Designing for Circularity

Exploring the Impact of Service Systems Design when Developing a Circular Product-Service System

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Abstract

This thesis examined how products can be redesigned to become services for a more sustainable future. Concretely, it was investigated how service systems design can add value to a circular product-service system so that it is at least as attractive to the linear counter product. The thesis was built up on a case study, a collaboration with a start-up, which allowed a practical exploration of the topic. Therefore, the approach throughout this thesis was not only user-centered but also included the approach and concept of circularity as well as co-design.

The design process led through various phases and different methods were performed in order to design a solution with a strong sense of sustainability and circularity.

To start, a literature review around the topic of sustainability and specifically on the theory of the circular economy was performed in order to build a base for the further research. Then, the design process started by exploring the holistic topic of sustainability and circularity in relation to cleaning products with the help of primary as well as secondary research. Here, a look into different companies was taken as well as different materials for packaging were explored. Furthermore, current and future trends were investigated and the user preferences towards cleaning products were analyzed.

After exploring the broader context, the first co-creational workshop was held where we could define first parts of the service and also redefine the research question. Then, the focus was put completely back on the user and the linear user journeys were mapped out in order to create hypotheses around possible pain points. These hypotheses were then confirmed or rejected by doing in-depth interviews. Additionally, the interviews helped us in being able to create possible personas/target segments.

After exploring the context and then defining certain parts, first ideas were co-created through a workshop. Parts of these ideas were pretotyped and tested in order to validate, and then the best of these features were rearranged into one, complete product-service system.

Finally, different service design tools were used to represent the final concept, such as system maps, ecosystem map, user journey and a service blueprint.

This thesis widens the approach of service systems design by not only being purely human-centered when developing services. Instead it is showcased that designers, when using systems thinking and co-design throughout the process can support the complex sustainable shift. This can create convenient and valuable solutions for the environment, the user and the service provider.

Acknowledgements

Grazie to our supervisor Nicola Morelli for all the support and advice before and throughout the process of writing this thesis.

Gracias to our thesis collaborator Luis Ortega. We are grateful for Luis welcoming us into his start-up project and the trust he has shown in us throughout co-designing his business.

Tak to PA Consulting for giving us the opportunity to participate in the Master Thesis Mentoring Programme. Special thanks to Signe Nørrevang and René Overgaard Jensen, for taking the time to mentor us, showing great interest in our thesis project, and pushing us with different perspectives.

Thanks to all the people participating in our co-design activities, surveys, interviews and user testing. Your participation was inevitable and very appreciated.

Danke to our family and friends from far and near for always supporting us, and especially throughout the past four months.

Learning Objectives

Official Learning Objectives

KNOWLEDGE

- Will have acquired specific knowledge about key empirical aspects of the selected problem area.
- Are familiar with the central academic debates in relation to the chosen topic/problem area.

SKILLS

- Can identify a relevant problem area within the field of development and international relations and argue for the relevance of the chosen problem.
- Are able to find relevant academic literature on the chosen topic
- Can summarize the major academic debates in regards to the elected subject area.
- Can select relevant theories and methods in relation to the chosen problem area and argue for this choice.

COMPETENCES

- Can delimit a research area and outline a research project.
- Can work independently with academic literature search.
- Can apply and explain academic and PBL principles to create a project design, which can form the basis for the MA thesis.

(AAU, 2021)

Personal Learning Objectives

For this thesis, the personal learning objectives were outlined, taking into consideration our shared motivations:

- Gain a deeper understanding in how service design can support sustainability
- Evaluate how useful the different methodologies and tools learned throughout the master are in a real case scenario
- Use service design to not only support the creation of a start-up but also to ensure a great customer experience in order to realize competitive advantage
- Acquire a deeper understanding into how service design can support the transition towards circularity
- Use the thesis to explore how service design can support, impact, and create a successful start-up
- Use a co-creative approach involving the start-up owner to align expectations throughout the process and come with more efficient results

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Abbreviations

Throughout the thesis, the abbreviations for the following terms were used:

BM	Business Model
BMC	Business Model Canvas
CBMC	Circular Business Model Canvas
CE	Circular Economy
PSS	Product-Service System

01 Introduction

Introduction

Motivation

The global consuming population is on the rise and thereby creates a larger pressure on finite resources. The overshooting day is reached earlier every year which is challenging the global sustainable production and consumption systems.

Therefore, the current linear 'take-make-use-waste' approach needs to be rethought and the realm of Service Systems Design with its holistic, systematic and human/user-centered approach, might be one of the solutions for innovating, supporting and contributing to a more sustainable future (Chick & Micklethwaite, 2011; Ceschin & Gaziulusoy, 2016).

In particular, the incorporation of circular design thinking within different (service-) systems and value propositions could bring a solution to the current linear approach. Slowing the process is no long term solution but "the circular economy represents systemic change. It goes beyond fixing current issues and incremental improvements, to a full scale industrial transformation" (Ellen MacArthur Foundation, 2017b).

Service Systems Design can not only help to identify consumer behaviours and map interests but also determine needs and desires. Moreover, it can help to change motivations by proposing valuable and enjoyable experiences and thereby making circular solutions more attractive to consumers.

Applying a holistic approach supports the aim to not only work incrementally and towards zero-waste by reducing, reusing, repairing, regulating, and recycling but rather to achieve radical changes towards net-positive by rethinking, reinventing, redirecting, recovering and redesigning a whole system.

The thesis project is centered around the shift from the traditional, linear way of selling and buying cleaning products to the innovation and co-creation of a circular counter product-service system. The initial problem statement reads as follows:

HOW CAN PRODUCTS BE REDESIGNED TO BECOME SERVICES FOR A MORE SUSTAINABLE FUTURE?

