (VROM) and Economic Affairs (EZ)*.

Green, P. E., & Srinivasan, V. (1990). Conjoint analysis in marketing: new developments with implications for research and practice. *The journal of marketing*, 3-19.

Groothuis, F. (2018) Tax as a force for good - Rebalancing our tax systems to support a global economy fit for the future, ACCA Global. Retrieved on 10-11-2019 from: https://www.accaglobal.com/content/dam/ACCA_Global/professional-insights/Tax-as-force-for-good/pi-environmental-tax.pd

Hankammer, S., & Steiner, F. (2015). Leveraging the sustainability potential of mass customization through product service systems in the consumer electronics industry. *Procedia CIRP*, *30*, 504-509.

Halme, M., Anttonen, M., Hrauda, G., Kortman, J., (2006). Sustainability evaluation of European household services. *Journal of Cleaner Production,* 14 (17), 1529-1540.

Hanley, N., Wright, R. E., & Adamowicz, V. (1998). Using choice experiments to value the environment. *Environmental and resource economics*, *11*(3-4), 413-428.

Harrison, G. W. (2006). Making choice studies incentive compatible. In *Valuing environmental amenities using stated choice studies* (pp. 67-110). Springer, Dordrecht.

Haughton, D., Legrand, P., & Woolford, S. (2009). Review of three latent class cluster analysis packages: Latent Gold, poLCA, and MCLUST. *The American Statistician*, *63*(1), 81-91.

Hauser, J. R. (2007). A note on conjoint analysis. *Unpublished manuscript, MITSloan Management. Retrieved from http://www. mit. edu/~ hauser/Papers/NoteonConjointAnalysis.pdf*

Hensher, D. A., & Bradley, M. (1993). Using stated response choice data to enrich revealed preference discrete choice models. *Marketing Letters*, *4*(2), 139-151.

Hensher, D. A., Rose, J. M., & Greene, W. H. (2005). *Applied choice analysis: a primer*. Cambridge University Press.

Hensher, D. A. (2006). How do respondents process stated choice experiments? Attribute consideration under varying information load. *Journal of applied econometrics*, *21*(6), 861-878.

Hou, J., & Neely, A. (2013). Barriers of servitization: results of a systematic literature review. *Paper presented at the The Spring Servitization Conference*, Birmingham, UK, pp. 189-195.

Hoyos, D. (2010). The state of the art of environmental valuation with discrete choice experiments. *Ecological economics*, *69*(8), 1595-1603.

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, *15*(9), 1277-1288.

Hunecke, M., Blöbaum, A., Matthies, E., & Höger, R. (2001). Responsibility and environment: Ecological norm orientation and external factors in the domain of travel mode choice behavior. *Environment and Behavior*, *33*(6), 830-852.

Johnson, J.W. (2000). A heuristic method for estimating the relative weight of predictor variables in multiple regression. *Multivariate behavioral research,* 35, 1-19

Johnson, F. R., & Orme, B. (2003). Getting the most from CBC. *Sequim: Sawtooth Software Research Paper Series, Sawtooth Software*.

Johnson, F. R., Lancsar, E., Marshall, D., Kilambi, V., Mühlbacher, A., Regier, D. A., ... & Bridges, J. F. (2013). Constructing experimental designs for discrete-choice experiments: report of the ISPOR conjoint analysis experimental design good research practices task force. *Value in Health*, *16*(1), 3-13.

Kemp, R., & van Lente, H. (2011). The dual challenge of sustainability transitions. *Environmental Innovation and Societal Transitions*, *1*(1), 121-124.

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, *127*, 221-232.

Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the Circular Economy: Evidence from the European Union (EU). *Ecological Economics*, *150*, 264-272.

Lancaster, K. J. (1966). A new approach to consumer theory. *Journal of political economy*, *74*(2), 132-157.

Lee, Younghwa; Kozar, Kenneth A.; and Larsen, Kai R.T. (2003) "The Technology Acceptance Model: Past, Present, and Future,"*Communications of the Association for Information Systems*: Vol. 12, Article 50.

Lee, J. H., & Song, C. H. (2013). Effects of trust and perceived risk on user acceptance of a new technology service. *Social Behavior and Personality: an international journal*, *41*(4), 587-597.

Lewandowski, M. (2016). Designing the business models for circular economy—Towards the conceptual framework. *Sustainability*, *8*(1), 43.

Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: a comprehensive review in context of manufacturing industry. *Journal of Cleaner production*, *115*, 36-51.

Limayem, M., Hirt, S. G., & Cheung, C. M. (2007). How habit limits the predictive power of intention: The case of information systems continuance. *MIS quarterly*, 705-737.

Louviere, J. J., & Woodworth, G. (1983). Design and analysis of simulated consumer choice or allocation experiments: an approach based on aggregate data. *Journal of marketing research*, 350-367.

Louviere, J. J. (1988). Conjoint analysis modelling of stated preferences: a review of theory, methods, recent developments and external validity. *Journal of transport economics and policy*, 93-119.

MacArthur, E. (2013). Towards the circular economy. *Journal of Industrial Ecoloy,* 23-44.

Magidson, J., & Vermunt, J. K. (2002). Latent class models for clustering: a comparison with K-means. *Canadian Journal of Marketing Research*, *20*, 37–44.

Magidson, J., & Vermunt, J. (2007). Removing the scale factor confound in multinomial logit choice models to obtain better estimates of preference. *Sawtooth Software Conference*, 1–18.

Manski, C. F. (1977). The Structure of Random Utility Models. Theory and Decision, 8(3), 229 – 255.

Manzini, E., & Vezzoli, C. (2003). A strategic design approach to develop sustainable product service systems: examples taken from the 'environmentally friendly innovation'Italian prize. *Journal of cleaner production*, *11*(8), 851-857.

Mashhadi, A. R., Vedantam, A., & Behdad, S. (2019). Investigation of consumer's acceptance of product-service-systems: A case study of cell phone leasing. *Resources, Conservation and Recycling*, *143*, 36-44.

Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information systems research*, *2*(3), 173-191.

Matschewsky, J., Lindahl, M., & Sakao, T. (2015). Facilitating industrial adoption of design methods for product-service systems. In *DS 80-7 Proceedings of the 20th International Conference on Engineering Design (ICED 15) Vol 7: Product Modularisation, Product Architecture, systems Engineering, Product Service Systems, Milan, Italy, 27-30.07. 15* (Vol. 7, pp. 301-310). DESIGN SOC.

McMeekin, A., & Southerton, D. (2012). Sustainability transitions and final consumption: practices and socio-technical systems. *Technology Analysis & Strategic Management*, *24*(4), 345-361.

Meijkamp, R. (2000), *Changing Consumer Behaviour through Eco-efficient Services. An Empirical Study of Car Sharing in The Netherlands*, Delft University of Technology, Delft.

Mont, O. (2001). Introducing and developing a Product-Service System (PSS) concept in Sweden.

Mont, O. (2002). Clarifying the concept of product–service system. *Journal of cleaner production*, *10*(3), 237-245.

Mont, O. (2004). *Product-service systems: panacea or myth?*. IIIEE, Lund University.

Mont, O., & Plepys, A. (2003). Customer satisfaction: review of literature and application to the product-service systems. *International Institute of Industrial Environmental Economics*.

Mont, O., Plepys, A., Whalen, K., & Nußholz, J. L. (2017). Business model innovation for a Circular Economy: Drivers and barriers for the Swedish industry–the voice of REES companies.

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information systems research*, *2*(3), 192-222.

Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing. *Operations management research*, *1*(2), 103-118.

Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International journal of service industry management*, *14*(2), 160-172.

Orme, B., & Howell, J. (2009). Application of covariates within Sawtooth Software's CBC/HB program: theory and practical example. *Sawtooth Software Research Paper Series*.

Orme, B. (2006). Getting started with conjoint analysis: strategies for product design and pricing research.

Orme, B. (2012). Latent Class v4. 5: Software for Latent Class Estimation for CBC Data; Sawtooth Software. *Inc.: Orem, UT, USA*.

Orme, B. (2016). CBC/HB V5, Software for Hierarchical Bayes Estimation for CBC data, Sawtooth Software, Orem (Utah)

Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: Integrating trust and risk with the technology acceptance model. *International journal of electronic commerce*, *7*(3), 101-134.

Pettersson, P. (2000), What happens within Electrolux AB?, 'Funktionsförsäljning' – Product-Service Systems, Stockholm, *Swedish EPA*

Piscicelli, L., Cooper, T., & Fisher, T. (2015). The role of values in collaborative consumption: insights from a product-service system for lending and borrowing in the UK. *Journal of Cleaner Production*, *97*, 21-29.

Planing, P., & Britzelmaier, B. (2011). A critical literature review on consumer acceptance of product innovations. *International Journal of Management Cases*, *13*(3), 235-241.

Planing, P. (2015). Business model innovation in a circular economy reasons for non-acceptance of circular business models. *Open journal of business model innovation*, *1*(11).

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of applied psychology*, *88*(5), 879-903.

Poppelaars, F., Bakker, C., & Van Engelen, J. (2018). Does Access Trump Ownership? Exploring Consumer Acceptance of Access-Based Consumption in the Case of Smartphones. *Sustainability*, *10*(7), 2133.

Rahman, M. M., Lesch, M. F., Horrey, W. J., & Strawderman, L. (2017). Assessing the utility of TAM, TPB, and UTAUT for advanced driver assistance systems. *Accident Analysis & Prevention*, *108*, 361-373.

Ramani, K., Ramanujan, D., Bernstein, W. Z., Zhao, F., Sutherland, J., Handwerker, C., ... & Thurston, D. (2010). Integrated sustainable life cycle design: a review. *Journal of Mechanical Design*, *132*(9), 091004.

Repo, P., & Anttonen, M. (2017). Emerging consumer perspectives on circular economy. In *The 13th Nordic Environmental Social Science Conference HopefulNESS Available at. https://www. researchgate. net/publication/317596538_Emerging_consumer_ perspectives_on_circular_economy*.

Reim, W., Parida, V., & Örtqvist, D. (2015). Product–Service Systems (PSS) business models and tactics–a systematic literature review. *Journal of Cleaner Production*, *97*, 61-75.

Rexfelt, O., & Hiort af Ornäs, V. (2009). Consumer acceptance of product-service systems: designing for relative advantages and uncertainty reductions. *Journal of Manufacturing Technology Management*, *20*(5), 674-699.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E. F., ... & Nykvist, B. (2009). A safe operating space for humanity. *nature*, *461*(7263), 472.

Rogers, E. M. (2010). *Diffusion of innovations*. Simon and Schuster. 5th Edition, New York Press.

Rose, J. M., Hensher, D. A., Caussade, S., de Dios Ortúzar, J., & Jou, R. C. (2009). Identifying differences in willingness to pay due to dimensionality in stated choice experiments: a cross country analysis. *Journal of Transport Geography*, *17*(1), 21-29.

Rosen, P. A. (2004). The effect of personal innovativeness in the domain of information technology on the acceptance and use of technology: a working paper. *Oklahoma State University*.

Roy, R. (2000). Sustainable product-service systems. *Futures*, *32*(3-4), 289-299.

Ryan, M., & Gerard, K. (2003). Using discrete choice experiments to value health care programmes: current practice and future research reflections. *Applied health economics and health policy*, *2*(1), 55-64.

Safeena, R., Date, H., Hundewale, N., & Kammani, A. (2013). Combination of TAM and TPB in Internet banking adoption. *International Journal of Computer Theory and Engineering*, *5*(1), 146.

Samaradiwakara, G. D. M. N., & Gunawardena, C. G. (2014). Comparison of existing technology acceptance theories and models to suggest a well improved theory/model. *International Technical Sciences Journal*, *1*(1), 21-36.

Sammer, K., & Wüstenhagen, R. (2006). The influence of eco-labelling on consumer behaviour–Results of a discrete choice analysis for washing machines. *Business Strategy and the Environment*, *15*(3), 185-199.

Sawhney, M., Balasubramanian, S., & Krishnan, V. V. (2004). Creating growth with services: in a world of commoditized products, companies are turning to service offerings for growth. The key to success involves redefining markets in terms of customer activities and outcomes, not products and services. *MIT Sloan management review*, *45*(2), 34-44.

Schenkl, S. A., Rösch, C., & Mörtl, M. (2014). Literature study on factors influencing the market acceptance of PSS. *Procedia CIRP*, *16*, 98-103.

Schlereth, C., Eckert, C., & Skiera, B. (2012). Using discrete choice experiments to estimate willingness-to-pay intervals. *Marketing Letters*, *23*(3), 761-776.

Schlereth, C., & Skiera, B. (2016). Two new features in discrete choice experiments to improve willingness-to-pay estimation that result in SDR and SADR: Separated (adaptive) dual response. *Management Science*, *63*(3), 829-842.

Schmidt, D. M., Bauer, P., & Mörtl, M. (2015a). PSS for influencing customer barriers and acceptance. *Journal of Economics Business and Management*, *3*(10), 990-993.

Schmidt, D. M., Malaschewski, O., Fluhr, D., & Mörtl, M. (2015b). Customer-oriented framework for product-service systems. *Procedia CIRP*, *30*, 287-292.

Schotman, H., & Ludden, G. D. S. (2014). User acceptance in a changing context: why some product-service systems do not suffer acceptance problems. *Journal of design research*, 12(3), 188-203.

Schwarz, G. (1978). Estimating the dimension of a model. *The Annals of Statistics,* 6(2), 461–464.

Schwartz, S. H. (1977). Normative influences on altruism. *Advances in experimental social psychology*, 10, 221-279.

Simon, H. A. (1955). A behavioral Model of Rational Choice. *The Quarterly Journal of Economics*, 69(1), 99–118.

Slade, E. L., Dwivedi, Y. K., Piercy, N. C., & Williams, M. D. (2015). Modeling consumers' adoption intentions of remote mobile payments in the United Kingdom: extending UTAUT with innovativeness, risk, and trust. *Psychology & Marketing*, *32*(8), 860-873.

Stahel, W. R. (2016). The circular economy. *Nature News*, *531*(7595), 435.

Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of educational research*, *79*(2), 625-649.

Surveygizmo (n.d.) Sample Size Calculator retrieved on 22-1-2019 from: https://www.surveygizmo.com/sample-size-calculator/

Swait, J., & Adamowicz, W. (2001). Choice environment, market complexity, and consumer behavior: a theoretical and empirical approach for incorporating decision complexity into models of consumer choice. *Organizational Behavior and Human Decision Processes*, *86*(2), 141-167.

Swait, J., & Adamowicz, W. (2001a). The influence of task complexity on consumer choice: a latent class model of decision strategy switching. *Journal of Consumer Research*, *28*(1), 135-148.

Swait, J., & Louviere, J. (1993). The Role of the Scale Parameter in the Estimation and Use of Multinomial Logit Models. *Journal of Marketing Research,* 30(3), 305–314.

Taherdoost, H. (2018). A review of technology acceptance and adoption models and theories. *Procedia Manufacturing*, *22*, 960-967.

Taylor, S., & Todd, P. A. (1995a). Understanding information technology usage: A test of competing models. *Information systems research*, *6*(2), 144-176.

Taylor, S., & Todd, P. (1995b). Decomposition and crossover effects in the theory of planned behavior: A study of consumer adoption intentions. *International journal of research in marketing*, *12*(2), 137-155.

ThØgersen, J. (1995). Understanding of consumer behaviour as a prerequisite for environmental protection. *Journal of consumer policy*, *18*(4), 345-385.

Thompson, R. L., Higgins, C. A., & Howell, J. M. (1991). Personal computing: toward a conceptual model of utilization. *MIS quarterly*, 125-143.

Tietze, F., & Hansen, E. G. (2013). To own or to use? How product service systems facilitate eco-innovation behavior. Academy of management Conference, Orlando, Florida

Tischner, U., Verkuijl, M., & Tukker, A. (2002). Product Service Systems: best practice document: SusProNet.

Train, K. E. (2009). *Discrete choice methods with simulation*. Cambridge university press.

Tukker, A. (2004). Eight types of product–service system: eight ways to sustainability? Experiences from SusProNet. *Business strategy and the environment*, *13*(4), 246-260.

Tukker, A., & Tischner, U. (2006). Product-services as a research field: past, present and future. Reflections from a decade of research. *Journal of cleaner production*, *14*(17), 1552-1556.

Tukker, A. (2015). Product services for a resource-efficient and circular economy–a review. *Journal of cleaner production*, *97*, 76-91.

Tunn, V.S.C, Bocken, N.M.P, van den Hende, E.A., Schoormans, J.P.L. (2019). Diffusion of access-based product-service systems: Adoption barriers and how they are addressed in practice. *3rd PLATE Product Lifetimes and the Environment Conference, Berlin*

Van Rijnsoever, F. J., & Kempkes, S. N. (2014). A discrete choice experiment to explain knowledge acquisition strategies of SMEs. *In DRUID Society Conference 2014*.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science*, 46(2), 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS quarterly*, *36*(1), 157-178.

Vezzoli, C., Ceschin, F., Diehl, J. C., & Kohtala, C. (2012). Why have 'Sustainable Product-Service Systems' not been widely implemented? Meeting new design challenges to achieve societal sustainability. *Journal of Cleaner Production*, 35(10), 288-290.

Vezzoli, C., Ceschin, F., Diehl, J. C., & Kohtala, C. (2015). New design challenges to widely implement 'Sustainable Product–Service Systems'. *Journal of Cleaner Production*, *97*, 1-12.

Yang, H. (2013). The case for being automatic: introducing the automatic linear modeling (LINEAR) procedure in SPSS statistics. *Multiple Linear Regression Viewpoints*, 39(2), 27-37.

Yin, R. K. (2017). Case study research and applications: Design and methods. Sage publications.

8. Appendix – Table of Content

Appendix I - Full Survey – English

The full survey was held in Dutch, but to understand which questions & variables were included in the survey and to show some choice-task to get a feel of the survey a translated version is shown.

Quota & Screen-out questions:

To start the respondents got 3 questions that checked if a respondent was eligible to answer the survey. These three questions were: gender, age and income. The latter two are divided into 4 subgroups (as is shown on the next page). For every subgroup at least a quota of 200 respondents was reached. If one of the subgroups was already filled with more than 200 respondents, respondents in this category were terminated, hence prioritizing the subgroups that weren't filled up until 200. There were two quota checkpoints in this survey.

This was done to allow for a larger heterogeneity among groups and to make Latent Class Analysis (LCA) possible. Furthermore this makes the sample more heterogenous, which makes for higher representativity and possible generalizability. The majority of the sample was gathered through panel provider Dynata (SSI Research). They provided a total of 950 completes to the survey, the additional respondents were gathered by the researcher and the internship supervisor.

If respondents did not want to provide salary or gender they were screened out (terminated) and they were not able to continue the survey. This was done because these were possible important variables that were crucial for segmentation, and not providing these details would make the respondents answer's useless.

Welcome to this survey! Click *'Next'* to continue.
This survey can only be made on a computer, laptop or tablet.

----------Page End----------

What is your gender?

Male

Female

I don't want to assign myself to any of the categories above. [Screen-out]

What is your age?

18-35 years

36-50 years

50-64 years

65+ years

----------Page End----------

-

[Quota Check]

----------Page End----------

-

What is the total gross income of your household?