External Supervisor

PA Consulting Master Thesis Mentoring

As part of the thesis, we decided to apply for the PA Consulting 'Mentoring Programme' and were accepted to work with them.

With their mentoring programme, PA Consulting offers extra support and guidance in the thesis project process. They provide a mentor team consisting of a junior and a senior consultant, thereby offering both deep knowledge and capabilities as well as recent experience within the writing of the thesis report (PA Master Thesis Mentoring Programme, 2021). Next to meetings with the PA supervisors, the programme also involves a couple of events that support the process (PA Master Thesis Mentoring Programme, 2021).

Through our application, we were matched with the junior consultant analyst, Signe Nørrevang, and the senior managing consultant, René Overgaard Jensen. Signe has a lot of experience with writing reports and thus could help with the structuring part of the thesis, communication and generally improving and optimizing the way of working. Rene, with over 20 years of experience, is an expert in logistics and transport and has a lot of experience with start-ups and thus could support us in these areas of our project.

Prior to the start of the mentoring programme, a kick off meeting was arranged, where we agreed on having the mentoring meeting online, every other week, for 30 minutes. Previous to these arranged meetings, a process-update since the last mentoring as well as a plan for the meeting itself was sent to align expectations. During these meetings, mainly the process from the previous meeting was presented and current doubts and challenges were discussed.

These meetings not only guided us throughout the process but also pushed us further. Having to prepare a process-update every other week (prior to the meeting) illustrated our process clearly and thus helped to reflect better upon it. Furthermore, due to our Mentors backgrounds of business and consultancy, they could provide us with different perspectives that initiated further reflections on the process.

Additionally to the private mentoring, PA Consulting arranged two workshops - next to the kick off meeting - to attend together with the other Mentees. These workshops were held online and supported the process of the thesis writing. The first workshop was about 'Structuring your Communication' where we received useful tools on how to best structure the report, and the second workshop 'Pitch Perfect' gave insightful tips for the oral exam.

Case

Case Study Introduction

The case study of this thesis was in collaboration with a start-up that had the aim to innovate and launch a circular business in the field of personal- and home care products.

The goal was to provide an attractive and efficient service when buying cleaning products that, at the same time, was more environmentally friendly than conventional companies. For this, the start-up intended to shift from the linear take-make-waste approach to a circular service system. Sustainability is at the core of the start-up as well as for us. Making sustainable decisions and thus sustainable solutions were prioritized next to the overall aim of offering the best user experience.

When we started the thesis, the start-up was in the beginning phase. This meant that many things (budget, target group, user accessibility, etc.) were undefined and since the owner of the start-up was not settled on a concept yet, ideas would be openly received and accepted. Thus, there was a great opportunity to co-create and explore different scenarios together with the start-up throughout the process.

The main focus for our thesis was regarding consumer behaviour and their preferences towards personal and home care products as well as creating a user-friendly and circular product service systems with the belonging logistical aspects. The start-up was an entrepreneurial project conducted by Luis Abraham Ortega. The plan was to support each other's work as much as possible with the different approaches and fields of expertise from both sides. Throughout the thesis, if not mentioned by name, we refer to Luis as the "start-up owner".

Vision, Mision & Goals of the Start-up

Vision
Luis' vision is to empower people by facilitating sustainability through BySoap. According to him, this is getting us one step closer to a circular economy.

Mission
BySoap's foundation is built on personal values, and the motivation of starting the company came from the desire to give back to nature by creating a circular PSS. At BySoap we cherish nature and therefore we feel committed to do business in a way that is good for people and the environment.

Goals

- Prevent pollution by working in cooperations with manufacturers who implement conservation techniques in their production processes
- Engage employees to be more aware and committed to sustainability
- Waste reduction/minimization
- Encourage responsible consumption
- Use less packaging, always recyclable and/or reusable
- Constantly innovate in product packaging so that it is easier to reuse/recycle
- Smooth logistics and a great user experience

Constraints

Time

We concluded that four months were not enough to map and provide a very detailed and in-depth researched service for a company. Our findings and concepts have strong potential, nonetheless in order to start running the company we considered that more market research and a detailed business plan would be needed, where there is extra emphasis on the profits and financial part. Moreover, due to the nature of the products focused on in this thesis, especially the testing part of our service suffered from the time constraint and needed to be simulated in a much shorter time frame which posed challenges and biases.

Different Priorities

When starting the project we thought that the priorities between our academic thesis and the goals of the start-up could collide or go in different directions. The start-up could take certain directions different from what we suggested or designed, based on other criteria like profit, feasibility or resources. However this constraint, against our assumptions, was not present during most parts of the project.

Profitability Aspect

The financial aspect is an important factor that can have a direct impact in the decision making process throughout the development of the project.

Oftenly, when faced with a circumstance where we had to decide which direction to take, the profitable aspect came to our minds and made us doubt certain directions. Due to the economic part not being our area of expertise, it was a challenge, that when encountered these types of circumstances to be able to navigate and cope with the economic profits versus other aspects that belong more to our thesis goals as well as our area of expertise e.g. CE and the user experience. Therefore, we found it important to point out as a constraint that for our academic thesis as well as in general as service designers, profits and economic aspects are not the area of expertise, and therefore, other professionals are needed in order to handle and support us as designers with these aspects.

Framework

Framework

Double Diamond

We decided to follow the Double Diamond as our framework since it has been used by both of us in previous projects and always helped to simplify, structure and keep an overview throughout the design process.

The Double Diamond was created in 2005 by the British company 'Design Council' and consists of the four stages, 'Discover', 'Define', 'Develop' and 'Deliver' that represent the design process (Drew, 2019). The shape of the two diamonds which frame the four phases is given on purpose, and guides the designer whether to "think divergent" or "think convergent".

Divergent thinking - or when the diamond is opening up - illustrates the process of gathering as much data and as many ideas as possible whereas the convergent thinking - or the closing of the diamond - illustrates the process of narrowing down the many ideas and thoughts (Infolio, n.d.).

Even if illustrated linearly, the framework does not only guide through phases but also encourages iteration and adaptation between stages. This allowed us to rework ideas and be flexible in the process, constantly adapting to successfully meet the users needs. Additionally, and due to the collaboration with the start-up as well as the problem statement of this thesis, the approaches of co-design and nature-centered design were taken.

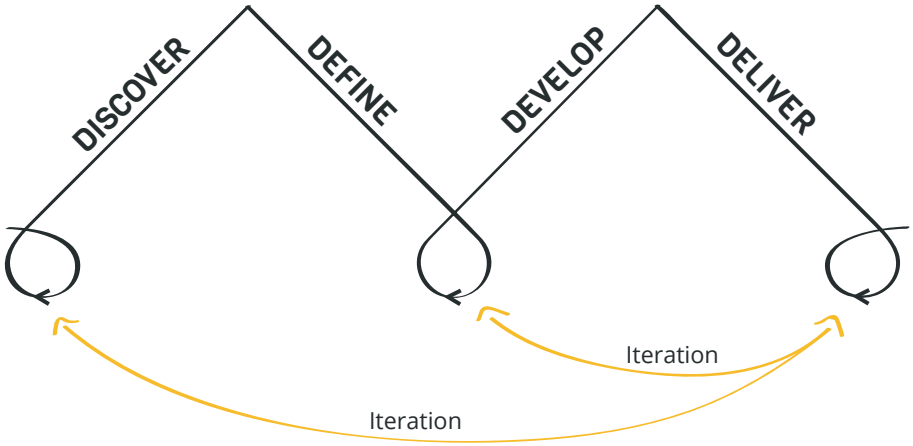


Figure 1: Double Diamond Framework

Tentative Timeline

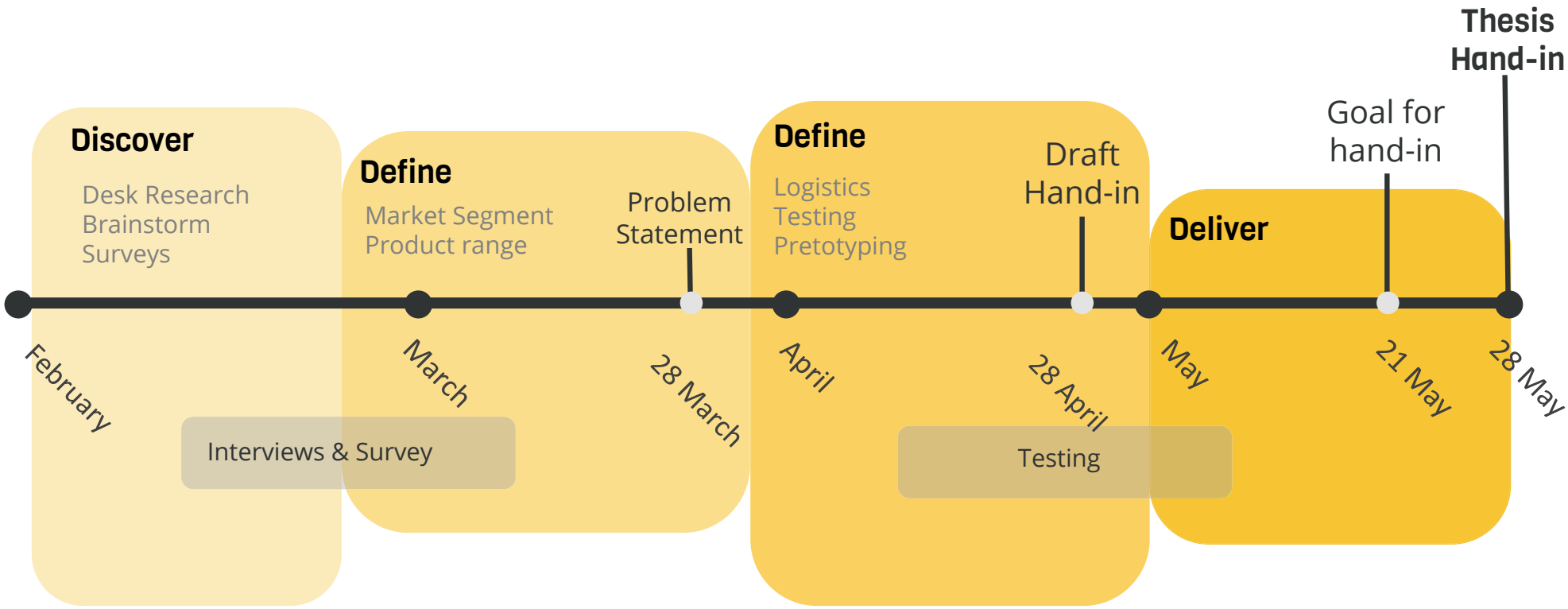


Figure 2: Tentative Timeline

Actual Timeline

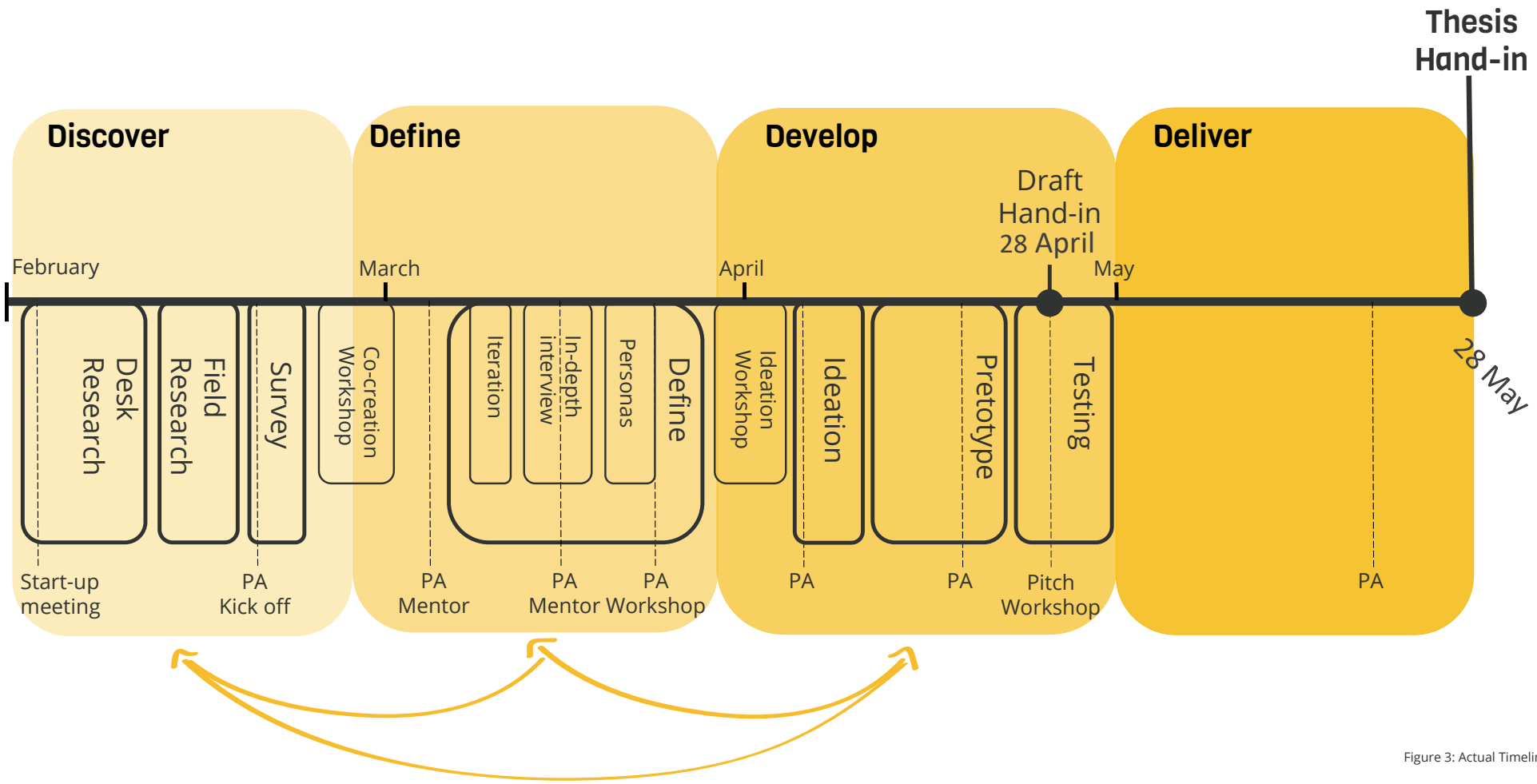


Figure 3: Actual Timeline

Literature Review

Literature Review

This section includes background information and theory around the CE and sustainability, necessary as a base for the later process of the thesis. First, an introduction into sustainability and circularity and how the two concepts are connected, is given. Their similarities and differences are outlined, and their evolving, current state, and the problem within it are discussed. Next, we will dive into circularity by looking into its development and its current most shared theories and practices. Further, an explanation and understanding of the meaning of 'narrowing', 'closing' and 'slowing' is outlined. The theory of the product-service system (PSS) is explained and a look into the classification is taken. Lastly, a possible method to tackle these problems and to generally help develop sustainable projects, design thinking, is investigated. Especially the co-design approach is explored and the benefits of involving participants - in our case the start-up owner and potential users - are discussed.