0-20000 euro gross per year

20001-40000 euro gross per year

40001-60000 euro gross per year

60001+ euro gross per year

I prefer not to tell this [Screen-out]

----------Page End----------

-

[Quota Check]

----------Page End----------

-

Consumer research 'Ownership or Usage'

Utrecht University is conducting research into business models in which you don't own the product, but pay for *usage* or *functionality*, the so-called 'as-a-service' models. In these models the manufacturer has the responsibility over the product, provides unburdening for you, and there are no hidden costs. Through this survey we would like to investigate which options have your preference, and on which this depends. The product we would like to ask some questions about is the washing machine.

All results will be held strictly confidential, and are only for this research. This survey will last 10-15 minutes.

----------Page End----------

Please read the following options very carefully!

Imagine you are about to choose a new washing machine. You can either buy a machine, pay per month for a machine or use a machine in which you pay per wash (PPU). In all models water, electricity and detergent cost are at your expense. Nowadays you can even choose for laundry services. In the following section we provide these options, and we will ask you to choose which one of these has your preference.

The options are:

1. **Buy-option**

- You buy the machine at once as your own investment
- You receive 2 years guarantee, the appliance will last 8 years.
- You will be the owner of the machine, and thus responsible for maintenance and repairs[31].

2. Pay-per-month / Lease

- You pay a specified amount each month for the duration of the contract (e.g. one year). After that, it is cancellable each month.
- You don't need any investment (initial purchase amount).
- You are not (or will be) the owner of the machine.
- If the machine breaks down, it will be fixed or replaced for free within 48 hours.

3. Pay-per-wash / pay-per-use

- You have your *own* washing machine, but you pay per wash for the duration of the contract (e.g. one year).
- You don't need any investment, the cost of each wash are dependent on the temperature you wash at.
- You are not (or will be) the owner of the machine. U will receive periodic (software) updates, so you always wash most efficiently.
- If the machine breaks down a replacement or repair will be provided within 48 hours.

All the washing machines mentioned above have the same characteristics and features.
In all models water, electricity and detergents are at your own expense.

Furthermore it is possible to have your laundry done for you:

4. Laundry-service

- Your (unsorted) laundry (up to 6kg; one wash) will be picked up in a laundry-bag, washed, ironed, folded and delivered back home. This will unburden you completely.
- You do not need a washing machine, or even the space/ connection for that.

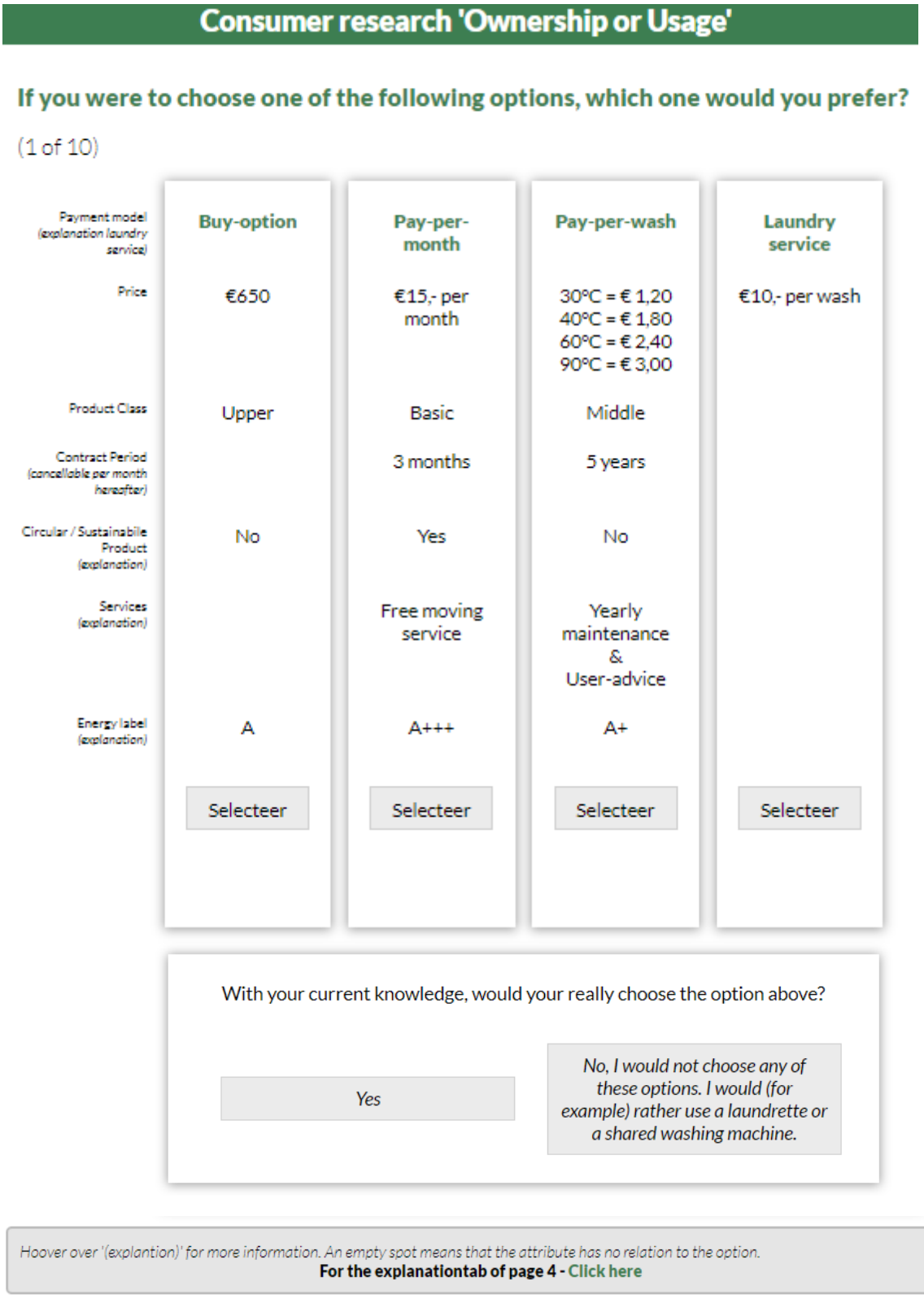
At all times you can go back to this page. At the bottom of each page; click on 'explanation page 4' to get back here.

----------Page End----------

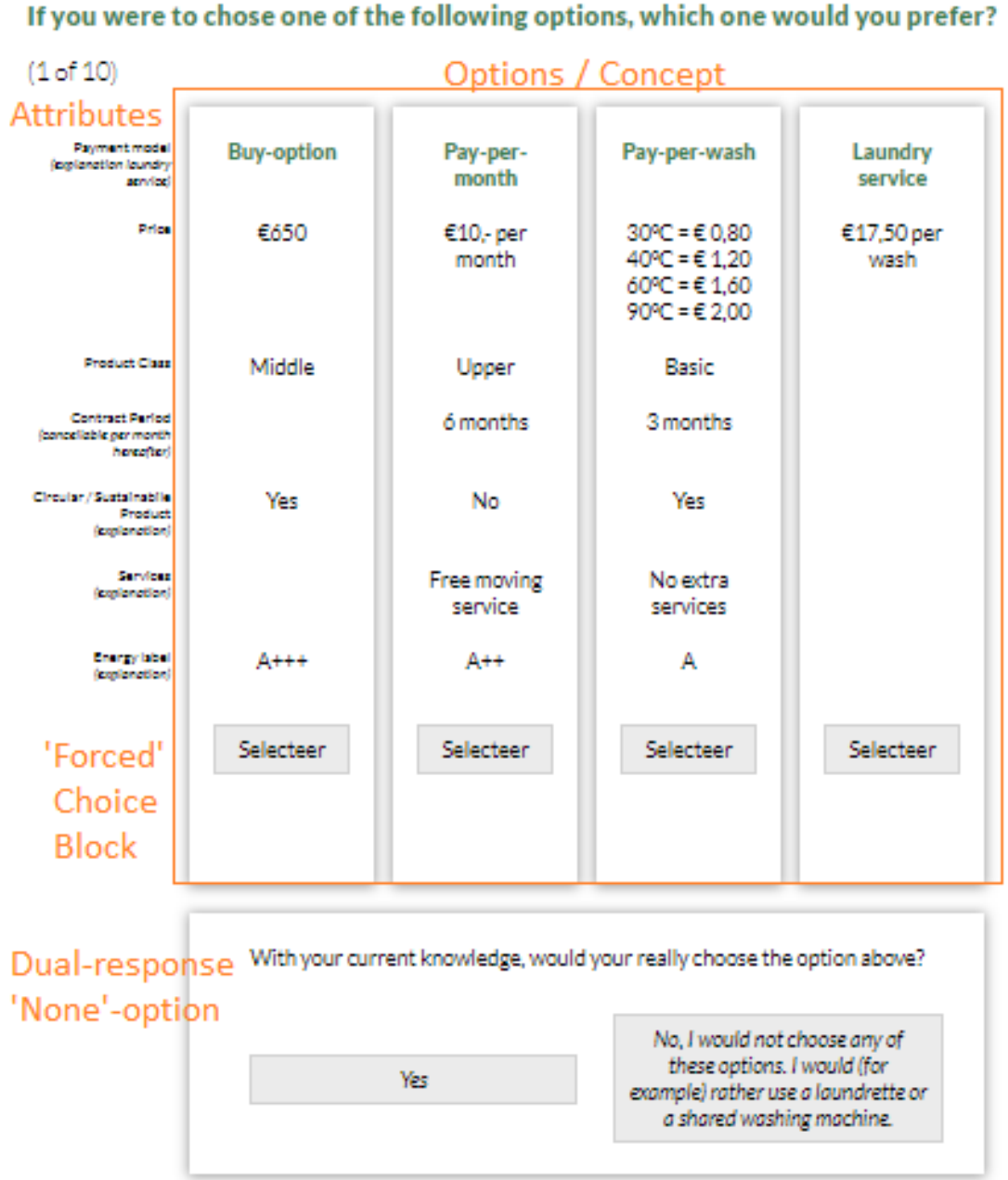
Now we would like to ask you to fill out 10 choice-tasks. Please select which one of the provided option has your preference.

[31] *In case respondents had questions about the options, underlined words were provided with some additional information if respondents hoovered over them.*

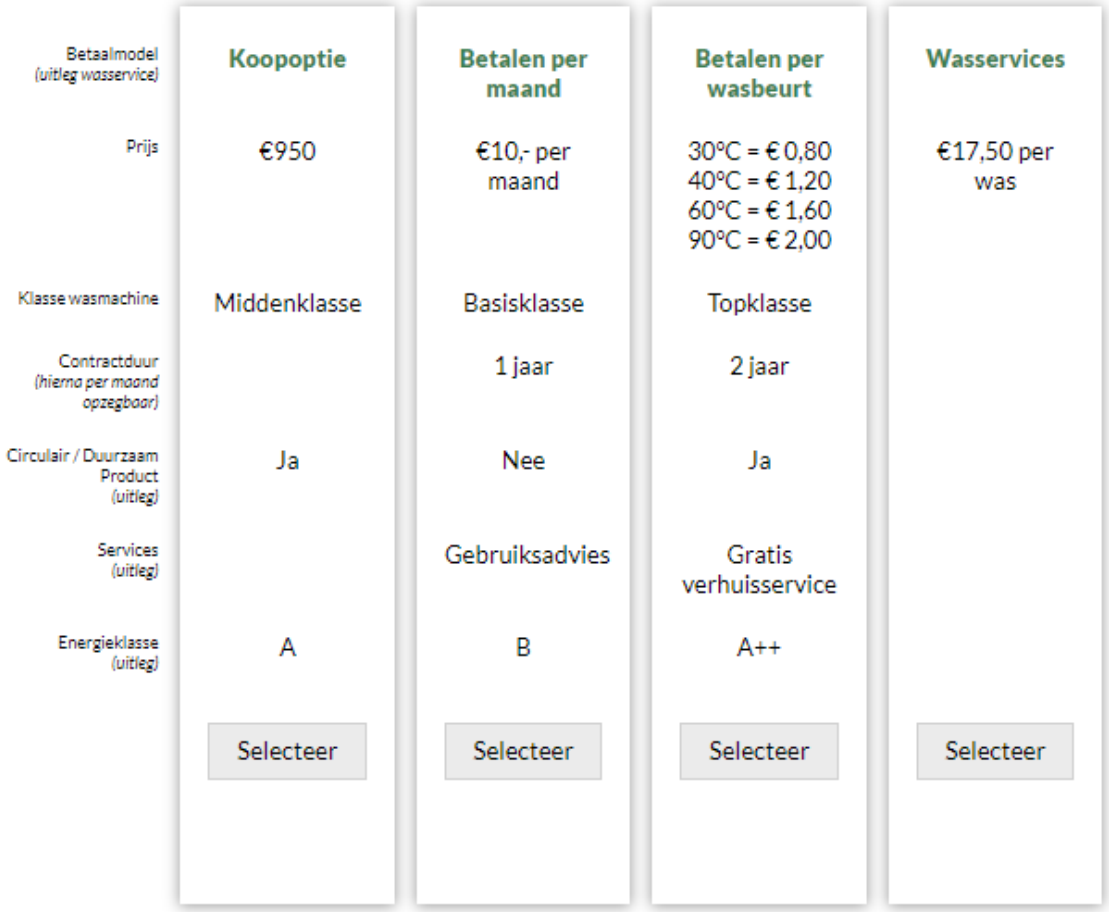
CBC 1/10 (English) – Example of the Webpage



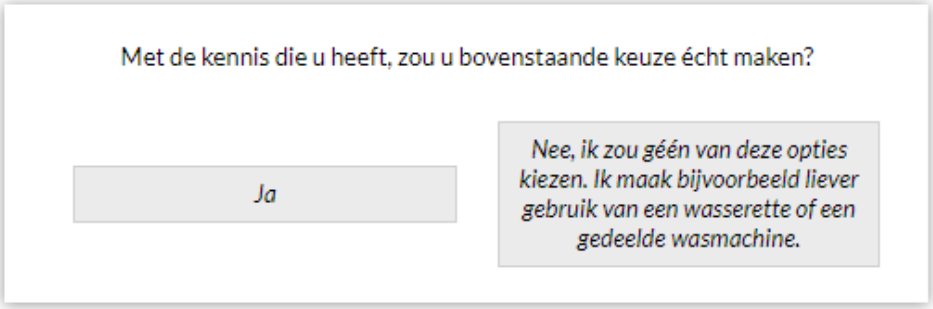
The first block is the so-called forced-choice block; 'which one of these options/concepts would you prefer?'. On the left hand side the attributes names are provided. Given the option provided and the respondents knowledge, would they 'stick with their choice' or would you not really choose any of the options? This is the so called; *Dual Response 'None'- option* (see next page).



CBC 1/10 (Dutch version as shown to respondents)

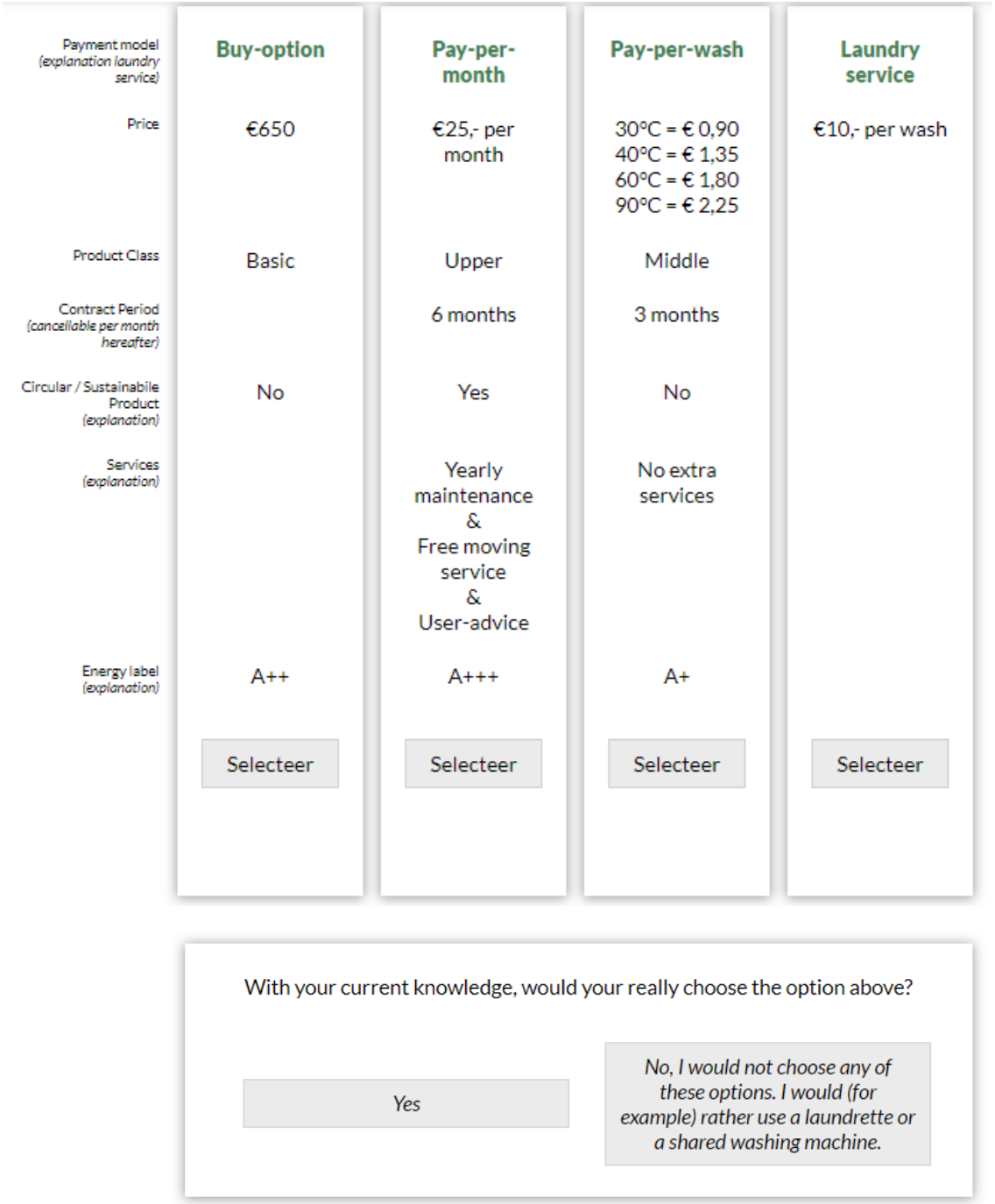


Then they were asked if they would stick with their option:



Then a new CBC, with different attribute levels was provided, to see if with other attribute levels they would prefer other options. In total the respondents did ten choice-tasks. To get a feel for the respondents survey, two more varieties are shown in the next pages.