The literature research was mainly completed on the database of Google Scholar, the literature presented at the Copenhagen Business School during the exchange in the third semester as well as the literature presented throughout the Service Systems Design Master's at Aalborg University. The literature chosen in this review was based and limited in regards to the relevance for this thesis.

Introduction

There is a complexity in addressing sustainable development due to the large and interdisciplinary areas it merges with. "Sustainable Development studies is a complex and diverse field of academic research and policy analysis" (Redclift, 1984). This poses a particular problem for specialists and professionals to describe it in a simple way. Therefore, for this thesis project we would use what the Brundtland report stated:

"Humans have the ability to ensure development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

World Commission on Environment and Development-Brundtland Report (1987)

As this phrase implies, if we want to achieve sustainable development, we firstly need to be responsible and take care of the natural resources to ensure that life is not affected by modifying ecosystems resulting in damaging life on earth and put in risk the future of the next generations ('Declaration on the Responsibilities of the Present Generations towards Future Generations 12 November 1997', 2010). Most of the processes we do today within producing, farming, consuming, designing and developing technologies are not in favour of sustainability, rather the opposite (Van der Ryn & Cowan, 2007). "Business as usual is not an option for a sustainable future" (Bocken et al., 2014, p. 42), therefore, creating and adapting to more sustainable processes, methods and systems is an urgent matter.

Due to the urgency of adapting sustainable processes, the circular economy recently became an important concept to address the issues of sustainable development. But what is the circular economy exactly and how is it aligned as well as different to the concept of sustainability? The two terms are often not clearly defined and thus their meaning stays ambiguous, unorganized (Korhonen et al., 2018) and vague (Robinson, 2004). This gap is addressed by various authors and this part of the literature review has the aim to collect some of the main findings of these authors and close this gap by providing distinguishable facts around sustainability and circularity and their similarities as well as main differences. The following part investigates how sustainability and the circular economy are connected.

How are Sustainability and Circular Economy connected?

Sustainability & Circular Economy

Similarities

Investigating similarities, both concepts have the overarching aim to address environmental issues (Sauvé et al., 2016). As emphasized both by Geissdoerfer et al. (2017) and Sauvé et al. (2016), both concepts rely and are based not only on one research field but rather multi- and interdisciplinary research fields that need to be explored. Another similarity mentioned was that both concepts rely on regulations by some authorities as tools for implementation and that collaborations and the cooperation with different stakeholders are necessary when working towards sustainability and circularity (Geissdoerfer et al., 2017; Sauvé et al., 2016).

Differences

Aside from these similarities, the two concepts also carry some differences which is why they are "used in different contexts and with different purposes" (Geissdoerfer et al., 2017). It seems like the concept of sustainability is generally more open for interpretation compared to the concept of circularity. Sustainability, focuses on sustainable development and is more open-ended and with broader objectives to be applicable in many fields to reach sustainability compared to the more narrow CE (Geissdoerfer et al., 2017; Sauvé et al., 2016). This openness and flexibility of sustainability is perceived differently by the various authors. As outlined by Geissdoerfer et al. (2017), some authors consider it to be an advantage to be applicable to various contexts and fields but others see it as being too vague and thus it hinders them to use it. Compared to sustainability, the CE comes with specific tools (Sauvé et al., 2016) and thereby the authors argue that it gives a clearer direction of how to proceed and how to implement (Geissdoerfer et al., 2017).

The focus area of the two concepts is widely discussed in the literature and can be seen as another factor that differentiates. Often, the terms of sustainability and sustainable development are connected to the aim to achieve the triple bottom line - a balance between the social, economic and environmental pillars.The CE however, is mostly concerned to protect the environment while balancing it with financial development which leaves the economic but especially social pillar aside (Murray et al., 2017). Nonetheless, since the CE puts forward some circular models, some authors argue that the CE is also concerned with the economic pillar (next to the environmental pillar) which only leaves the social pillar being completely absent in the CE (Geissdoerfer et al., 2017; Sauvé et al., 2016).

As mentioned before, both concepts have the overall goal to address environmental issues. However, the scope of it is discussed a lot when applied to the linear economy and the two terms of sustainability and circularity are used to discuss the same problem. As mentioned by Sauvé et al. (2016), the sustainability approach only partially achieves to address environmental problems since when applied to the linear economy, the focus mostly lies in an 'efficiency' approach such as waste treatment with recycling. Geissdoerfer et al. (2017) discusses the same problem with the 'efficiency' approach but links it to CE (instead of sustainability). Here, they point out that this approach is very short-sighted and fast-result oriented in comparison to the long-sighted sustainability approaches. The terms stay ambiguous and are both used to explain the same problem of the efficiency approach applied to the linear economy not being the solution and being short-sighted. Murray et al. (2017) supports the thought of the sustainability approach being the one that is short sighted - at least when applied to the linear economy. They argue that the CE is taking a more holistic approach and thus not focuses on waste treatment but rather tries to rethink the system. CE is not only an approach to prevent but rather to restore and "to repair previous damage by designing better systems within the entity of the industry itself" (Murray et al., 2017, p. 373).

Critiques to the Circular Economy

The earlier outlined fact and difference to sustainability, that CE usually does not cover the social aspect, is mentioned as a main critique and limitation to CE by the majority of authors (Bakker et al., 2014; Bocken et al., 2016; EMF, 2013b; Rashid et al., 2013 as cited in Geissdoerfer et al., 2017; Murray et al., 2017; Sauvé et al., 2016). As outlined by Murray et al. (2017), the absence of the social pillar "limits its ethical dimension, and some unintended consequences" might occur. Further, mentioned by Geissdoerfer et al. (2017), leaving out the social aspect might attract "the wrong people" and not support the necessary and right transition towards a sustainable economic system.

Furthermore, Ritzén & Sandström (2017) outline different barriers when it comes to CE. One specific barrier seems to be repetitive throughout literature: The economic barrier. According to (Sauvé et al., 2016), the fact that "it is usually more expensive to manufacture a durable long lasting good than an equivalent quick and disposable version" is outlined as a barrier for companies to change from linear to circular. Ritzén & Sandström (2017) frame in total five different barriers to CE which are financial, structural, operational, attitudinal and technological. They see the financial barrier of CE that it usually does not give rapid returns and rather works long-sighted. This, and the fact that a lot of uncertainty comes with CE (also due to the lack of business cases representing revenues made with the change to the CE) makes it hard to convince business-owners to undergo this systems change (Ritzén & Sandström, 2017). "Businesses tend to hold their ground and rather continue the old way of doing things than venture into unknown futures" (Korhonen et al., 2018).