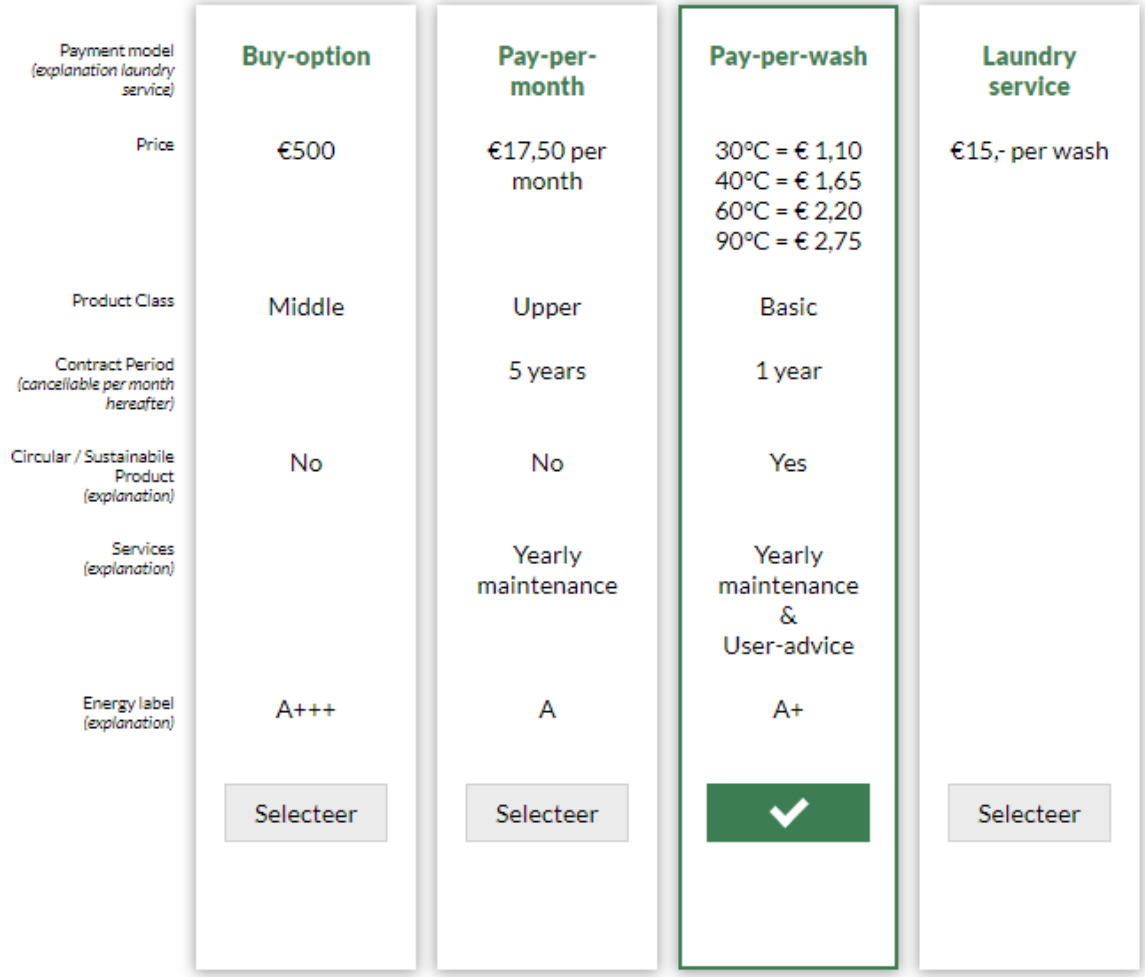
Another CBC – 5/10 (e.g.) – choice task (English)



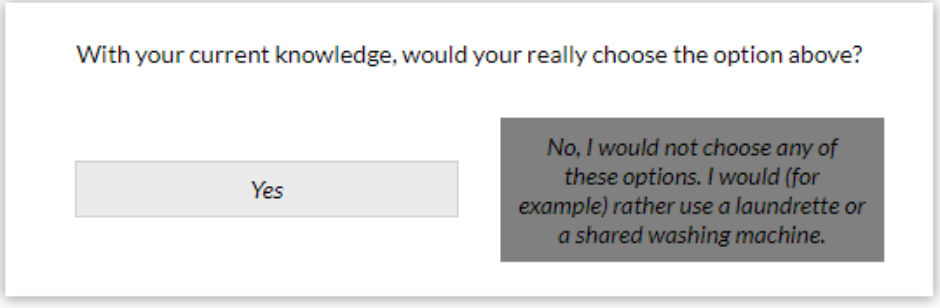
----------Page End----------

-

Another CBC – 10/10 (e.g.) – choice task (English) + selected options



Or



Now 20 general questions will be asked about your current situation and your preferences. After these questions the survey is finished.

Are you currently using one of the following examples *(multiple responses possible)*

□ Washing machine pay per month

□ Washing machine pay per wash

□ Laundry service for washing your clothes

□ I go to a laundrette or a shared washing facility to do my laundry

□ No, I do not use any of the aforementioned examples, I bought a washing machine.

Do you know someone that uses one of the following options: *(multiple answers possible)*

□ Yes, Washing machine pay per month

□ Yes, Washing machine pay per wash

□ Yes, Laundry service, (pick-up, clean and home delivery of laundry)

□ Yes, a laundrette or shared washing facility

□ No, I do not know anyone that uses one of the option above

Do you currently have a subscription, or do you lease in one of the following product categories: (*multiple answers possible)*

□ Shared mobility(Car2Go, Blablacar, Greenwheels, Snappcar etc.)
□ Furniture
□ Hearing Devices
□ Spotify/Netflix

Different, namely...

□ Cars/Motorbikes
□ Bed or matrasses
□ Solar panels
□ Bicycle/e-bike, scooters
□ Clothing
□ Home appliances
□ Electronics

How often do you wash each week?

□ Less than once a week

□ 1-2 times

□ 2-3 times

□ 3-4 times

□ 5 or more

Do you like doing the laundry?

□ Yes

□ No

----------Page End----------

-

[Only when currently owning a washing machine (bought one)]

Do you have sufficient space for doing the laundry at your home? (For the machine and the drying)

□ Yes, I have sufficient space for doing the laundry

□ No, I consider to have space deficiency for doing the laundry

□ None of the above / not applicable

----------Page End----------

-

[Only when currently currently using Laundry Services]

U selected that you use a laundry service. Do you agree with the following:

Laundry services are a good value for money:

	1	2	3	4	5	6	7	
Completely disagree								Fully agree

----------Page End----------

-

Are you concerned about the environment on a global scale?

	1	2	3	4	5	6	7	
Not concerned at all								Very concerned

In what way does your concern about the environment have effect on your daily purchasing decisions?

	1	2	3	4	5	6	7	
No influence								A lot of influence

I am known among friends to be the first to test a new technology or innovation:

	1	2	3	4	5	6	7	
Totally disagree								Fully agree

In what way is trust in the supplier/manufacturer of such products important for you?

	1	2	3	4	5	6	7	
Totally unimportant								Really important

The next questions are about the individual options. Can you indicate whether you agree with the following statements:

The use of a washing machine in which I have to *pay per wash (use)* enhances my efficiency in washing (e.g. smarter, better, more energy efficient and with a fuller drum):

	1	2	3	4	5	6	7	
completely disagree								fully agree

The use of a washing machine where I have to *pay per month* or *pay per wash* is better for the environment, because the producer/manufacturer remains responsible for it:

	1	2	3	4	5	6	7	
completely disagree								fully agree

Which of the following option **wouldn't** you buy/adopt, even if they were available for an affordable price?

□ Buying a washing machine

□ Paying per month for a washing machine

□ Paying per wash with a washing machine

□ Laundry services

□ I would condiser all options for an affordable price

Which of the following option would you buy/adopt, if price did not matter?

□ Buying a washing machine

□ Paying per month for a washing machine

□ Paying per wash with a washing machine

□ Laundry services

----------Page End----------

Do you live in a house you are renting or you bought?

□ Renting

□ Bought a house

How many persons in your household?

□ One person household

□ Two person household

□ Three person household

□ Four person household

□ 5+ person household

Where is your household composed off?

□ Family with young kids (average below 12 years)

□ Family with kids (average above 12 years)

□ Working or applying for work (or pensioners)

□ Students

□ Mix of students & working people

□ None of the above

Do you think you are going to move within the next two years?

□ Yes

□ No

Have you ever had a moment you could not do the laundry because of a broken machine, and you had to wait for repairs?

□ No, never

□ Yes, in the past 5 years.

□ Yes, but this is longer than 5 years ago

□ I can't remember

What has been your highest education?

□ WO (University or PhD)

□ HBO (Higher Education)

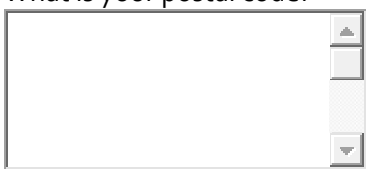
□ MBO (Practical Education)

□ High School

□ Other

If you are still studying, please fill out your current level.

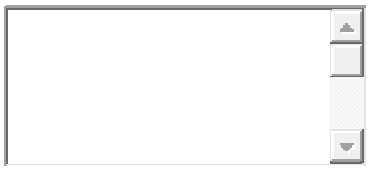
What is your postal code?



----------Page End----------

Thank you! You have now reached the end of this survey.

Do you have any comments about the questionnaire or additional remarks on one of your answers? Please provide them here:



Thank you, you can now close this survey!

Appendix II – Elaboration of Acceptance & Behaviour theories

Theory of Planned Behaviour

The theory of planned behaviour (TPB) was first proposed by Ajzen in (1985) as an extension on the Theory of Reasoned Action (TRA) (Fishbein, 1979). TPB is a theory that predicts deliberative and planned behaviour (Safeena et al., 2013), and compared to the TRA a third independent determinant of intention was added; the Perceived Behavioural Control (PBC). The attitude toward the behaviour is the degree to which performance is perceived as positive or negative, and it is shaped by behavioural beliefs. The subjective norm is the social pressure of engaging in a certain behaviour, this is shaped by normative beliefs (Schwartz, 1977). PBC refers to people's perception of their ability to perform a given behaviour. PBC depends on the extent to which a person believes that there are resources/obstacles that can help/hinder performance (Rexfelt & Hiort af Ornäs, 2009), and is shaped by control beliefs. All three constructs feed into intention. Consequently, intention gives the best indication of a person's readiness to perform a certain behaviour, and can thus be considered an immediate antecedent of behaviour.

TPB has been successfully used in a wide variety of settings, mainly in acceptance research and to explain and predict decisions (Safeena et al., 2013). An overview of TPB can be seen in figure 9.

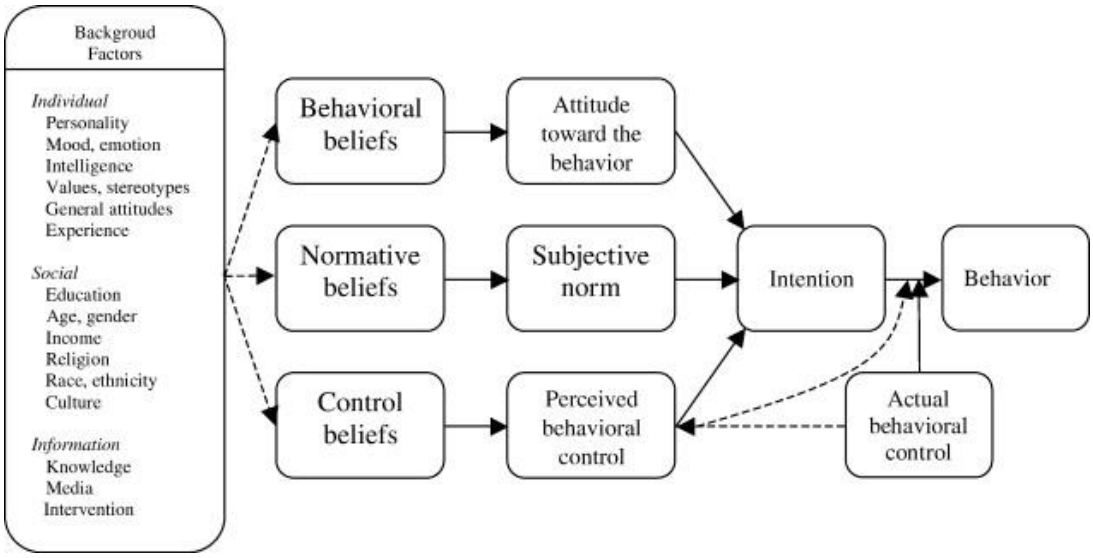


Figure 9 - The theory of planned behavior by Ajzen (1991)

Technology Acceptance Model

The second theory of importance is the Technology Acceptance Model (TAM), this model too is an extension on the TRA. TAM models how consumers come about accepting and using a technology (Davis, 1985; Davis, 1989). Consequently, this model is one of the most utilized models for studying acceptance. TAM originally focuses on computer-based information systems; however, the theory is successfully applied in different fields of interest (Davis et al., 1989; Farooq et al., 2017), and could also be applied to PSS (Rexfelt & Hiort af Ornäs, 2009).

Both previous models have provided useful conceptual frameworks for dealing with complexities of human social behaviour. However, TAM was specifically designed for describing external factors that affect internal attitudes and use intentions of the consumer, and so predicting the acceptance and usage of a system. Hence the TAM can be regarded as a good instrument to understand consumer acceptance processes, and to provide a solid basis for a consumer acceptance testing methodology. This theory can explain consumer behaviour across a broad range of product-service systems and consumer populations, while being both parsimonious, theoretically justified and

a solid predictor of adoption behaviour (Davis et al., 1989; Taylor & Todd, 1995a). An overview of the model can be seen in figure 10.

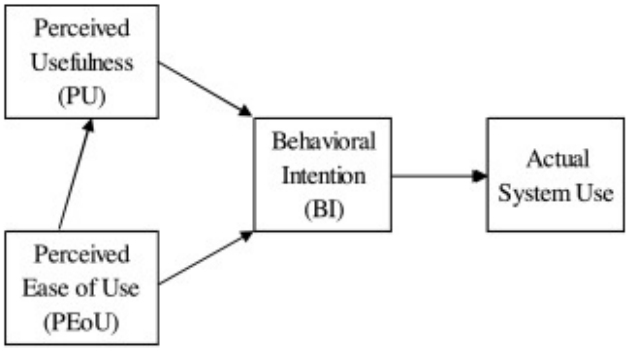


Figure 10 - The Technology Acceptance Model proposed by Davis (1989)

This theoretical model evaluates the effect of system characteristics on BI (consumer acceptance) of product-service systems. TAM suggest that when consumers are presented a new technology, a number of factors influence their decision about how and when they will use it. This ultimately leads towards the adoption decision or use of the system (Safeena et al., 2013; Straub, 2009). The predictors of the acceptance are; Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) (Adams et al., 1992). According to Davis (1989, p. 320) PU is; '*the extent to which a person believes that using a particular system will enhance his or her performance'* and PEOU is *'the extent to which a person believes that using a particular system will be free of effort'.* When the behavioural intention (or the consumer acceptance) towards a certain PSS is favourable, a consumer has a large chance of adopting the PSS.

In short because of TAM we learned that BI could be used synonymously with Consumer Acceptance (CA) and Use Behaviour (UB) with Actual Adoption (AA). So, acceptance represents a favourable opinion towards PSS, adoption represents actually implementing using such technologies. In this case the intention to accept PSS and ultimately the adoption of PSS. Hence or new short overview of consumer acceptance looks as follows:

Figure 11 - Overview of Acceptance & Adoption of PSS

Both these models (TAM & TPB) imply that behaviour is mostly determined by the intention to perform a certain behaviour. However, Davis (1989) also noted that TAM' fundamental constructs are influenced by technological and usage-context factors, that may alter consumer acceptance. So, acceptance towards a new product-service system may vary with its technology, target users and context. Hence this research will elaborate on an evolvement of a new model out of these two, that is better able to suit the context of PSS.

Unified Theory of Acceptance and Use of Technology (UTAUT)

A more elaborate model of acceptance and use of technology was proposed by Venkatesh et al., (2003). This model is an extention on the TRA, TPB and TAM, and has a higher described variance (Samaradiwakara & Gunawardena, 2014, p. 31). These models have proved to be highly useful for getting an index of whether a solution will find acceptance or not. However these still have their limitations in regards to their context in which they are applied. To counteract this argument Venkatesh et al. (2003) made a synthesis of eight different adoption theories[32]; whereof the Diffusion of Innovation (DOI) by Rogers (2010) is most well known (see figure 9). This last theory, together with TAM & TPB, were put forward by Rexfelt & Hiort af Ornäs (2009) as some of the most useful theories in prescribing factors to be central to acceptance of PSS solutions[33]. Hence UTAUT being composed of these theories was found to be very useful for this research.

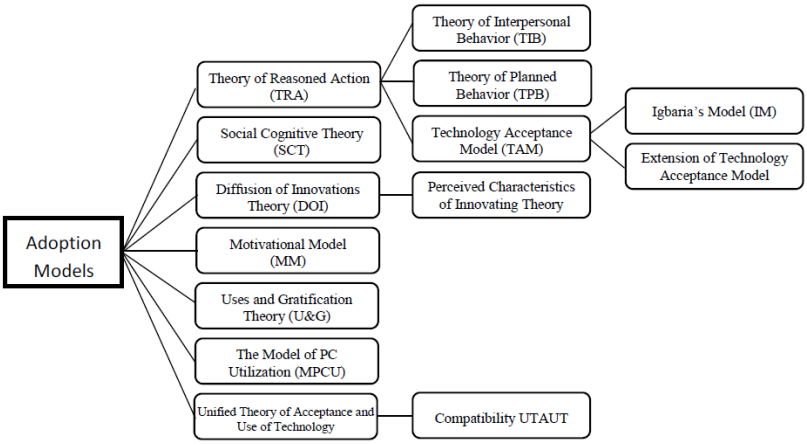


Figure 12 - Overview of Adoption Models (from: Taherdoost, 2018)

This model (see figure 13) has been severely tested and consist of direct determinants of Behavioral Intention (BI) & Use Behavior (UB); Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) and Facilitating Condition (FC). Venkatesh et al. (2003) found 4 moderators to be of importance to the effect of the determinant. An overview of which constructs these determinants are composed of

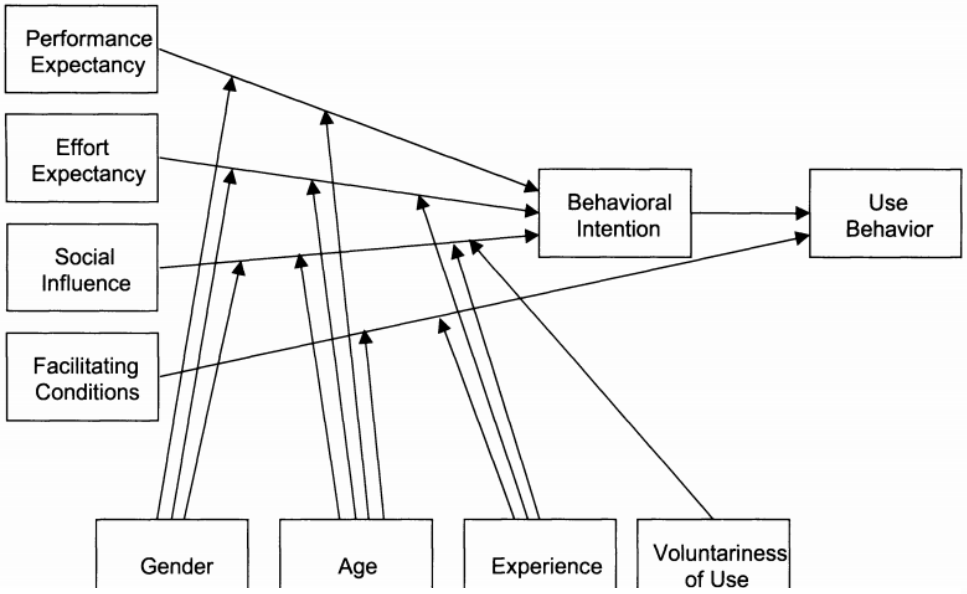


Figure 13 - UTAUT-model by Venkatesh et al. (2003)

[32] The eight models reviewed are the theory of reasoned action, the technology acceptance model, the motivational model, the theory of planned behaviour, a model combining the technology acceptance model and the theory of planned behaviour, the model of PC utilization, the innovation diffusion theory, and the social cognitive theory.