Reflection

Investigating how the concepts of CE and sustainability are connected in the perspectives of different authors helped to understand the complexity within it but also opened up for reflections and building own opinions and views on the two concepts. For this thesis, the approach that concepts of CE and sustainability have the same goal but circularity is a more tangible tool, was taken. Seeing circularity not only as a more tangible tool but also (or maybe because of that) as an approach that pushes to think a bit further might also lead to pushing the sustainability agenda more.

We agree with the authors arguing that sustainability as a concept is very open ended and can be applied in various ways which can be very beneficial but often might also end up only focusing on one part of the process only, instead of the bigger picture and the whole system. We are well aware that changing a whole linear system into a circular one is a challenge for many organizations but keeping it as open-ended as the concept of sustainability does, might not push organizations enough to do the necessary changes.

Circular Economy

"An economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes – thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations."

Kirchherr et al. (2017)

The current, traditional, and linear way of taking natural raw resources, transforming them into products and then getting disposed of them stands opposed to the circular economy. The circular economy tries to close the gap between production and post-use in order to improve environmental damage that has been done by the fast-paced linear throwaway culture. (Ellen MacArthur Foundation, 2017).

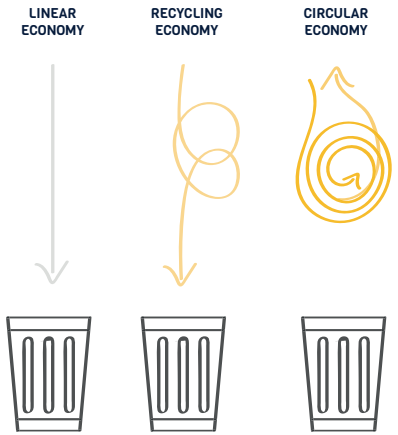


Figure 4: Linear vs Circular Economy

Brief History & the Development of the Circular Economy

There is no clear stated origin or author standing for the innovation of the CE but rather many different contributors.

Circular practices such as sharing and repairing have been around forever, mainly due to scarcity and poverty reasons (Stahel, 2020). The Industrial Revolution has changed the issue of scarcity into high economic growth through mass production - mass production of anything that "turned scarcities first into plenty, then abundance and a plethora of waste" (Stahel, 2020, p. 7).

The economic model of mass production and consequently waste, had firstly been questioned in 1970 and developed under a lot of different influencers over the years (Stahel, 2020). At that time, CE was no longer practiced out of necessity but got introduced as a "conscious choice to cope with abundance and to reduce waste" (Stahel, 2020, p. 11).

Even though CE principles developed over many years, it was only in the early twenty-first century that Braungart and McDonough gathered the knowledge of CE and introduced their 'Cradle to Cradle' trademark that should structure and identify circular processes and/or products (Stahel, 2020). Later in 2010, CE became central in Europe through the activities and the creation of the Ellen MacArthur Foundation (Stahel, 2020; Bocken et al., 2016).

The Butterfly Diagram by the Ellen MacArthur Foundation

As already mentioned, the Ellen MacArthur Foundation has played a big role in popularizing the shift towards the CE and visualized the circular principles with the 'Butterfly Diagram' illustrated on the following page.

The illustration contains two sides, the technical resources which are considered finite (yellow side, right) and the biological nutrients which are considered renewable resources (blue side, left). The vertical line in the center, visualizes the current, linear way of handling resources going from extraction to manufacturing, usage and ending in waste. (Ellen MacArthur Foundation, 2019)

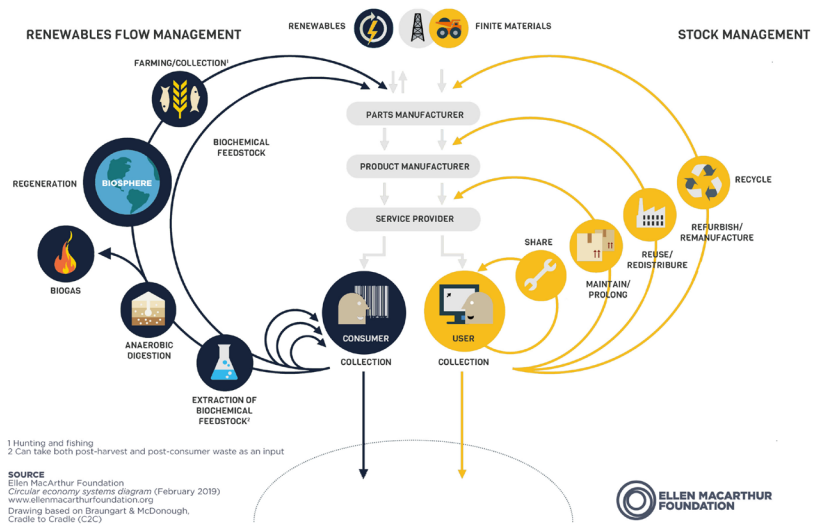


Figure 5: The Butterfly Diagram (Ellen MacArthur Foundation, 2019)

Technical Resources (yellow side)

Looking into the technical side of the diagram, there is an important concept called 'the power of the inner circle' (Fig. 6). This refers to the value of products being kept higher, the smaller the circle/the closer the circle is kept to the center. This means that maintenance is preferred over reusing/redistributing which is preferred over refurbishing/remanufacturing which again is preferred over recycling. (Ellen MacArthur Foundation, 2013, p. 8)

Additionally, there is the concept of the 'power of circling longer' (Fig. 7). This relates to the previous concept outlined and emphasizes the importance of circling as long as possible before moving to an outer circle. This way of handling products supports the idea of keeping the value as high as possible at all times. (Ellen MacArthur Foundation, 2013, p. 8)