[33] The product-related factors that are highly influential on the diffusion of an innovation; relative advantage, compatibility, complexity, trialability and observability.

and how they are defined can be found in the following tables.

The first determinant Performance Expectancy (PE) consist of five constructs, they are listed down below (from Venkatesh et al., 2003);

Construct	Definition
Perceived Usefulness (Davis 1989; Davis et al., 1989)	The degree to which a person believes that using a particular system would enhance his or her job performance.
Extrinsic Motivation (Davis et al., 1992)	The perception that users will want to perform an activity because it is perceived to be instrumental in achieving value outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions.
Job-fit (Thompson et al., 1991)	How the capabilities of a system enhance an individual's job performance.
Relative Advantage (Moore and Benbasat, 1991; Rogers, 2010)	The degree to which using an innovation is perceived as being better than using its precursor.
Outcome Expectations (Compeau & Higgins, 1995; Compeau et al., 1999)	Outcome expectations relate to the consequences of the behaviour. Based on empirical evidence, they were separated into performance expectations (job-related) and personal expectations (individual goals).

Table 6 - PE constructs and their definitions

The second determinant Effort Expectancy (EE) consist of three constructs, they are listed down below (from Venkatesh et al., 2003);

Construct	Definition
Perceived Ease of Use (David, 1989; Davis et al., 1989)	The degree to which a person believes that using a system would be free of effort.
Complexity (Thompson et al., 1991)	The degree to which a system is perceived as relatively difficult to understand and use.
Ease of Use (Moore and Benbasat, 1991)	The degree to which using an innovation is perceived as being difficult to use.

Table 7 - EE constructs and their definitions

The third determinant Social Influence (SI) consist of three constructs, they are listed down below (from Venkatesh et al., 2003);

Construct	Definition
Subjective Norm (Ajzen, 1991; Davis et al., 1989; Fishbein & Ajzen, 1975; Mathieson, 1991; Taylor & Todd, 1995a; 1995b)	The person's perception that most people who are important to him think he should or should not perform the behaviour in question.
Social Factors (Thompson et al., 1991)	The individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with other, in specific social situations.
Image (Moore and Benbasat, 1991)	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system.

Table 8 - SI constructs and their definitions

The fourth determinant Facilitating Conditions (FC) consist of three constructs, they are listed down below (from Venkatesh et al., 2003);

Construct	Definition
Perceived Behavioural Control (Ajzen, 1991 Taylor & Todd, 1995a. 1995b)	Reflects perceptions of internal and external constraints on behaviour and encompasses self-efficacy, resource facilitating conditions, and technology facilitating conditions.
Facilitating Conditions (Thompson et al., 1991)	Objective factors in the environment that observers agree make an act easy to do, including the provision of support.
Compatibility (Moore and Benbasat, 1991)	The degree to which an innovation is perceived as being consistent with existing values, needs and experiences of potential adopters.

Table 9 - FC constructs and their definitions

An overview of all three models with components and definitions are presented in the next table (source Rahman et al. 2017):

Summary of the theoretical models of technology acceptance.

Theory	Components of Behavioral Intention	Definitions
Technology Acceptance Model (TAM)	Attitude Toward Behavior	"An individual's positive or negative feelings (evaluative affect) about performing the target behavior" (Fishbein and Ajzen, 1975, p. 216).
	Perceived Usefulness	"The degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320).
	Perceived Ease of Use	"The degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320).
Theory of Planned Behavior (TPB)	Attitude Toward Behavior	Same as in TAM
	Subjective Norm	"The person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein and Ajzen, 1975, p. 302).
	Perceived Behavioral Control	"The perceived ease or difficulty of performing the behavior" (Ajzen, 1991, p. 188).
Unified Theory of Acceptance and Use of Technology (UTAUT)	Performance Expectancy	"The degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003, p. 447).
	Effort Expectancy	"The degree of ease associated with the use of the system" (Venkatesh et al., 2003, p. 450).
	Social Influence	"The degree to which an individual perceives that important others believe he or she should use the new system (Venkatesh et al., 2003, p. 451).
	Facilitating Conditions	"The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al., 2003, p. 453).

Figure 14 – Differences between TAM, TPB and UTAUT in components and definitions.

Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)

As mentioned by Davis (1989), a good acceptance model is highly dependent on the context it is applied to. A model specialized to study acceptance and the use of technology in consumer context is UTAUT2. This model incorporates three more determinants into the UTAUT; Hedonic Motivation (HM), Price Value (PV) and Habit (H). In comparison to UTAUT1 this model has an increased variance explained in consumer acceptance and an increase in variance explained in actual adoption. Lastly this model has been extended and tailored in such a way that it fits the context of consumer technologies. (Venkatesh et al., 2012, see figure 15)

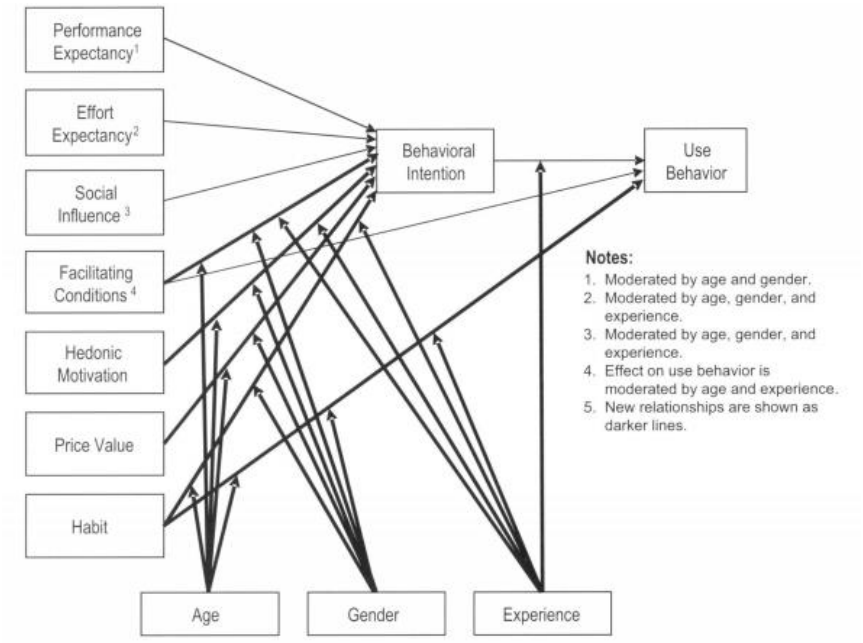


Figure 15 - UTAUT2 -model by Venkatesh et al. (2012)

The first predictor that was added was Hedonic Motivation (HD). This is defined as the fun or pleasure derived from using a technology. It has been shown to play a role in determining technology acceptance and use (Venkatesh et al., 2012; Brown and Venkatesh, 2005). The second predictor that was added was Price Value (PV). This is an important predictor since in consumer research the consumer usually must bear the monetary cost involved in such adoption decisions. It has been found that the cost and pricing structure has a significant impact on consumer adoption (Venkatesh et al., 2013). This price value is hugely dependent on the income of the consumer and the convenience these consumers derive from possible adoption of PSS. If the convenience is considered high, a high price value will be given to the PSS. In general, the price value is considered positive when the benefits of using a technology are perceived greater than the monetary cost (Venkatesh et al. 2012). Lastly Habit (H) is defined as the extent to which people tend to perform behaviour automatically because of learning (Limayem et al. 2007). To conclude, experience, including trialability of PSS and previous experience with PSS, have a moderating effect on the effect from CA to AA. Voluntariness (UTAUT1) has been dropped since consumers are almost always voluntary in their choices, and voluntariness is not relevant as construct for models for B2C markets. *Yet again*, Venkatesh et al (2012) argue that future research should focus more on structural elements of acceptance and adoption. Hence an extension specifically for product-service systems (PSS) is needed. The complete model with moderating effects can be seen in figure 16.

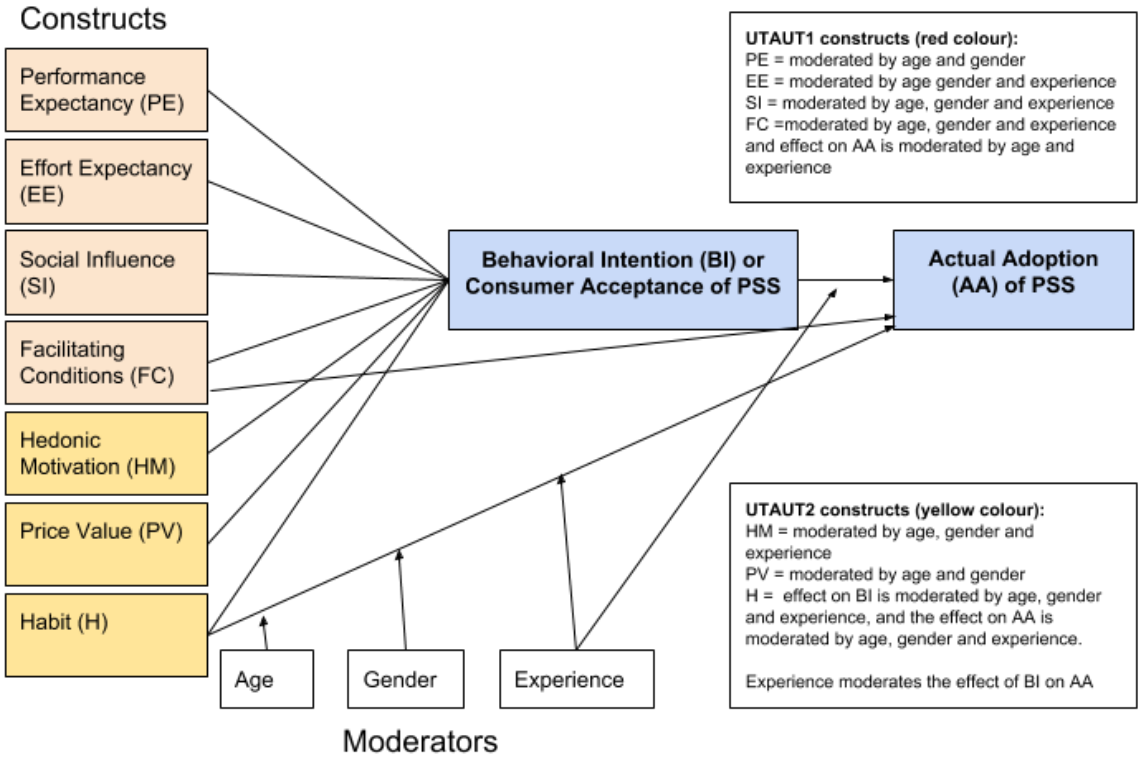


Figure 16 – Extensive Theoretical Model - UTAUT2 for PSS acceptance and adoption with moderator variables

Appendix III – Testing by means of the pilot-survey

While testing the pilot-survey the following questions were recorded or asked:

- How long did it take?
- All attributes and options make sense?
- What were the most important things you looked at? What did you find important?
- What were the least important things you looked at? What had no effect on your choice?
- Do you think we forgot a level? Do you consider some levels to be duplicates?

All testing and research led to the following tips (that have all be implemented):

- Don't use scale attributes (because of scale use bias)
- Think of flexible and experimental designs (Alternative Specific Design)
- Use 2-8 attributes, do not exceed more than 10 attributes.
- Don't use a lot of text and make it as simple as possible.
- Use in between 8 and 12 choice-tasks.
- Use HB- Hierarchical Bayes. This is considered by most research as the golden standard and it is therefore the most common utility estimation approach. Estimates utilities for each individual! (as opposed to pooled counting or pooled multinomial logit). That calculate utility for a population or segment.
- Attributes should be concrete & unambiguous.
- Use 3-5 levels per attributes.

An overview of more complete testing, data collection & cleaning:

Test-Round	Amount of tests	Avg. completion time	Way of testing	Remarks
1	1 respondent	22 min	Manual - hardcopy	Too elaborate survey, a lot of unclarities.
2	3 respondents	19 min	Manual - hardcopy	Still very elaborate, high cognitive load.
3	5 respondents	17 min	Manual - hardcopy	Clearer survey, increase flow.
4	5 respondents	15 min	Manual - hardcopy	Fixed attribute positions; target reached.
6	6 respondents	10 min	Online – Dynata employees	Online a significant increase in completion time was reached. Minor mistakes were adjusted.
7	80 respondents **Softlaunch**	10 min	Online – Dynata panel members	Survey went 'live' to real respondents. To check for minor mistakes, a stop was implemented after 80 respondents.
8	1170 respondents **Hard launch**	9: 37	Online – Dynata panel members & Personal Network	Around 900 respondents were gathered through Dynata the rest trough personal networks.
9	-130 respondents **Cleaning dataset**	9:53	Sawtooth Software	Removing speeders & low quality respondents.

Appendix IV - Logbook of changes made to the DCE-survey

After extensive consultation of researchers and experts within the field of DCE-studies, the pilot-study was started. In total 20 persons completed this pilot-study and provided feedback on the survey, the goal was to leave a little as possible room for interpretation by the respondents. In the following points a description of consideration is given (not in chronological order):

1. After consultation with Sawtooth Software specialists, the complete numeration method for the survey was opted for instead of the balanced overlap method. This was because not all options were thought to be known to consumers, and complete enumeration would be the best choice for the Alternative Specific Design.
2. After consultation with SKIM specialist Hans Willems; the lay-out of the options and clear order of options was considered. As he called it; a CBC study is the Ferrari of research methods; everything has to be right. To decrease cognitive load on the respondents, he suggested to opt for fixed order of options in the survey, and a fixed order of attributes in the survey. Although this could potentially lead to 'position-bias', the benefits of decreasing cognitive load outweighed these disadvantages.
3. The four price attributes were merged, so only one clear price attribute was shown. This made the survey a lot easier to understand.
4. The option were widened to fit more information on the attribute levels in each screen.
5. Skip-logic was added to help screen-out respondents that would not add significant value to the survey if they declined to fill-out salary or gender.
6. Some persons in the pilot study emphasized the importance of circular product; hence this attribute was kept in, although it is expected to have a low influence on preference.
7. There is no clear evidence that gender has no effect on preference, just for certainty this variable remained included in the survey.
8. After consultation with Dynata (the panel provider) a quota was installed on screening questions; income and age. Because these were considered most important variables for further research, adding quota's made sure that sufficient respondents from every group entered the survey.
9. After test-rounds in the pilot study more adjustments were made to the survey to make it easier and quicker to complete. This meant in some cases that variables; like 'risk' were deleted.
10. Because not all of the terminology used in the survey was clear to all persons in the pilot-study additional information was added into the survey by adding pop-up boxes when hoovering over difficult concepts within the survey.
11. All orthogonal design were elaborately tested to check for possible mistakes; D-score and standard-errors were checked to see if the design fit CBC-standards; this was the case, all Std. errors remained under the threshold of 0.05.
12. Prohibitions were excluded from this research as alternative specific design was chosen, and prohibitions would significantly mess with the algorithms providing the orthogonal research design. All attribute levels should be able to be shown with all options (except for ASD ones).
13. The length of levels in the survey was significantly reduced because many person found it to be too much text in the attribute-level boxes.
14. The initial explanation screen was rewritten a couple of times to increase clarity and shorten the amount of text. It was added that free installation and disposal of the washing machine

was an inherent characteristic of the PSS options. It was added that water, electricity and detergents were all cost incurred by the user, and not payed for by the PSS providers.

15. Energy label was normalized as the initial energy labels showed ranges from A+++ (10%) to A+++ (40%), because these energy labels were often unclear to persons in the pilot-surveys. The highest option was normalized to A+++ and the lowest option back to the B-label.
16. At first the survey included price-ranges, these were ambiguous to interpret. Some interpreted them on the lower end of the range, others on the higher end. Hence clear prices were set for each option.
17. The cold wash price level for the pay-per-use option was deleted, since this would simplify the prices for this option.
18. Since some of the option presented could be the first time respondents see these (like PPU), Sawtooth Software and Peter Mulder (Improof Research) suggested to opt for the Dual Response None option. This allows some flexibility in the respondents answers, since they are not obliged to choose an option that they are not content with. This is often done with new product development, since respondents are not aware of these new products.
19. One person in the pilot-study suggested to make it more clear who incurs the cost in each option. And if it is possible to share the price load among flatmates for example. Additional information was added to the survey to accommodate these thoughts.
20. The possibility to add hold-out task (or fixed tasks) was investigated, since these would increase the validity of the research. However hold-out task were complicated to include in an alternative specific design and could overcomplicate results.
21. Ownership attribute was made inherent to each option, only the purchase option had transfer of ownership, hence this was also explained in the explanation page of the DCE study. The incorporation of ownership in the revenue/payment model saved another attribute in the whole DCE, simplifying the survey.
22. Deposit fees were initially added to the price attribute in the survey, but this led to a lot of questions. Again, to simplify results and because one of the PSS providers explained deposit is not so important for consumers, this addition was deleted. Furthermore often times there is the possibility to give your appliance back to the producer of the product.
23. In the beginning also a second-hand option was included in the DCE-choice tasks. However the second-hand option was off course limited to only the lower prices of all the options. This led to prohibitions in the model, which weakened the research design. Furthermore this option increased the cognitive load for respondents. For those reasons this option was deleted.
24. The services have been simplified to three different services. Yearly maintenance and preventative maintenance have been added together. Which resulted in the services; user-advice, free moving service and maintenance. By combining all the possibilities (including the no-services option) a total of 8 different levels was created for this attribute.
25. The amount of choice task was brought back from 12 per respondent to 10 per respondent to decrease completion time, and decrease cognitive load on the respondents.
26. In total more than 800 different versions of the DCE-survey were made (with 10 different choice-tasks), which led to 8000 unique choice-task to be made by all respondents.
27. Additional open question was added in the end for respondents to provide feedback on the survey or additional information on one of their answers.
28. A warning was included in the beginning that this survey could only be made on laptops only.

Appendix V - Coding framework (quantitative counting analysis):

This framework was set-up to find out which attributes were important for PSS in general. Furthermore it provided insights in which attributes were important specifically for the washing machine, coding is done through comments in the complementary material.

Attributes:

Attribute	Mentioned by … interviewees
Price (Financial incentive; save cost or initial investment)	17
Flexibility / Temporariness *	15
Quality / Better Product Class (Relative advantage) ***More premium or durable product or higher product class***	14
Sustainability / Environmental Impact	13
Contract period	11
Circular Product	9
Use of resources (mainly energy / attribute energy label)	7
Reliability (always working; certainty)	5
Complexity (ease of use; decrease practicalities)	5
Always the latest product	4
Observability (visibility)	4
Availability / Accessibility (especially for MaaS)	4
Compatibility	4
Use-time (especially for MaaS)	3
Customizable	2
Service: Unburdening (Repairs and maintenance)	17
Additional services (general)	14
Convenience (as an overarching term)	13
Service: Use-guarantee (No downtime)	8
Service: Installation & Disposal (take-back mechanism)*	7
Service: User advice	4
Service: Moving Service	2

**= implicitly stated on the explanation page, not included as attribute in choice-sets*

Mutually exclusive attributes:

To make sure there is not too much overlap between the attributes, several of these attribute were included implicitly in the revenue model. In other words, this was stated clearly in the explanation page of the options. Additionally not all of the attribute were applicable to the washing machine.

For example flexibility was made standard on all PSS models. This means that a consumer could stop the PSS within a month after the obligatory contract period had ended. The flexibility or temporariness was thus incorporated in the attribute *contract period.* Furthermore since free installation and disposal with most options was already the standard within the market, this attribute was also skipped. The convenience, use guarantee, reliability and additional services are collectively equivalent to each other; they are a function of the unburdening and providing repairs and maintenance to the end-user.

The following attributes were thus included in the DCE:

- Revenue model / Price (differing per option)
- Product class (as a function of the quality)

- Contract period (as a function of flexibility and temporariness)
- Circularity (as a function of sustainable product)
- Services (with free moving services (especially important for big white-goods), user advice, and repairs & maintenance were included. (as a function of convenience)
- Energy label (as a function of the use of resources ánd sustainability)

Then for this specific product and in regards to the PSS options (PPM and PPU) the following attributes were neglected for this specific DCE study:

- Complexity; PSS are not more difficult than the purchase option, consumers still have their own machine, only the revenue model is different.
- Always the latest product; this was not included since washing machines are not necessarily a product class with rapid technological advancement. So there was less of a need to own the 'latest model'
- Observability; This was excluded because washing machine are not observable since this is an appliance used inside, and since there was no difference with the purchase option.
- Availability; this also did not change for PPM and PPU, since the availability issues were again no different than the purchase option.
- Compatibility; it has to be compatible with the consumers current situation and lifestyle, since in essence nothing changes compared to the purchase option this one was not included.

These other generic attributes are still valuable finding, they can still be used for further research.

In regards to Rogers' attributes of innovation; relative advantage, complexity, compatibility, trialability and observability. Only trialability (is hard to provide trials for washing machines) and compatibility (is not different than other washing machines) were also not an issue here. Relative advantage was covered by the product class category.

Important variables or factors influencing acceptance of PSS: *=Given trough explanation page

Important Variables	Mentioned by … interviewees
Awareness of the PaaS option is low	12
Salary / Income (affordability)	11
Practicalities (decrease barriers)	10
Ownership is an issue (loss of) (implicit to each model)	9
Transparency in value proposition *	9
Trend from ownership towards usage	9
Age	8
Environmentally conscious	8
Lifetime of the product (Durability) *	7
Contamination (with sharing BMs or previous use)	7
Acceptance of PaaS remains low	7
Amount of washing	7
Image building (status & identity)	5
Complexity (ease of use)	5
Customer is moving or going to move	5
Trust	4
Uncertainty (about future or previous use)	4
Incentive (e.g. deposit) for good return of the product	4
Life in a city or rural area? (PaaS fits better in urban)	3
Type of product is important (also expensive products)	3
Fits (or doesn't fit) with routines and habits	3
Amount of other subscriptions/contract	3
Efficient use of resources	3
Barrier to enter in a subscription	3
Possible future repairs	2
Fit with the lifestyle	2
Past experiences	2
Social proof	2
Load factors of washing machines is low	2
The circumstances of the person matter (general)	1

If a variable wasn't mentioned in more than 25% of the time it was deemed not necessary to include.

Research Design (Survey or DCE) related:

Research Design	Mentioned by … interviewees
Need for LCA / Segmenting is important (LCA)	8
A good product line for PSS are white-goods and especially the washing machine	6
Not only the buy-option or PSS are ways to get to clean laundry; also laundry laundry services are an increasing option.	4
Make sure to include additional services in DCE	3
PSS is not necessarily Mobility as a Service (MaaS)	3
Know the intensity of usage and thus the demographics	3

Consumers are hard to segment (Need for HB analysis)	2
Rogers adoption theory good base for understanding attributes that help adoption of PSS	2
Conjoint excellent method for PSS research	1
Use fractional factorial design / orthogonal design	1
Be aware of importance scores; they are dependent on the attribute levels you choose	1

Different types of consumer groups:

Consumer group	Mentioned by … interviewees
Students & Young people (millenials) & Starters	11
Sustainability / environmentally friendly consumers	9
Financially motivated	8
Flexibility seekers; Expats or nomadic consumers	7
Convenience Seekers	6
Wealthier consumers (e.g. DINKY's or professionals)	5
Reducing possessions (non-materialistic/ anti-consumers)	4
Daring or forward thinking consumers (risk-takers)	3
Seniors	3
'Dependent on the product'	3

Consumer considerations or trade-offs when choosing PSS:

Consumer considerations or trade-offs:	Mentioned by … interviewees
Calculating Break-even-point (purely financial)	8
Total Cost of Ownership (TCO) are hard to estimate	7
Cost-Benefit analysis in their head, is the price worth the extra services	6
Comparing it with the buy-option	3
Trade-off of losing independence because of ownership	2

Comparing the interviews to the literature:

The following tables list respectively other factors, consumer characteristics and company related factors that were listed by previous research to be important for consumer acceptance.

Other factors that might be of influence to consumer acceptance (no direct attributes):

Factors	Definition	Author(s)
Perceived fixed and variable cost	Insight in the total life-cycle cost, or any other additional cost. *e.g. Installment, operating, maintenance, repair & disposal cost*	Mont (2004), Venkatesh et al. (2003), Chou et al. (2015), Davis et al. (1992)
Practicalities	The amount of effort (time and money) it takes to start using	Antikainen & Lammi (2016)
Frequency of Use	How often do you use the PSS? *Infrequent used PSS more succesful.*	Tukker (2015), Mont (2004)
Customization	The degree to which a consumer can customize their PSS to own liking.	Baines et al. (2007), Sawhney et al. (2004), Van Beuren et al. (2013)
Control	The amount of control the consumer has over the product.	Ajzen (1991), Cherry & Pidgeon (2018), Venkatesh et al. (2012)
Infrastructure	Support technology, the ability to offer whole service ecosystems. Compatibility issues that may constrain usage. Interoperability.	Mont & Plepys (2003), Antikainen & Lammi (2016), Venkatesh et al. (2012), Schmidt et al. (2015a)
Networks	Partners and suppliers of service provider	Schmidt et al. (2015b), Venkatesh et al. (2012), Mont & Plepys (2003)
Contamination	The product has to be clean, safe and without contamination.	Antikainen & Lammi (2016)

Consumer characteristics:

Characteristic	Definition	Author(s)
Habits	Habits as an obstacle to acceptance	Meijkamp (2000), Venkatesh et al., (2013), Antikainen & Lammi (2016)
Willingness	Willingness to look for a change, ability to adopt different mindsets	Antikainen & Lammi (2016)
Risk	Ability to take risks (models enables risk reduction)	Antikainen & Lammi (2016)
Mindset	Mindset as an obstacle to acceptance (feels weird or uncomfortable	Antikainen & Lammi (2016)
Ownership	Issue of ownership for consumers	Littig (2000)
Environmental attitude	The attitude towards more sustaianble options, and the willigness to pay for that	Littig (2000), Antikainen & Lammi (2016).
Relationship with the product	Have a strong connection or relationship with the product (status or identity related)	Antikainen & Lammi (2016)
Situation	Current life situation of the consumer; stable or moving, temporary situation?	Antikainen & Lammi (2016)

Relationship with company;

Factor	Definition	Author(s)
Habits	Habits as an obstacle to acceptance	Meijkamp (2000), Venkatesh et al., (2013), Antikainen & Lammi (2016)
Uncertainty	Uncertainties (risk, cost and responsibility)	Mont (2004), Schrader (1999)
Communication	Communication between supplier and consumer	Mont (2004)

Interesting quotes from interviewees (anonymized):

Interviewee 1:

- 'Some ways of consuming are a form of self-expression.'
- 'Most people will still choose ownership over products-as-a-service'
- 'People still follow the same buying process. This will be hard to change, since PSS have different sales channels than conventional stores or websites'
- Prices based on the temperature of washing, is really a step further, it makes sure that sustainability consideration are taken into account, and you provide advantages through that model'.
- 'An interesting model for you to look into are the theory of planned behaviour, because this model can help you take behavioural change into account'.
- 'Those additional services remain super important. These services can help change people's mind. You just have to provide something extra with PaaS. Look at the success of Swapfiets.'

Interviewee 2:

- 'The practicalities of how the consumption is carried out are of huge importance to PSS'
- 'It is not only on what you consume, but a lot about how you consume, meaning what we have to do in the consumption process. If that is time consuming, difficult or boring, then it will be a large barrier.
- 'I think it is the independence really that the consumer often like'
- 'It is more reasonable that two business can come to some kind of win-win situation. Like; we have a service for you, we are better at it, and that's the relation. It gets trickier in the business to consumer market, because consumer kind of expect the other part use you somehow. It is often difficult to say if you are reaching a win-win'.
- 'PSS is supposed to fit with our everyday life.'
- 'Transportation is complex, there are a lot of alternatives and combinations of alternative system to satisfy your needs.'
- 'In PSS you are interested in the function or the result'
- 'Major parts of the consumption process that are important are: acquiring the product, using the product and then disposing the product/getting rid of the product.'
- 'So yeah because a lot of my take on PSS is really a lot about behaviour change, I mean all is. The practicalities in real life are that you have to do stuff differently. So that's an interesting point of departure.
- 'Linear consumption is losing convenience'
- 'The resource intensive consumption will not be able to compete in the future'

Interviewee 3:

- 'When you have an emotional value to a product, invites people to own them'
- 'The fact that you can control something, you can modify it, so very often, you want to own something you want to show off who you are. So products are the extension of your personality'.
- 'Its all about the way people can built an identity by consuming a certain way'.
- 'Some people say it is only PSS when it is designed to be resource-efficient'
- 'If it is something you really want to be yours, you may want to adapt it or customize it, than that's definitely where PSS will not work.'
- '[In sharing business models] the community aspect is really important'

- 'Sustainability is important but it is not high on the list of why consumer buy'
- 'Most PSS require planning'
- 'You need to make it easy to use PSS'
- 'Another word that gains traction is subscription'
- 'Terminology also matters; words like renting or leasing'
- 'The law basically need to change, the law is not built for PSS'.

Interviewee 4:

- 'Mobility PSS are relatively widely accepted, at least compared to other PSS'
- 'I define access-bases PSS, are those PSS where the ownership remains with the provider'
- 'I'm just a bit more critical about PSS, because there so much talk about PSS, and that it is automatically more sustainable. So you see that people want to make PSS out of every product'. 'PSS is not automatically sustainable'.
- 'PSS is booming, but not every product is suitable as PSS'
- 'Usually when you look at PSS, it's basically the story of a product being leased', but we don't wat to call it leasing…'
- 'Acceptance for me is when you see it as a valid option, or a valid alternative'
- 'A prerequisite for PSS offerings is that they know about it'
- 'I have a nice argument for you in my paper that basically says that the most important thing is the relative advantage'
- 'Even relative advantage is quite complex, because the PSS has so many different aspects,. It's not just a service, it's not just a product. So there's so many different aspects. There is so many different attributes that can go wrong to hat people have expectations regarding. So that any of them could lead to non-adoption or non-acceptance.'
- 'I don't think PSS, no matter how you do the design, would probably be relevant for everyone'.
- 'Young people are more likely to go for PSS than older people. Older people are more likely to rent short-term access. Younger persons tend to go for the longer use-time PSS'
- 'PSS should provide a benefit, and providing a relative advantage that is relevant to consumers in their specific context. So the other aspect are just the consumer circumstances.'
- 'A big cultural shift is needed. Somehow creating more awareness'
- 'PSS are often harder to find, people don't even think about it, because it's not the same [sales] channel.'
- 'Choices are made more emotional than rationally'
- 'People don't like commitment, or another contract, especially if it is not needed'. 'However buying is also a big commitment'.
- 'You have so many different contract, so I think it is quite a hassle for consumers to try to manage all that , and have the overview'
- What I see as a problem, again, in terms of sustainability are there too many [PSS] competing? Like mobility or sharing services? Because then again, you have a lot of products that are unused,. Everyone is trying to provide more to be more convenient.'
- 'Pay-per-use could still have a shorter life-time, because the incentive still remains that people wash more'.
- With sharing business models, hygiene, contamination and especially uncertainty become more and more important.

Interviewee 5:

- 'PaaS or PSS should not only be a new way of financing, for example because you don't have enough money. You can do that with a bank. We want to provide additional services'
- 'We want to investigate if our customers actually want to pay for pay-per-use. Since they are quite able to guess the amount of washing they do each week.'
- 'People are afraid that their machine might break and that they have to wait a long until it gets fixed, or that these cost are really high. The last thing is clear insights in the cost; no strange or extra cost. '
- 'PaaS or Product-as-a-Service enables that people can now afford highly energy efficient machines.'
- 'It [the PaaS market] will be much bigger in the future'
- 'The PaaS market can become much bigger but we have to lower the price, or provide more service'
- 'There is currently a trend of moving away from ownership.'
- 'Refurbishment of appliances will lead to cost reduction, because you will give them a second life'
- 'Most MaaS concepts are successful, like Felyx. But also concepts like Swapfiets'
- 'Brand awareness is important for popularity'
- 'PaaS/PSS is a sort of insurance'
- 'People will only get a new washing machine when the old one is broken. So the new one has to be there fast. Therefore fast delivery is key, it has to be available fast.'
- 'Awareness for these PaaS business models is still very low. Most people don't know this model even exists. However there is a bigger trend coming: more people now know about this business model.' 'Word of mouth an awareness are important. So the social environment can have effect on the success of PaaS'.
- 'Consumers still make a calculation in their head. What do I pay, and what do I get in return? Important trade-off: between the service and the price you have to pay extra compared to the conventional option'.
- 'The value for the customer/consumer needs to be raised. More services, or better communicate the current services. I think the value needs to go up or the price must go down. Most interesting for is to see how we can raise the value'.

Interviewee 6:

- 'A main advantage [for PaaS] is that you will have an other relationship with the customer, more contact moments, a longer relationship and more connections.'
- 'In PaaS as a company you have the responsibility'
- 'Also in the future the focus of consumers will stay with the buy-option (of a sustainable product). Leasing and other models remain for pioneers.'
- 'To make leasing more attractive we should enhance the whole experience around the PaaS'.
- 'Lease a Jeans becomes more and more popular, it attracts a lot of people and it created a lot of media attention' . 'This is also a big step from ownership to usage'.
- 'The awareness for the PaaS-option is low. People still consider it a strange concept, but it gets more popular'.
- 'Crucial for good PaaS is the return of the product through reverse-supply chains.'
- 'PaaS is fundamentally different than the buy-option'

Interviewee 7:

- 'There is a notable change in the market happening'
- 'There is more and more service provided, and retailers can no longer differentiate on the basis of price alone, you have to differentiate on the basis of services. Also the willingness to pay for is higher for services'
- 'PaaS advantage: connects with the demand for sustainability and for smarter ways of consumption'.
- 'Consumers become more aware of their consumptions and the things they buy'.
- 'With PSS we remain the owner. The consumers get access to the product. We provide usage to the product and not necessarily ownership. You want the outcome, not the product.'
- 'Leasing is off course not the buy-option. Although more expensive, you also get way more services'.
- 'With PaaS people are afraid that they are 'stuck' with the product. But that is not different with the buy-option'.
- 'Not all products are possible PaaS products'
- 'I think the PaaS market can become much bigger. But it all depends on the acceptance of the consumer'. 'Acceptance of the consumer is for me that the consumer is open for not buying of the product but using the product. So paying per month for example, and that takes time.'
- 'There are different consumer groups, but that depends on the product'
- 'Low consumer awareness but also low consumer acceptance. If things are new they are often not admired'. Position of PaaS is important; it should not be contrasted with the buy-option, but rather be a stand-alone offer.'
- 'Does the service fit with what the client wants? Price remains the most important thing off course.'
- 'Services are pretty hard to sell. Consumers also want everything for as little money as possible.'
- 'The market needs to open up to these BM's, awareness needs to increase for PaaS'

Interviewee 8:

- 'People do not want to own, but we are moving from ownership to usage'.
- 'We help corporations with their asset management in the B2B context'.
- 'We are already actively working to refurbish old products'.
- 'Because of PaaS we also have to start working more modular'.
- 'Awareness of consumers [for PSS] is too low'

Interviewee 9:

- 'We are currently best positioned in the market for a PSS proposition'.
- 'People want clean laundry; they do not want the ownership. There are many ways to get to clean laundry. Traditionally this was done by buying, but you can also get it through PaaS or full washing services.'
- 'The market of PaaS and Laundry Service will be 20% of the total market. Between 5 and 10 years.'
- The typical groups mentioned (the younger group, the group with less capital, the flexibility seekers) are the early adopters. The groups however will be a lot bigger!
- 'White goods stay behind in the sustainability consideration of the design'

- 'Consumers will be attracted because of the clear insights in the amount of money you will spent and also because they can access the best product there is this way'.
- 'Consumers get used to ever developing technology. They are afraid to get locked-in. With this model you will always have the latest model an can change quickly without additional money'. 'Nowadays machines are more technological instead of functional or mechanical'.
- 'Our products have a lifetime of more than 20 years. Most consumers don't even know what can happen in 20 years.' They don't want to have more technologically advances product in the market, while they are stuck with their old model.'
- 'Do not change the status quo forcefully but gradually. Because it can potentially harm your own business model [cannibalization].'
- 'Main advantage for the business is that you will have a continuous stream of income and materials trough PaaS'.
- 'You will redesign your products to better fit with the value proposition'.
- 'Legislation will have an important role in the transition towards circularity too, for example by having legislation that producers take responsibility over the disposed products'.

Interviewee 10:

- 'When doing a case study on one product, the generalizability to all PaaS will be difficult'
- 'Companies are looking into new business models that will have success with customers. They are not doing this because of circularity reasons [at first].'
- 'PaaS enables for better customer fit, because of the focus on the problem-solution'.
- 'Companies want to get rid of seasonal influences, and want recurring revenue streams'
- 'Another point [for PaaS] is off course the planet; using resources more efficiently and contributing to the circular economy'.
- 'In the Netherlands in general there is a negative perception to subscriptions'.
- 'The PaaS market will be really big'
- 'Youngsters or students have different needs than seniors. But both groups would be helped by a service solution, but for different reasons'.
- 'If you find price or attributes of a product important, then everything is organized in a very traditional way'.
- 'To often for consumers the trade-off is still the buy-option versus PaaS. But this – in correct terms- means you are comparing apples and oranges.' 'You should show the TCO of a product. Because a service is much more than just the product'.
- 'The business model is still unknown. A lot of consumers still want ownership. Change in mindset in consumers is necessary.'
- 'You have to sell PaaS, with other arguments than sustainability, like with other advantages like the convenience'. 'In PaaS, service is super important, is you don't provide good service you won't have a business model'.