Another aspect is 'the power of pure circles' (Fig. 8). The idea here is to rethink the way of how components come together in one product. When designing circular products, it is important to keep everything as simple as possible in order to keep components homogenic, so that they can easily be taken apart again and either reused or recycled. This homogeneity or pureness, often gets lost in current products when e.g. glueing parts together. (Ellen MacArthur Foundation, 2013, p. 8)

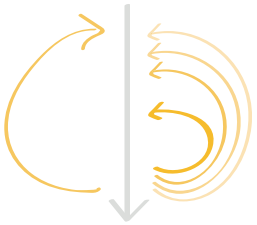


Figure 6:
The power of the inner circle

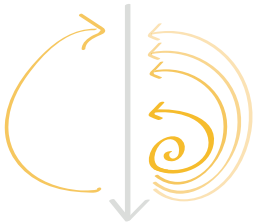


Figure 7:
The power of circling longer

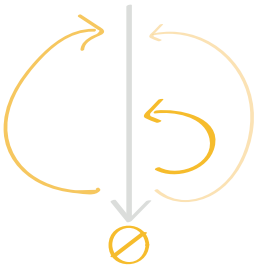


Figure 8:
The power of pure circles

(Ellen MacArthur Foundation, 2013)

Biological Resources (blue side)

Looking into the biological side of the diagram, it consists of two bigger parts: Cascading and the anaerobic digestion.

One of the main concepts here is regarding 'the power of cascaded use' (Fig. 9). Cascading could be seen as the biological term of circling longer, and even though that through every cascade value is lost in the product, it is still better than taking virgin raw materials for making new products. An example of cascading could be a pure, 100% cotton t-shirt (without dye) that is cascaded and the fibres used to make some insulation. Within cascading, the importance of the pureness of the products needs to be pointed out since the concept can only be

applied to pure, non-toxicated products. (Ellen MacArthur Foundation, 2013, p. 8)

The other concept in the biological side is the anaerobic digestion that is, simply put, a composting technology. It is a process that turns biological waste into nutrients again so it can be returned to the soil and thus supports future food production (the by-product of this process is biogas that can be used to substitute other gas). (Ellen MacArthur Foundation, 2013, p. 8)

Figure 9: The power of cascaded use
(Ellen MacArthur Foundation, 2013)

7 Schools of Thought

The concept of CE is rather broad and carries various ideas from different authors. The concept combines different schools of thoughts that are based on the following circular principles outlined in the lecture by Sönnichsen (2020a). They all follow the general aim to systematically design out waste.

1. Regenerative and Restorative by Design
2. Minimizes leakage to landfill and incineration (energy recovery)
3. Keeps resource at highest possible value at all times
4. Powered by Renewable Energies
5. Cross-sectoral collaboration is essential (internal & external)
6. Higher complexity than linear value chains
7. Holds the potential to decouple monetary growth from growth in virgin resource extraction

Based on these principles, the 7 Schools of Thought within CE are the following:

- Cradle to Cradle by Michael Braungart and Bill McDonough
- Performance Economy by Walter Stahel
- Biomimicry by Janine Benyus
- Industrial Ecology by Ernest Lowe & Lawrence Evans
- Natural Capitalism by Paul Hawken, Amory Lovins & L. Hunter Lovins
- Blue Economy by Gunter Pauli
- Regenerative Design by John T. Lyle

The scope of the start-up is focusing on the servitization of products and therefore, we mainly took the perspective of the performance economy into consideration in this thesis. However, also Cradle to Cradle and the Industrial Ecology School of Thought and their perspectives helped us throughout the process. Thus, these are the ones elaborated further below:

Cradle to Cradle: Eco-effectiveness vs. Eco-efficiency
by Michael Braungart & Bill McDonough

The Cradle to Cradle concept outlined by Michael Braungart and Bill McDonough is tightly connected with the 'Butterfly Diagram' of the Ellen MacArthur Foundation where resources are grouped into biological and technical nutrients. Braungart and McDonough distinguish between 'eco-efficiency' and 'eco-effectiveness' where they see the first one as good but not good enough, and the latter as the aim to achieve (Sönnichsen, 2020b).

The focus in eco-efficiency is mostly on reducing the negative impact of the product itself which means increasing recyclability (which usually means downcycling), extending the product lifespan, reducing toxicity, and dematerialization. This results often in applying the concept to current, linear processes in order to improve parts instead of the whole system.

According to Braungart and McDonough, eco-efficiency equals zero

waste which focuses on reducing negative impacts, which is not enough and they suggest to strive for eco-effectiveness that aims at a net positive impact. Their idea of "less bad is no good" is pushing for eco-effectiveness with a fundamental systemic redesign of products and their production processes. (Sönnichsen, 2020b)

In this regard, they suggest that we rethink and eliminate the current concept of waste. For them, "waste = food" which means that someone's waste can and should be used as a valuable input for another process. Further, they support the use of renewable energy sources and at the same time design new systems that neither harm the environment nor humans and that can be reused perpetually. (Sönnichsen, 2020b)

Industrial Ecology

by Ernest Lowe & Lawrence Evans

The concept of the Industrial Ecology proposes closed loop processes where waste is input for another process. It is mainly concerned with the management of material and energy flows through the industrial ecosystems and emphasizes on the natural capital restoration and social well-being in the local area. (Ellen MacArthur Foundation, 2017a)

'Kalundborg Symbiosis' is a very well-known, danish industrial park where the concept is being put into practice (Sönnichsen, 2020a).

Performance Economy

by Walter Stahel

The performance economy by Walter Stahel proposes servitization as a strategy to overcome the problems created in the linear industrial economy (Stahel, 2010). The performance economy school of thought focuses on product-life extension, long-life goods, waste-prevention and a closed loop approach to production processes (Ellen MacArthur Foundation, 2017a).