Interviewee 11:

- 'The sustainability consumer group is too small to scale our business model. Sustainability also doesn't lead to sales straight away. However it does generate quite a lot of media-attention'.
- 'Complete modularity enable us to make easy repairs'.
- 'More expensive products are more suitable for PaaS, furthermore this is way easier to do in the B2B-market. Since you have one point of entry and all logistics are easy and you talk about larger quantities'. 'The B2C-models makes return logistics a lot harder, because electronic have little value, the cost are pretty low'.

- 'There is still a large barrier for consumers to get a subscription'.
- 'Buying is commitment, with a subscription or PaaS you will have flexibility'.
- 'Companies that provide PaaS need to be very transparent in their value proposition'. 'The flexibility is of huge importance, it is more important for some groups than price. Price is subordinate to a contract period and the flexibility'.
- 'Consumer goods often have branding and status as issues. There has to be social proof for people to take up a subscription'. 'Social proof of PaaS needs to rise for higher adoption rates'.

Interviewee 12:

- 'In this moment consumers still want to own the product'.
- 'Consumers might have this need [for PaaS], but they just do not realize it yet'.
- 'Calculation of the cost over the lifetime or contract period. If that is more expensive than buying, people tend to buy, under-evaluating the other aspects.'
- 'As a PaaS company you have to be clear in the added value of such a model; provide transparency in the value proposition'.
- 'Our main reasons for PaaS was our ambition for more sustainability and circularity'.
- 'One of the main advantage of PaaS is the frequent contact with the customers, and you have longer customer retention that way. Furthermore we are expecting first mover advantages.'
- 'Consumers will choose for PaaS because of the unburdening, you have no hassle, just one call and we come and get your product. There is no investment needed, and you get access to a high quality of a product'.
- 'We have to make it easy for consumers, decrease barriers and practicalities'. 'Most important factors are flexibility, convenience and comfort. It is relatively easy, and it does not cost a lot of time.'
- 'Different consumer groups look differently at these concepts'
- 'Some consumers consider it [PaaS] to be an inferior option. But it doesn't have to be that way'.
- 'Ownership can also be a burden; you want to own something, but a matrass that you buy you never need to take a look at for the first couple of years.' 'The change in mindset among consumers will take some time'
- There has to be higher consumer acceptance. The price needs to improve, and people need to see that is can be a sustainable alternative. Then also the barriers of entry needs to be lower. In short, to get to acceptance is never one factor'.
- 'The ownership model will remain, but it will become just less important.'
- 'It will become less apparent that people will get their identity from products. There remains a trend that products become less and less important.'

Interviewee 13:

- 'PaaS is a model of dis-ownership'.
- 'There is a need for flexibility among some groups; they don't know where they will be in 2 years'.
- 'Students would be more price sensitive than business customers. They are willing to pay more for extra. They also understand the concept of risk insurance etc., students be like, okay I'm just going to buy it; But it can be more expensive if you count it all in.'
- 'We provide an incentive for consumers to return the product in a good state'.

- 'For PaaS we need to know the intensity of usage; and thus the demographics of the user. Different residual values for each and every item, for each product.'
- 'I believe that we can have around 24-25% conversions to the PaaS market among students'.
- 'The Furniture-as-a-Service concepts is particularly interesting for B2B or B2B2X concepts.'
- 'On Services you can get more profit than on the product itself'
- 'Business customers don't mind paying per month, they are less likely to check how much it will cost them in total (in comparison to consumers).'
- 'They [consumers] want new stuff, but what would happen if the products are second-hand from the beginning?' "End consumers most likely want a new product'
- 'It is tricky to calculate the residual value, that is why asset management is super important'.
- 'It is important we think of true modularity, and then also what materials do we put in there, because we need to put materials in there from the beginning that are easy to separate and recycle, and that we then can use for new production.'
- 'Hygiene & Sanity (contamination) are important factors in PaaS especially in some regions like China'.
- 'There is a lot more attention from business customers than from end consumers for PaaS. Especially from a sustainability stem-point'.
- 'There are different needs for different segments. And maybe it is not for the end consumer, the regular Dutch person who has a new apartment'
- 'Consumers are very price sensitive; what do they get in return? Tipping point is very easy to reach with consumers [it being too expensive]'
- 'Why should I know pay the same as two years ago? [the product is now a lot older]'
- 'There is this kind of loyalty element; I think pricing for PSS is super important'
- 'The customer cannot feel that he is being fooled in the value proposition. Not being overcharged, but the price being exactly right'.
- 'I do not trust that a second-hand product is as good as a new one yet.'

Interviewee 14:

- 'We are actively working on a Laundry on demand solution; a laundry service'
- 'Robotization is an important development in the laundry branch; it leads to less FTE and more efficient practices, reducing prices'.
- 'The market potential for washing services (B2B and B2C) will double in the next 5 years.' 'A huge growth is expected within the B2C washing services context. This is not the old steaming services; but home pick-up and delivery.
- 'A professional is off course better able to wash very delicate fabrics than people at home. Speciality laundry items are now still the majority of the market. Next generations will also want the convenience of someone else doing the laundry.'
- 'Washing services are more sustainable (less CO_2 emitting) even with logistics included. It also saves a lot of water and detergents.'
- 'Professional services lead to less plastic fibres being emitted into the water. Because of more professional processes and better filters.'
- 'Washing machine have a very low load factor. They are only in use 2% of their lifetime'
- 'There are quite some hidden cost people don't notice when putting on their washing machines.' 'People are forgetting these hidden cost of washing. For example the space they need for the washing machine itself, that is already quite costly.' 'People also spent 5 hours a week on doing the laundry (when living in a house of 4). You could have spent that time much better'.

- 'You also have to for the product off course, and pay for the electricity, water and detergent. Especially if you also have a dryer (which is highly energy intensive). You don't have to pay for this with a washing-service.'
- 'Because of different quality in washing services also prices vary hugely'
- 'Because of new developments price of these services will drop drastically'
- 'The reasons for washing services are changing. At first it was a necessity; people just couldn't wash it at home. Now it will be more about convenience and sustainability. This is the same generation that buys organic. The younger generations. These youngsters are also willing to pay more for sustainability.'
- 'Convenience is very important and we have the numbers to back that up'
- 'Younger generations look at this more positively than the older generation'
- 'More professional washing services lead to textiles that will be 20-25% longer lasting'
- 'Washing services can be as cheap/expensive as you doing the laundry yourself if you consider all those other things too'
- 'One target group for washing services are students that live close together. They have lower demand for quality; just wash it and fold it. They live close to each other which makes logistics a lot better. Another target group are older people that need care. They mostly also live together in buildings'.
- 'Just everything has to be well arranged with services. It can be sustainable but that will not be why people like it, the basics [of clean clothes] first have to be there'. 'The quality needs to be high, than your retention will also be high. Retention is important in this model'.
- 'Important aspect is the quality but also the time aspect. If we look at other concepts, we see that quality, and how the quality is experienced, but also the logistics and the timing around logistics (do you deliver on the time agreed). Are key factors for retention and thus for the business model.'
- 'Consumers have no idea of what the real cost of their laundry actually are'. 'Furthermore people could have issues with hygiene aspects. Consumers also don't know that laundry services are sustainable too'.
- 'The time it takes for laundry services can be a barrier too; often times consumers lose their laundry for 2/3 days. With these services there is no option for a quick laundry'
- 'Washing and doing the laundry is considered a nuisance in the household. Because a large percentage doesn't like doing the laundry; there must be a market for washing services too. It is also less harmful, saves time and potentially cost. If the quality is okay, why wouldn't you do it? '
- 'Most consumers still find it a hassle to walk around with their laundry in public'.
- 'Awareness needs to grow; more marketing is needed'
- 'Laundry Services can get big for example in the anti-fast-fashion segment. Because this enables textiles to last 25% longer than their normal lifetime'.

Interviewee 15:

- 'I am lazy, I want convenience and service'.
- 'I don't take the effort to look for a good bike'.
- 'I think pay-per-use (wash) like Homie is currently still too expensive'
- 'If you make the calculations, and it is better to buy a washing machine, than I think it is too expensive.'
- 'A disadvantage is the price, it is often costly compared to the buy-option.'
- 'A PaaS company should be transparent in their terms and conditions. Open in their value proposition, and provide flexibility'.

- 'Producers need to rethink how they design their product, so that it can be interchangeable too'
- 'Additional services like an app are just nice to haves. I would not necessarily buy it because of that'. 'Unless it can save money off course. Furthermore I want the convenience and the flexibility'.
- 'The PaaS model has the possibility to make the world better'
- 'PaaS is more suitable for expensive products'
- 'Companies need to think about understanding their product first, think about take back mechanisms, and what they put in their product. They can start by first already applying services to their current BM.'
- 'PaaS is also about the affordability, but this also comes with the risk that many people get stuff they can't really afford.'
- 'Current B2C PSS concepts are not yet successful'
- 'Tricky is the valuation when the product comes back. When you know the residual value, you are better able to set the right price (or lower it). This uncertainty lead to risk avoidance by companies'. 'So you need to provide incentive for returning a good functioning product.'
- 'You have to have a good value proposition and story for a PaaS, you should provide a good overview of the total cost of ownership for the consumers'.
- 'Environmental impact remains an important factor. PaaS enables more sustainable business models.'
- 'Some businesses are currently only pursuing PaaS because of gaining market share; not for the right '[sustainability] reasons.'

Interviewee 16:

- 'The modularity and repairability are important for PaaS. PaaS allows for better modularity and circularity'
- 'The focus should be on the value for consumer, not the value of the product itself.'
- 'The ownerships remains is where the incentive is there to design stuff in a different way so it will last longer as well. For example, the maintenance cost fall on us, so that's is where the change really happens. That is part of the service proposition, where we in the end, we will manufacture products that move away from fashion & trendy products. But to products that need to deliver and which first target the functionality in a good way.
- '[on the most important PSS attributes] I thought two things: the convenience of having easy repairs, so with spare parts you will be able to fix your phone. The other one was that people could terminate their contract within one month notice. I think that another one was flexibility, the flexibility to scaling up or scaling down the amount of devices that you have in your company, is also very nice.'
- 'The rate of development of new models is important. We see that the life time value of the product is increasing.'
- 'Only 30% of the market is ready for it, willing to pay for it, but the other 70% is still far away'.

Interviewee 17:

- 'Our PaaS started from the inconvenience we saw with the consumer. We did not start from a PaaS in mind, or the circularity of the product.'
- 'This concept will lead to better and cheaper products, that are better for the environment, have a longer lifetime and that will be better taken care off.'
- 'More expensive for the individual, some say, but it [PaaS] can be less expensive for society as a whole. Those additional cost are almost never considered.'
- 'We have always listened very well to the client, and we thought big straight away'. 'Marketing, recognizability [observability] and really good service helped in our success'.
- 'At a certain point people say; I don't want the product, I just don't want to have the hassle; I want the outcome'. 'Some generations [older] take a lot longer to get used to this.'
- 'In some groups saturation is reached. But there is still possibility to grow. Where this will end, I don't know.
- 'You pay for the product, but you expect something in return. That can be the service or a really good product.'
- 'The awareness can be higher, but this is also dependent on the target group and the age category'.
- 'You start to add value when the product breaks down off course. We don't want to provide a service that is of no use to people'
- 'Flexibility is important. You have to be able to terminate a contract within a month if you don't need it or want it anymore.'
- 'A person can have 100 reasons for a Swapfiets because the bike got stolen quite often, or that they don't want a wobbling bike, or they don't have the money, some because they want to be part of the group'.
- 'We are going to provide more and different propositions. For example even more premium product or e.g. an e-bike.
- 'Oftentimes you give more than just money, you also give away your time. You can reduce that. There is a good word for that: convenience. That is the essence of everything in life. I don't like to do the laundry, I like to wear clean clothes.'
- 'Having worries is the inverse of convenience'
- 'Product from which you do not directly derive status are suitable for PaaS. Those are supportive commodity products'
- 'PaaS is not necessarily suitable for products that have rapid technological development because you have to make it compatible'

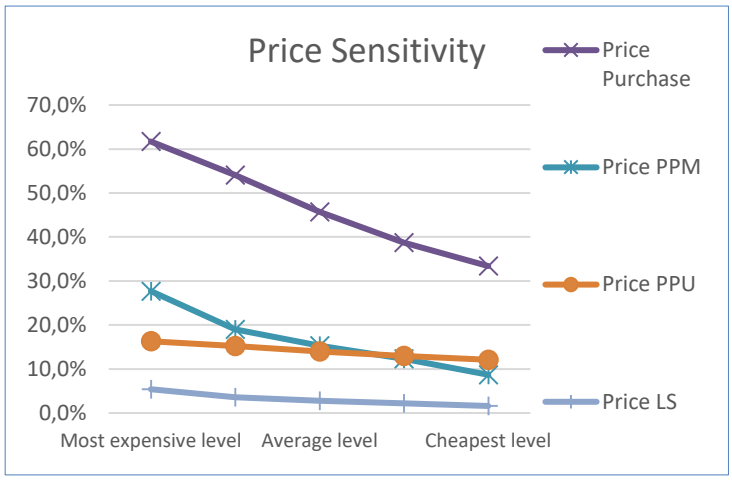
Interviewee 18:

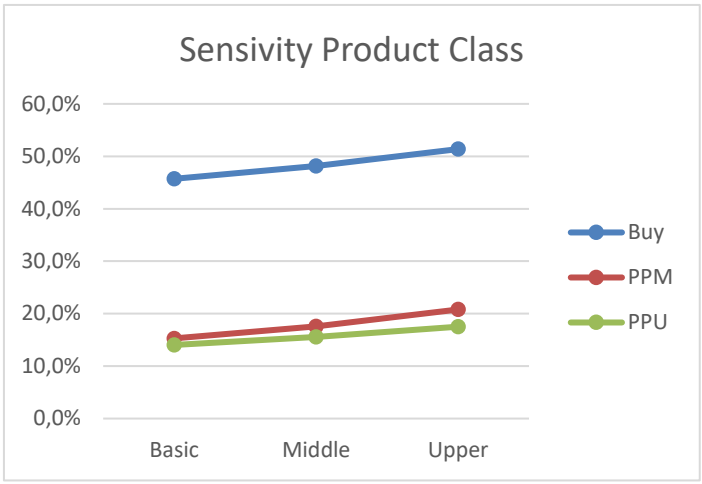
- 'We have no hidden cost, no installation fee and no deposit; we like to keep it easy for customers'.
- 'PPM business models have historically overpriced the customer. We are now showing that a fair balance (in price) is also possible'
- 'The business model itself – the pay-per-wash- is still really important for people.'
- '80% of the consumers say no unexpected cost are really important'
- 'We used to be very focused on sustainability, but consumers just don't mind that much, sustainability often is just a bonus'.
- 'Not all [PaaS] companies have sustainability considerations when starting with a PaaS, this can potentially harm the market'.

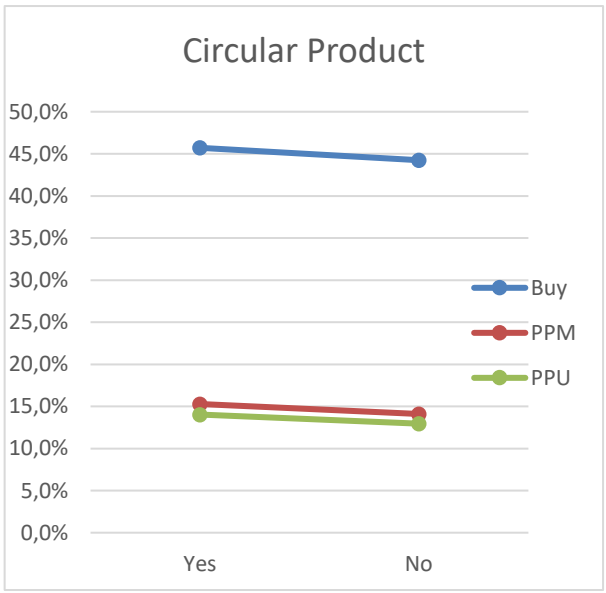
- ‘As long as the end-customer feels the pressure to wash less, I think that is a very clear and open value proposition’.
- ‘There are certain factors that the proposition has to have for consumer to consider it. Sort of the minimal demands; these are called the hygiene factor’.
- ‘Free delivery was one of the things that was not as important to consumers as expected’.
- ‘The energy efficiency of appliance was less important than expected’.
- ‘There is this perception that we are not cheap. But if we then provide the calculations, it turns out we are pretty cheap. We are also the cheapest in the market. So we need to communicate our price and value proposition better. We are already making the price aspect more insightful to consumers.’
- ‘We are looking into the contract period and the life time of our clients and see how we can improve’.
- ‘There is a high retention rate, most people only quit because they are moving and in their new place they already have a washing machine’.
- ‘We want to lengthen the use of our appliance as long as possible, and refurbish if needed.’
- ‘We are committed to this model, and in about three years we will see how this works out. If we for example need to change quite a lot’.
- ‘The producer of the appliance now has the knowledge on the depreciation of the product. We don’t have that yet. However where the manufacturer knows when something breaks down on average, but not specifically for each customer with its specific usage. We have those insights instead of the manufacturer.’
- ‘The pay-per-use model is the only model that has no privacy issues when data is transferred to the company. Only the PPU model allows for sufficient legal grounds to share the usage data with the company [because the invoices are based on that]. It is the only model that surpasses the GDPR regulations. This is also the reason why a lot of other white-good appliances are not yet collecting usage data.’
- ‘HOMIE saves 25% in resources (water, electricity and detergents) compared to normal buy-options. Meaning a large sustainability improvement’.

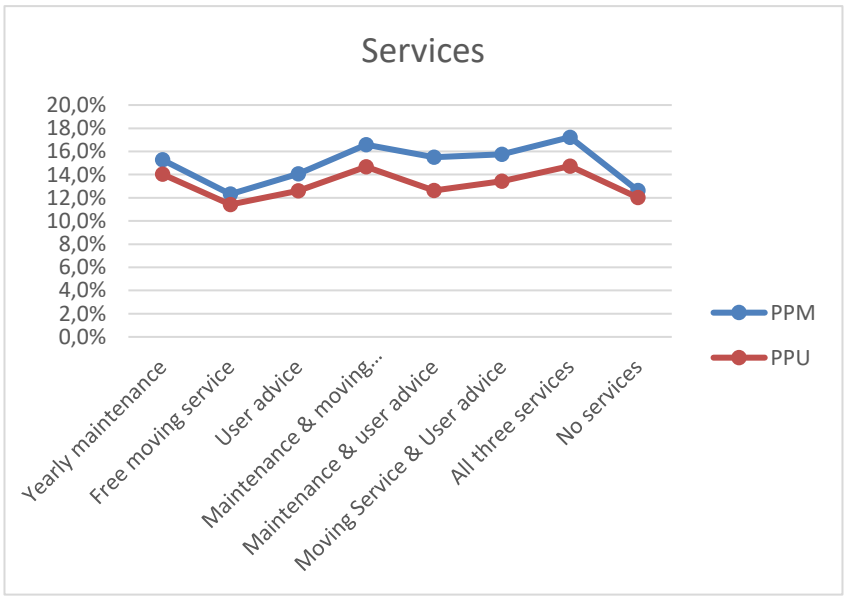
Appendix VI - Sensitivity analysis – Shares of preference per level

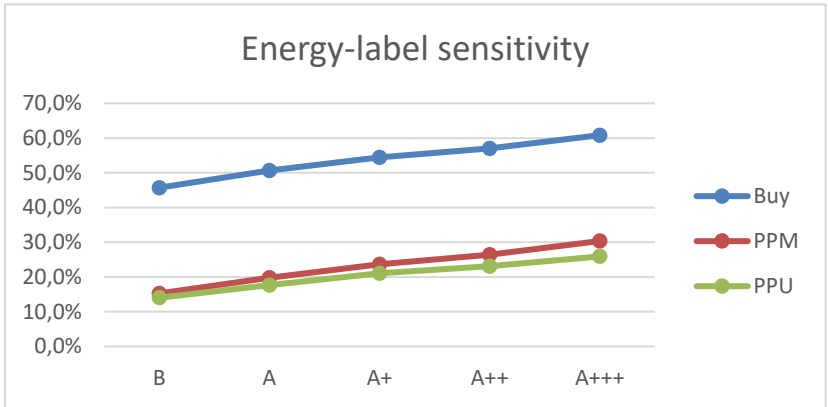
To show the tipping-points among attributes a sensitivity analysis was run, the following figures represent the shares of preference (y-axis) over different attribute levels. The sensitivity analysis shows relatively straight lines in all the attributes, no clear tipping-points in consumer behaviour are shown. This is a testament to well-defined attribute levels.

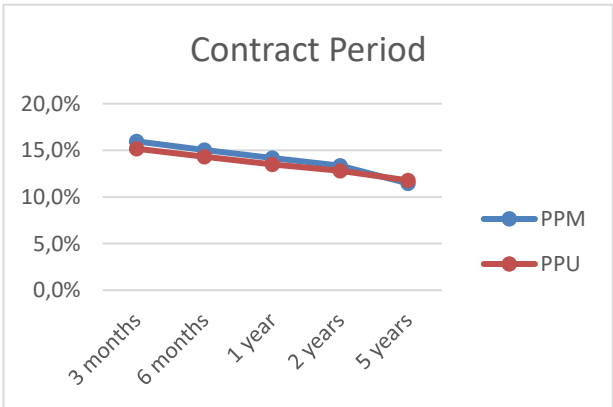












Appendix VII – Analysis

Utility – Standard Errors and t-Ratios of Multinomial Aggregate Logit Analysis:

A full overview of the effect scores (Utilities), the Standard Error and the t-Ratios (significance) are provided in the following model:

Variable	Effect	Std. Error	t Ratio[34]
Buy-option	1,23722	0,01952	63,39588
Pay per Month	0,27425	0,02270	12,07936
Pay per Use / Wash	0,11713	0,02336	5,01377
Laundry Service	-1,62859	0,04402	-36,99338
Price Buy-option	-1,92914	0,09096	-21,20754
Price per month	-0,70008	0,04837	-14,47298
Price per wash	-0,58352	0,17719	-3,29315
Price washing-services	-0,87052	0,11229	-7,75268
Basic class	-0,09777	0,01572	-6,22085
Middle class	-0,02372	0,01547	-1,53302
Upper class	0,12149	0,01509	8,05068
Contract Period	-0,01808	0,00976	-1,85207
Circular Product - Yes	0,03504	0,01204	2,91089
Circular Product - No	-0,03504	0,01204	-2,91089
Yearly maintenance	0,06396	0,04398	1,45434
Moving services	-0,12564	0,04626	-2,71602
User advice	-0,06405	0,04571	-1,40125
Yearly maintenance & moving services	0,09589	0,04384	2,18710
Yearly maintenance & user advice	0,04307	0,04443	0,96936
Yearly maintenance, moving services & user advice	0,09576	0,04382	2,18540
Moving services and user advice	0,00978	0,04487	0,21797
No services	-0,11878	0,04619	-2,57169
Energy Label - B	-0,33252	0,02507	-13,26284
Energy Label - A	-0,15168	0,02413	-6,28633
Energy Label - A+	0,00586	0,02345	0,24971
Energy Label - A++	0,14542	0,02285	6,36473
Energy Label - A+++	0,33292	0,02236	14,88925
NONE	0,05581	0,03119	1,78918

This model has the following fit statistics and estimator coefficient scores:

Log-likelihood for this model	**-14968,80698**
Log-likelihood for null model	-18687,63021
Difference	3718,82324
Percent Certainty	19,89992
Akaike Info Criterion	29983,61396
Consistent Akaike Info Criterion	30176,29368
Bayesian Information Criterion	30153,29368
Adjusted Bayesian Info Criterion	30080,20233
Chi-Square	7437,64647
Relative Chi-Square	323,37593

[34] *If the t-Ratios number is bigger than absolute |1.96| the attribute level is significant with a confidence interval of 95%.*

Latent Class Overview of Utility Scores – 5 group segment

Segment	1	2	3	4	5
Segment Sizes	11.1%	32.1%	11.1%	19.4%	26.3%
Part-Worth Utilities					
Buy-option	-0,63207	4,18706	2,25324	0,39886	1,17828
Pay-per-month	0,40577	-0,56464	0,44268	0,35331	1,33710
Pay-per-use (wash)	0,28650	-0,80633	-0,10935	1,67581	-0,48777
Laundry Service	-0,06020	-2,81609	-2,58658	-2,42798	-2,02761
Price buy-option	-2,19914	-4,91642	-4,30817	-3,71912	-3,46473
Price per month	-0,52900	-2,53839	-0,88544	-0,97995	-0,89109
Price per wash	-0,10025	-0,91600	-0,32378	-1,29490	-1,30151
Price laundry services	-0,58173	-1,31797	-0,44609	-2,17404	-1,83037
Basic class	-0,11229	-0,15590	-0,10607	-0,11634	-0,24198
Middle class	-0,05064	0,02145	-0,06470	0,02410	-0,04815
Upper Class	0,16293	0,13446	0,17077	0,09224	0,29013
Contract period	-0,00432	-0,00586	0,02113	-0,01906	-0,07368
Circular Product- Yes	0,01822	-0,00538	0,08603	0,06348	0,06851
Circular Product- No	-0,01822	0,00538	-0,08603	-0,06348	-0,06851
Yearly maintenance	0,09416	0,28429	-0,03941	0,16216	0,08848
Moving services	-0,15141	-0,42189	-0,12202	-0,15927	-0,28781
Users' advice	-0,03836	-0,33717	0,08468	-0,09638	-0,14021
Yearly maintenance & Moving services	0,24015	-0,21232	0,13999	0,19778	0,04718
Yearly maintenance & Users' advice	0,07994	-0,05827	-0,02600	-0,01460	0,14077
Yearly maintenance, Moving servicess & Users' advice	0,08114	0,36277	0,17881	0,10241	0,23897
Moving services & Users' advice	-0,12817	-0,07629	-0,07093	0,03387	0,13382
No services	-0,17745	0,45888	-0,14513	-0,22599	-0,22119
Energy-label B	-0,35839	-0,61623	-0,71030	-0,49810	-0,53682
Energy-label A	-0,14846	-0,21882	-0,27034	-0,36255	-0,15620
Energy-label A+	0,01180	0,16062	-0,10833	0,11308	-0,01846
Energy-label A++	0,16380	0,14212	0,34792	0,25548	0,20634
Energy-label A+++	0,33126	0,53232	0,74105	0,49208	0,50514
NONE	1,67685	-0,18926	3,05169	-1,30451	-1,56457

Latent Class Overview of t Ratios (significance)

Segment	1	2	3	4	5
Segment Sizes	11.1%	32.1%	11.1%	19.4%	26.3%
t Ratios					
Buy-option	-8,97077	27,55590	22,72002	4,91582	21,83520
Pay-per-month	8,19328	-3,12320	4,14862	4,38791	25,18131
Pay-per-use (wash)	5,60691	-4,56030	-0,95223	22,91214	-7,09588
Laundry Service	-1,04973	-7,48660	-9,88861	-12,16159	-15,26370
Price buy-option	-5,09862	-11,10299	-15,56816	-12,25793	-16,29499
Price per month	-4,33956	-8,91653	-5,36963	-7,89481	-10,38333
Price per wash	-0,22789	-0,86039	-0,45870	-3,86776	-2,61009
Price laundry services	-4,07918	-1,47630	-0,63035	-4,86324	-5,97749
Basic class	-2,20854	-2,26079	-2,02563	-3,10251	-7,16680
Middle class	-1,01468	0,31048	-1,24288	0,65897	-1,48199
Upper Class	3,42972	1,95667	3,35347	2,54691	9,21527
Contract period	-0,18117	-0,11657	0,59385	-0,95874	-3,57231
Circular Product- Yes	0,52809	-0,09495	2,15479	2,38834	2,67107
Circular Product- No	-0,52809	0,09495	-2,15479	-2,38834	-2,67107
Yearly maintenance	0,88124	1,35351	-0,24187	1,71913	0,96007
Moving services	-1,30123	-1,51613	-0,72922	-1,67827	-3,00682
Users' advice	-0,33762	-1,28985	0,51453	-1,02928	-1,48315
Yearly maintenance & Moving services	2,27844	-0,81933	0,88652	2,13899	0,50118
Yearly maintenance & Users' advice	0,72403	-0,22812	-0,15732	-0,15628	1,55348
Yearly maintenance, Moving servicess & Users' advice	0,74991	1,74834	1,11735	1,08398	2,55965
Moving services & Users' advice	-1,09564	-0,30188	-0,42792	0,35794	1,45491
No services	-1,51716	2,23836	-0,84761	-2,34067	-2,32332
Energy-label B	-4,46733	-5,80492	-8,06318	-8,01460	-9,97579
Energy-label A	-1,96114	-2,07573	-3,33785	-6,02167	-3,07898
Energy-label A+	0,16057	1,47369	-1,36014	2,03297	-0,37182
Energy-label A++	2,32437	1,31883	4,63882	4,67556	4,24233
Energy-label A+++	4,78013	4,88522	9,95049	9,21951	10,52237
NONE	27,03686	-1,01916	26,97767	-8,81804	-11,83179

Latent Class Overview of Utility Scores – Rescaled for Comparability (5 decimals)

Segment	1	2	3	4	5
Segment Sizes	11.1%	32.1%	11.1%	19.4%	26.3%
Buy-option	-114,86035	226,79096	189,72913	29,71209	93,26159
Pay-per-month	73,73704	-30,58360	37,27527	26,31898	105,83168
Pay-per-use (wash)	52,06213	-43,67480	-9,20755	124,83431	-38,60748
Laundry Service	-10,93883	-152,53256	-217,79685	-180,86537	-160,48579
Price buy-option	-399,62982	-266,29609	-362,76013	-277,04556	-274,23448
Price per month	-96,13084	-137,49121	-74,55625	-72,99879	-70,53038
Price per wash	-18,21709	-49,61469	-27,26347	-96,45982	-103,01514
Price laundry services	-105,71213	-71,38716	-37,56214	-161,94869	-144,87476
Basic class	-20,40481	-8,44454	-8,93114	-8,66627	-19,15266
Middle class	-9,20258	1,16167	-5,44820	1,79498	-3,81136
Upper Class	29,60739	7,28287	14,37934	6,87129	22,96402
Contract period	-0,78449	-0,31754	1,77953	-1,41997	-5,83156
Circular Product- Yes	3,31152	-0,29122	7,24414	4,72861	5,42243
Circular Product- No	-3,31152	0,29122	-7,24414	-4,72861	-5,42243
Yearly maintenance	17,11050	15,39851	-3,31858	12,07985	7,00285
Moving services	-27,51462	-22,85131	-10,27416	-11,86437	-22,78039
Users' advice	-6,97097	-18,26259	7,13044	-7,17921	-11,09796
Yearly maintenance & Moving services	43,64097	-11,50044	11,78789	14,73340	3,73396
Yearly maintenance & Users' advice	14,52702	-3,15644	-2,18943	-1,08753	11,14192
Yearly maintenance, Moving servicess & Users' advice	14,74404	19,64938	15,05602	7,62908	18,91437
Moving services & Users' advice	-23,29049	-4,13216	-5,97225	2,52328	10,59218
No services	-32,24645	24,85506	-12,21993	-16,83450	-17,50692
Energy-label B	-65,12757	-33,37804	-59,80923	-37,10428	-42,48955
Energy-label A	-26,97844	-11,85256	-22,76337	-27,00711	-12,36365
Energy-label A+	2,14391	8,69982	-9,12140	8,42393	-1,46091
Energy-label A++	29,76523	7,69794	29,29571	19,03144	16,33178
Energy-label A+++	60,19687	28,83284	62,39830	36,65601	39,98233
NONE	304,71745	-10,25103	256,96057	-97,17547	-123,83629

Utility Summary Report:

Average Utility Values				
Zero-Centered Differences			Utility Scaling Method	
Label	**Utility**	**Std Deviation**	**Lower 95% CI**	**Upper 95% CI**
Buy-option	114,14	104,46	107,86	120,43
Pay-per-month	35,07	51,04	32,00	38,14
Pay-per-use (wash)	4,80	62,45	1,04	8,55
Laundry Service	-154,01	48,99	-156,96	-151,06
Price buy-option	-297,71	46,85	-300,53	-294,89
Price per month	-96,62	28,51	-98,34	-94,90
Price per wash	-67,47	31,04	-69,34	-65,60
Price laundry services	-108,98	42,80	-111,56	-106,41
Basic class	-12,68	4,97	-12,98	-12,39
Middle class	-1,86	3,56	-2,07	-1,64
Upper class	14,54	8,00	14,06	15,02
Contract period	-1,80	2,41	-1,94	-1,65
Circular Product - Yes	3,45	2,66	3,29	3,61
Circular Product - No	-3,45	2,66	-3,61	-3,29
Yearly maintenance	10,69	5,79	10,34	11,04
Moving services	-19,88	5,49	-20,21	-19,55
Users' advice	-10,23	7,37	-10,67	-9,78
Yearly maintenance & Moving services	6,09	16,01	5,13	7,06
Yearly maintenance & Users' advice	2,96	6,64	2,56	3,36
Yearly maintenance, Moving servicess & Users' advice	16,18	4,26	15,93	16,44
Moving services & Users' advice	-1,20	9,33	-1,77	-0,64
No services	-4,61	20,54	-5,85	-3,38
Energy Label - B	-43,15	10,99	-43,81	-42,49
Energy Label - A	-17,93	6,69	-18,33	-17,53
Energy Label - A+	3,31	5,86	2,96	3,67
Energy Label - A++	17,07	7,91	16,60	17,55
Energy Label - A+++	40,69	11,91	39,97	41,41
None	6,34	147,75	-2,55	15,23

Average Importances

Attribute	**Importance**	**Std Deviation**	**Lower 95% CI**	**Upper 95% CI**
Payment Model	31,42	6,91	31,01	31,84
Price buy-option	17,86	2,81	17,69	18,03
Price per month	14,49	4,28	14,24	14,75
Price per wash	2,70	1,24	2,62	2,77
Price Laundry Service	16,35	6,42	15,96	16,73
Class	2,72	1,28	2,65	2,80
Contract period	1,03	0,99	0,97	1,09
Circular product	0,72	0,49	0,69	0,75
Services	4,32	1,27	4,24	4,40
Energy label	8,38	2,28	8,25	8,52

Utility Scores from HB-Analysis split to Segments of the Latent Class Analysis

Label	Total	Group 1	Group 2	Group 3	Group 4	Group 5
Buy-option	114,14	-92,71	223,37	185,49	32,83	94,50
Pay-per-month	35,07	73,70	-27,29	37,62	30,22	98,72
Pay-per-use (wash)	4,80	49,87	-42,79	-9,08	117,67	-30,82
Laundry Service	-154,01	-30,87	-153,29	-214,03	-180,71	-162,40
Price buy-option	-297,71	-401,88	-267,32	-361,67	-279,82	-277,12
Price per month	-96,62	-96,38	-135,79	-76,46	-73,70	-73,10
Price per wash	-67,47	-24,07	-50,89	-29,20	-97,00	-101,43
Price laundry services	-108,98	-108,27	-73,25	-41,50	-161,88	-144,16
Basic class	-12,68	-20,05	-8,68	-9,28	-9,26	-18,46
Middle class	-1,86	-8,80	1,04	-5,34	1,50	-3,46
Upper class	14,54	28,85	7,65	14,62	7,76	21,92
Contract period	-1,80	-0,86	-0,43	1,58	-1,62	-5,46
Circular Product - Yes	3,45	3,70	-0,12	7,05	4,79	5,28
Circular Product - No	-3,45	-3,70	0,12	-7,05	-4,79	-5,28
Yearly maintenance	10,69	16,15	15,16	-2,48	11,95	7,50
Moving services	-19,88	-26,87	-22,79	-11,01	-12,53	-22,38
Users' advice	-10,23	-6,62	-17,99	6,14	-7,41	-11,08
Yearly maintenance & Moving services	6,09	41,27	-10,99	11,69	14,43	4,03
Yearly maintenance & Users' advice	2,96	13,57	-2,85	-1,79	-0,49	10,20
Yearly maintenance, Moving servicess & Users' advice	16,18	15,11	19,60	15,26	8,26	18,51
Moving services & Users' advice	-1,20	-21,32	-3,82	-5,90	2,77	9,71
No services	-4,61	-31,30	23,69	-11,91	-16,98	-16,48
Energy Label - B	-43,15	-65,23	-33,74	-59,33	-37,80	-42,47
Energy Label - A	-17,93	-27,10	-11,99	-22,59	-26,53	-13,24
Energy Label - A+	3,31	1,73	8,43	-8,48	7,99	-0,76
Energy Label - A++	17,07	29,87	8,02	28,80	19,11	16,46
Energy Label - A+++	40,69	60,72	29,28	61,61	37,23	40,01
None	6,34	286,23	-11,84	246,38	-96,68	-117,24

HB-Importance scores split to the Latent Class Segments

	Importance					
Attribute	**Total**	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**
Payment Model	31,42	18,31	37,67	39,95	29,90	26,70
Price buy-option	17,86	24,11	16,04	21,70	16,79	16,63
Price per month	14,49	14,46	20,37	11,47	11,05	10,96
Price per wash	2,70	0,96	2,04	1,17	3,88	4,06
Price Laundry Service	16,35	16,24	10,99	6,22	24,28	21,62
Class	2,72	4,89	1,63	2,39	1,70	4,04
Contract period	1,03	0,43	0,20	0,78	0,77	2,59
Circular product	0,72	0,74	0,07	1,41	0,96	1,06
Services	4,32	7,26	4,69	2,81	3,16	4,09
Energy label	8,38	12,60	6,30	12,09	7,50	8,25

Appendix VIII - Counts crosstabulation – Payment Model

The following tables shows the count-scores compared over all other consumer characteristic variables that were included in the survey. With each table the question is explained and the main take-away points are given.

Gender:

Between group Significance. P < 0.01 ***Gender***

	Total	Male	Female
Total Respondents	1061	610	451
Buy-option	0,550	0,559	0,539
Pay per Month	0,227	0,217	0,239
Pay per Use	0,188	0,186	0,192
Laundry Service	0,035	0,038	0,030

Key take-away points:

There is no big difference between genders, but this is still significant. Females slightly prefer PPM or PPU models. While males slightly prefer buying and the laundry services.

Age:

Between group Significance. P < 0.01 ***Age***

	Total	18-35 years	36-50 years	51-65 years	66 years or older
Total Respondents	1061	232	244	282	303
Buy-option	0,550	0,470	0,508	0,601	0,603
Pay per Month	0,227	0,258	0,271	0,181	0,207
Pay per Use	0,188	0,229	0,194	0,190	0,150
Laundry Service	0,035	0,043	0,027	0,028	0,040

Key take-away points:

There are significant differences with younger and older generations. Older generations are significantly more likely to choose the buy option, whether younger generations are more likely to choose for PPM and PPU. The youngest and oldest generations have relatively the highest scores for laundry services.

Income:

Between group Significance. P < 0.01 ***Household income (before tax)***

	Total	0-20000 euro gross per year	20001-40000 euro gross per year	40001-60000 euro gross per year	60001+ euro gross per year
Total Respondents	1061	265	292	267	237
Buy-option	0,550	0,467	0,572	0,528	0,640
Pay per Month	0,227	0,227	0,199	0,277	0,201
Pay per Use	0,188	0,262	0,185	0,165	0,139
Laundry Service	0,035	0,043	0,043	0,030	0,020

Key take-away points:

There are significant differences with high and low incomes. Higher incomes prefer the buy-option over the PPM,PPU and laundry services, where lower incomes prefer PPM, PPU and Laundry Service. Interestingly the 40-60k income have the highest preference of the four groups for the PPM model. However people who really earn a more than 60k a year would chose the buy-option. In regards to the laundry service lower incomes chose that option more. This could be due to the fact that they do not have the initial investments for a purchase.

Education:

Between group Significance. P < 0.01 *Highest Level of Education*

	Total	WO (of PhD)	HBO	MBO	High school	Other
Total Respondents	1061	157	336	320	180	22
Buy-option	0,550	0,492	0,574	0,537	0,579	0,650
Pay per Month	0,227	0,249	0,209	0,240	0,211	0,186
Pay per Use	0,188	0,227	0,190	0,187	0,165	0,132
Laundry Service	0,035	0,032	0,027	0,037	0,044	0,032

This question regards if the respondent highest education level (WO = University, HBO = University of applied sciences, MBO = practical education).

Key take-away points:

We can see that respondents who have a higher education level choose for the Pay-per-Month option and the Pay-per-Use option more often compared to respondents that have more practical education or high school as their highest education. Respondents with MBO or High School education are also slightly preferring laundry services compared to higher-educated respondents.

Current usage/experience:

This question regards the comparison of utility scores, split between respondents who do or do not currently use a washing PSS (here being a PPM or PPU washing machine or laundry services).

Between group Significance. P < 0.01 *Current usage (experience with) of washing PSS*

	Total	No Usage of PSS	Current Usage of PSS
Total Respondents	1061	937	80
Buy-option	0,550	0,584	0,179
Pay per Month	0,227	0,212	0,379
Pay per Use	0,188	0,175	0,348
Laundry Service	0,035	0,029	0,095

Key take-away points:

7,9% say they are using a PSS. Although not surprising, respondents who are currently using washing PSS, are significantly more likely to choose for the Pay-per-Month option, the Pay-per-Use option and the laundry services. The group with experience chose the 'buy-option' 17,9% of the time, compared to the no experience group that chose the 'buy-option' 58,4% of the time. Compared to the total sample, the respondents using a washing PSS (PPM or PPU) are significantly more likely to go for washing-services (9,5%) compared the average total sample of 3,5%. Concluding that 7,9% is currently using PSS, which means that 92% are currently buyers. When we look at the counts for the payment model, we can see that just under half of this group would actually be willing to choose a PSS option, if it was provided with the right attributes.

Awareness of washing PSS:

This question regards the respondents' knowledge on if they are aware of someone else who uses a PSS washing solution like a pay-per-month or pay-per-use washing machine or laundry services.

Between group Significance. P < 0.01 *Awareness of washing PSS*

	Total	No Awareness of washing PSS	Awareness of washing PSS
Total Respondents	1061	877	140
Buy-option	0,550	0,590	0,315
Pay per Month	0,227	0,211	0,316
Pay per Use	0,188	0,168	0,319
Laundry Service	0,035	0,031	0,050

Key take-away points:
We can see that respondents who are aware of someone that uses a washing PSS, are significantly more likely to choose for the Pay-per-Month option, the Pay-per-Use option and the laundry services

Experience with other PSS or subscriptions (PaaS):

This question regards the respondents' current usage of (other) PSS or subscriptions (PaaS). No experience with PSS means the persons has 0 PSS/Subscriptions, Little experience with PSS means the persons has 1 PSS/subscription. Experience with PSS means the person has 2/3 PSS/Subscriptions and a person has a lot of experience if he or she has 4+ subscriptions/PSS.

Between group Significance. P < 0.01 *Experience with other PSS or subscriptions (PaaS)*

	Total	No Experience	Little Experience	Experience	A lot of experience
Total Respondents	1061	541 (51,0%)	368 (34,7%)	89 (8,4%)	19 (1,8%)
Buy-option	0,550	0,621	0,517	0,362	0,174
Pay per Month	0,227	0,178	0,268	0,300	0,395
Pay per Use	0,188	0,167	0,186	0,293	0,379
Laundry Service	0,035	0,034	0,030	0,045	0,053

Key take-away points:
We can see that respondents who have experience with more other (non-washing) subscriptions/PSS, are significantly more likely to choose for the Pay-per-Month option, the Pay-per-Use option and Laundry services

Washing per week

How many time does the respondent wash a week?

Between group Significance. P < 0.01 *Washes per week*

	Total	Less than once	1 - 2 times	2 - 3 times	3 - 4 times	5 or more times
Total Respondents	1061	100	392	258	153	114
Buy-option	0,550	0,484	0,507	0,584	0,597	0,636
Pay per Month	0,227	0,109	0,219	0,240	0,264	0,261
Pay per Use	0,188	0,358	0,233	0,148	0,110	0,087
Laundry Service	0,035	0,049	0,041	0,028	0,029	0,017

Key take-away points:
Respondents that do not wash a lot in the week have a higher preference for models where they pay-per-wash or make use of laundry services. Furthermore those who wash a lot, have a higher preference for the buy-option and the PPM option. This might be due to the fact that in these models you can wash 'unlimitedly' without additional direct cost of washing.

Moving within 2 years

This question relates to if people intend to move within 2 years, indicating a preference for possible flexible business models.

Between group Significance. P < 0.01 ***Moving within 2 years***

	Total	Yes	No
Total Respondents	1061	238	777
Buy-option	0,550	0,453	0,582
Pay per Month	0,227	0,257	0,215
Pay per Use	0,188	0,259	0,168
Laundry Service	0,035	0,032	0,035

Key take-away points:

People that consider moving, are significantly more likely to choose for PPM and PPU. However there is no big difference with washing-services between the groups. This is remarkable because this laundry solution is especially dynamic; you actually don't even need the washing machine anymore. Furthermore people that do not intend to move in short term prefer the buy-options more often.

Rent or Bought a house

Between group Significance. P < 0.01	***Renting or Bought a house***		
	Total	Renting	Bought a house
Total Respondents	1061	418	597
Buy-option	0,550	0,504	0,585
Pay per Month	0,227	0,239	0,215
Pay per Use	0,188	0,229	0,161
Laundry Service	0,035	0,028	0,039

Key take-away points:

Respondents who are renting are more likely to choose for PPM and especially PPU models. Interestingly home-owners are more likely to prefer the laundry services option, and logically the buy-option. The latter could be due to the fact that home-owners are often more financially stable, and can more easily afford to buy a high-end machine.

Persons in household

Between group Significance. P < 0.01	***Persons in Household***					
	Total	One	Two	Three	Four	Five+
Total Respondents	1061	286	460	109	108	52
Buy-option	0,550	0,517	0,606	0,464	0,513	0,531
Pay per Month	0,227	0,185	0,205	0,295	0,330	0,256
Pay per Use	0,188	0,262	0,153	0,202	0,141	0,187
Laundry Service	0,035	0,036	0,036	0,039	0,017	0,027

Key take-away points:

Respondents who have a large household are significantly less likely to choose the PPU or the laundry services. However larger households do prefer the PPM options more often, presumably because larger households also need to wash more. This could be due to the fact that this again provides unlimited washing opportunity, and is a model in which you can share cost among potential flatmates more easily. Interestingly the buy-option shows some very diverse results over the different households sizes.

Household composition

Between group Significance. P < 0.01	***Type of household composition***						
	Total	Family with kids (<12 yrs)	Family with kids (>12 yrs)	Working persons	Students	Mix	None of the above
Total Respondents	1061	110	153	494	24	23	211
Buy-option	0,550	0,399	0,530	0,590	0,450	0,452	0,580
Pay per Month	0,227	0,347	0,273	0,196	0,238	0,239	0,191
Pay per Use	0,188	0,205	0,154	0,181	0,279	0,278	0,206
Laundry Service	0,035	0,048	0,043	0,033	0,033	0,030	0,023

This questions relates to the type of household composition the respondents are in, this was included because student houses, or young families might have different needs than a household of working people.

Key take-away points:

Respondents with young kids are most likely to go for the pay-per month model and even the laundry services. Whereas households with mostly working persons prefer the buy-option. Families with kids (on average older than 12 years) have the lowest preference for the pay-per-use option. Presumably because this group also washes a lot.

Like to do the laundry

Between group Significance: not sign. ***Do you like to do the laundry?***

	Total	Yes	No
Total Respondents	1061	583	434
Buy-option	0,550	0,561	0,540
Pay per Month	0,227	0,221	0,231
Pay per Use	0,188	0,183	0,197
Laundry Service	0,035	0,035	0,033

This question relates to if you have like doing the laundry. Not liking to do the laundry could have been an indicator for raised preference for the laundry services.

Key take-away points:

There is no significant differences between people who like doing their laundry versus those who don't. Interestingly even the respondents who don't like doing their laundry don't have a higher preference for washing-services.

Lack of space

This question relates to if the respondents have enough space for doing their laundry. This was included because people that tend to find they do not have enough space for the laundry, might be more prone to choosing the laundry services.

Between group Significance. P < 0.01 ***Lack of Space***

	Total	Yes, I consider to have sufficient space for my laundry	No, I experience space deficiency with doing my laundry	None of the above
Total Respondents	1061	884	90	8
Buy-option	0,550	0,585	0,387	0,388
Pay per Month	0,227	0,211	0,340	0,213
Pay per Use	0,188	0,177	0,240	0,238
Laundry Service	0,035	0,028	0,033	0,163

Key take-away points:

People that consider that they do have enough space for doing their laundry, are significantly less likely to choose for laundry services. Furthermore they also significantly prefer PPM and PPU. While people that have sufficient space prefer the buy-options.

Worried about the environment

This question regards if the respondent is worried about the state of the environment globally (7 is very worried, 1 is not worried at all).

Between group Significance. P < 0.01	*Worried about the environment (7-point likert scale)*							
	Total	1	2	3	4	5	6	7
Total Respondents	1061	39	51	97	138	289	273	129
Buy-option	0,550	0,710	0,575	0,566	0,565	0,582	0,530	0,453
Pay per Month	0,227	0,149	0,229	0,207	0,228	0,212	0,248	0,233
Pay per Use	0,188	0,100	0,137	0,170	0,177	0,174	0,199	0,277
Laundry Service	0,035	0,041	0,059	0,057	0,030	0,032	0,023	0,037

Key take-away points:

We can see that respondents who are worried are significantly more likely to choose for the Pay-per-Month option, the Pay-per-Use option compared to respondents that are not worried. Those that are not worried (1 or 2) prefer the buy-option over the other options. For laundry services there seems no clear correlation, since the numbers don't perform in an orderly manner. However lower scores on the environmental awareness seem to favour the laundry services more.

Sustainability Consideration (influence on consumption)

This questions relates to if respondents let sustainability consideration influence their consumption behaviour, 1 = no influence at all, 7 = a lot of influence on their behaviour.

Between group Significance. P < 0.01	***Sustainability Consideration***							
	Total	1	2	3	4	5	6	7
Total Respondents	1061	65	89	148	147	323	177	67
Buy-option	0,550	0,683	0,615	0,561	0,561	0,555	0,499	0,434
Pay per Month	0,227	0,182	0,217	0,220	0,203	0,229	0,243	0,263
Pay per Use	0,188	0,120	0,099	0,189	0,197	0,187	0,233	0,252
Laundry Service	0,035	0,015	0,070	0,030	0,039	0,029	0,025	0,051

Key take-away points:

Respondents who have high sustainability consideration regarding their consumption behaviour, are significantly more likely to choose for PPM and PPU. Interestingly the highest recorded preference percentage for laundry services was recorded with a score of sustainability consideration of 2 (7%).

Personal Innovativeness

This question regards to self-appointed Personal Innovativeness attribute (PI), in which PI is defined as the eagerness for testing or adopting new technologies.

Between group Significance. P < 0.01	*Personal Innovativeness (7-point likert scale)*							
	Total	1	2	3	4	5	6	7
Total Respondents	1061	160	199	215	159	165	81	37
Buy-option	0,550	0,586	0,609	0,562	0,562	0,515	0,411	0,484
Pay per Month	0,227	0,195	0,221	0,225	0,207	0,247	0,263	0,262
Pay per Use	0,188	0,173	0,146	0,184	0,186	0,214	0,290	0,203
Laundry Service	0,035	0,047	0,025	0,028	0,045	0,025	0,036	0,051

Key take-away points:
We can see that respondents who have high PI (6/7) are significantly more likely to choose for the Pay-per-Month option, the Pay-per-Use option and Laundry services compared to respondents with a low PI (1/2). However there is clearly some 'noise' in this data, as there are some outliers like the count scores for laundry services for score '1', '4', and '7' report a higher score of respectively 0.047, 0.045 and 0.051.

Trust in PSS provider

Questions regards to if the respondents finds trust in the provider important; 1= not important, 7= very important.

Between group Significance. P < 0.01	***Trust in PSS provider*** (7-point likert scale)							
	Total	1	2	3	4	5	6	7
Total Respondents	1061	31	41	56	139	327	283	139
Buy-option	0,550	0,674	0,556	0,548	0,619	0,546	0,536	0,505
Pay per Month	0,227	0,148	0,256	0,250	0,182	0,235	0,238	0,212
Pay per Use	0,188	0,129	0,120	0,164	0,160	0,188	0,197	0,248
Laundry Service	0,035	0,048	0,068	0,038	0,038	0,030	0,029	0,035

Key take-away points:
People that find trust in the provider very important are more likely to choose PPU models. This cannot be said for PPM models, as these results vary over the different outputs. Furthermore people that don't find trust so important are more likely to go for laundry services. The buy-options shows no clear results, however people that do not find trust in the provider of PSS important seem to have a slight preference for the buy option.

Better for Environment

This questions relates to if respondents think that PPM or PPU are more environmentally friendly options, since the ownership, and thus the responsibility for the product lies with the manufacturer/provider. 1 = they do not think so 7 = they totally think so.

Between group Significance. P < 0.01	***Better for Environment*** *(7-point likert scale)*							
	Total	1	2	3	4	5	6	7
Total Respondents	1061	195	145	189	178	164	97	48
Buy-option	0,550	0,767	0,672	0,609	0,492	0,395	0,319	0,331
Pay per Month	0,227	0,132	0,184	0,199	0,229	0,321	0,333	0,258
Pay per Use	0,188	0,086	0,115	0,158	0,240	0,236	0,315	0,352
Laundry Service	0,035	0,015	0,029	0,034	0,039	0,048	0,033	0,058

Key take-away points:

Respondents thinking PSS are better for the environment (6/7) indeed have a higher preference for PPM, PPU and laundry services. Those who do not think so (1/2) have a higher preference for the buy-option.

Efficiency

This questions regards if respondents think that pay-per-use (pay-per-wash) would increase their efficiency (e.g. smarter, better, energy saving and fuller machines) in washing. 1 = they strongly disagree, 7 = they strongly agree.

Between group Significance. P < 0.01	***Efficiency of washing when paying per wash (PPU)***							
	Total	1	2	3	4	5	6	7
Total Respondents	1061	211	129	134	117	175	160	90
Buy-option	0,550	0,755	0,626	0,610	0,569	0,461	0,389	0,333
Pay per Month	0,227	0,158	0,203	0,201	0,237	0,257	0,287	0,257
Pay per Use	0,188	0,068	0,140	0,156	0,159	0,247	0,286	0,347
Laundry Service	0,035	0,019	0,032	0,033	0,035	0,035	0,038	0,063

Key take-away points:

Respondents who think PPU enhances their efficiency in washing (score 6/7) are significantly more likely to choose the Pay-per-Use washing machine. This is obvious, people that don't think PPU enhances their efficiency are significantly more likely to prefer the buy-option.

Control Variables:

Price doesn't matter

This question (multiple selection) relates to which options the respondents would choose if price was **not** a factor. Checked means they would choose it if it was available at an affordable price.

Between group Significance. P < 0.01	***Price doesn't matter - Buy Option***		***Price doesn't matter - PPM***		***Price doesn't matter - PPU***		***Price doesn't matter - Laundry Service***	
	Total	Unchecked	*Checked*	Unchecked	*Checked*	Unchecked	*Checked*	Unchecked	*Checked*
Total Respondents	1061	**280**	***689***	**783**	***186***	**836**	***133***	**767**	***202***
Buy-option	0,550	0,386	*0,624*	0,581	*0,447*	0,581	*0,396*	0,571	*0,495*
Pay per Month	0,227	0,281	*0,200*	0,196	*0,338*	0,228	*0,196*	0,220	*0,235*
Pay per Use	0,188	0,266	*0,155*	0,186	*0,190*	0,156	*0,380*	0,183	*0,201*
Laundry Service	0,035	0,066	*0,021*	0,036	*0,026*	0,036	*0,027*	0,025	*0,069*

Not considering an option at all:

This question (multiple selection) relates to if any of these options were available for a reasonable price, which ones would you still **not consider**? *= these respondents would consider all options for an affordable price.

Non-consideration of options (Between group Significance. P < 0.01)

	Buy Option		**PPM**		**PPU**		**Laundry Service**		**Everything***	
	X	V	X	V	X	V	X	V	X	V
Total	891	125	602	414	503	513	407	609	175	47
Buy-option	0,563	0,479	0,458	0,689	0,429	0,673	0,453	0,619	0,562	0,474
PPM	0,221	0,252	0,294	0,123	0,239	0,211	0,257	0,203	0,226	0,213
PPU	0,187	0,204	0,209	0,159	0,290	0,090	0,227	0,164	0,191	0,266
WS	0,030	0,065	0,038	0,028	0,042	0,026	0,064	0,014	0,021	0,047

X = Unchecked, V = Checked

.