Instead of selling products, the performance economy offers access to products or a performance which means that "its customers are users" (Stahel, 2020, p. 8). Therefore, the ownership of the product stays within the company and thus also all costs, risks as well as waste needs to be handled and taken care of by the company (Stahel, 2020). Due to companies keeping the ownership, advantages for both the company and the environment are created. Companies build better, long-lasting products in order for them to minimize e.g. repairing costs which again minimizes fast-paced production of less good products and thus also minimizes waste.

Reflection

As mentioned earlier, the above outlined schools of thought were seen most fit to be investigated due to the scope of the thesis.

Cradle to Cradle, with its quite rigid and strict theory, gave quite a good understanding of the circular concept and discussed the butterfly diagram, outlined by the Ellen MacArthur Foundation, even further. Additionally, this school of thought, and their authors, present very clear boundaries of what they define as circular and what not.

Choosing to investigate the Industrial Ecology school of thought helped to expand our system's perspective and investigate how stakeholders can be combined in order to support each other in regards to sustainability. This school of thought helped us to not only consider important stakeholders but also made us reflect on waste outputs and how they can be rethought to become inputs for another stakeholder again.

Lastly, the Performance Economy school of thought was investigated as an obvious choice due to the nature of the thesis project. Understanding this school of thought and the change of ownership and the benefits that come with that were vital for this thesis project and supported the practical process with the case study.

Product Design and Business Model Strategies for a Circular Economy

Different design strategies can be applied to support a company's path towards circularity. The concept of CE could be explained as a loop system and in order to distinguish the linear economy with the circular economy, the design and business model strategies are categorized "according to the mechanisms by which resources flow through a system" (Bocken et al., 2016, p. 309).

Accordingly, Bocken et al. (2016) outlines three circular approaches when designing; two which target resource cycling and one which focuses on the reduction of resources. The two resource cycling approaches are based on Stahel's 'Performance Economy' and McDonough and Braungart's 'Cradle to Cradle' and are concerned with the cycling of resources by either slowing or closing the loop. For this thesis, these concepts will be used to design the PSS.

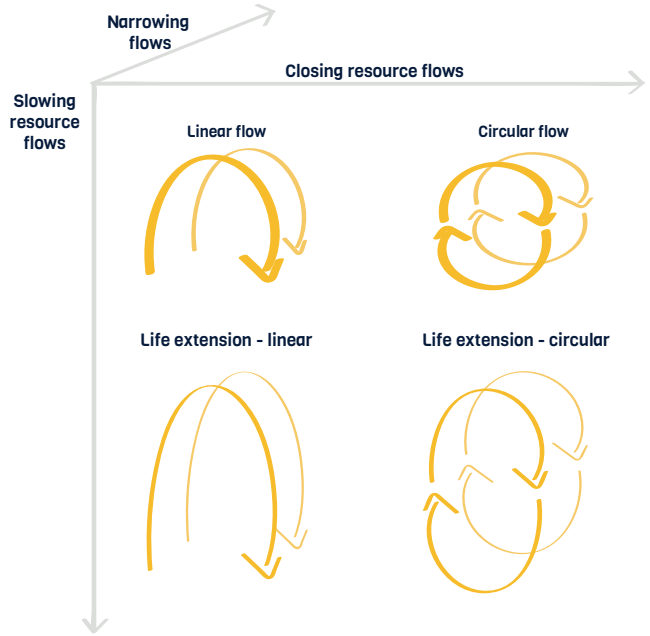


Figure 10: Resource flows (Bocken et al., 2016)

Slowing

By slowing the resource loop, the product's life gets extended through for example repairing and remanufacturing. Thereby, the need for new, virgin raw materials is not necessary and the usage of the already used resources life gets prolonged and thus the usage period slowed down (Bocken et al., 2016). This concept aims towards long-life products and product-life extension and, as mentioned earlier, is very much connected to Walter Stahel and the concept of the Performance Economy.

Design strategies to slow loops

Designing for long-life product

- Design for attachment and trust
- Design for reliability and durability

Design for product-life extension

- Design for ease of maintenance and repair
- Design for upgradability and adaptability
- Design for standardization and compatibility
- Design for dis- and reassembly

Figure 11: Design strategies to slow loops (Bocken et al., 2016)

Closing

By closing the resource loop, the end-of-life of a product and the part of reusing resources through recycling is centered in order to create and close "the loop between post-use and production" (Bocken et al., 2016, p. 309). This strategy aims towards a closed loop system and is very much leaning on the concept of Cradle to Cradle by Braungart and McDonough.

Design strategies to close loops

- Design for a technological cycle
- Design for a biological cycle
- Design for dis- and reassembly

Note: Design for dis- and reassembly fit both strategies for closing and slowing loops

Figure 12: Design strategies to close loops (Bocken et al., 2016)

Additionally, there is a third strategy mentioned by Bocken et al. (2016), the strategy of 'narrowing'. The strategy of narrowing simply means to use less resources per product. Thus, this concept does not focus on the cycling of products but on reducing the resource input in the product as well as production processes (Bocken et al., 2016). Compared to the previous outlined strategies, the strategy of narrowing is not necessarily addressing the time aspect and further does not incorporate loops and therefore might be applied to a fast paced, linear way of working. Therefore, this strategy has to be handled with care, since a looping of resources, which is the aim in the circular economy, is not assured by simply narrowing resources. Consequently, this strategy is not taken too much into consideration throughout the thesis.

Based on the above outlined circular product strategies, the different circular BM can be derived (Fig. 13).

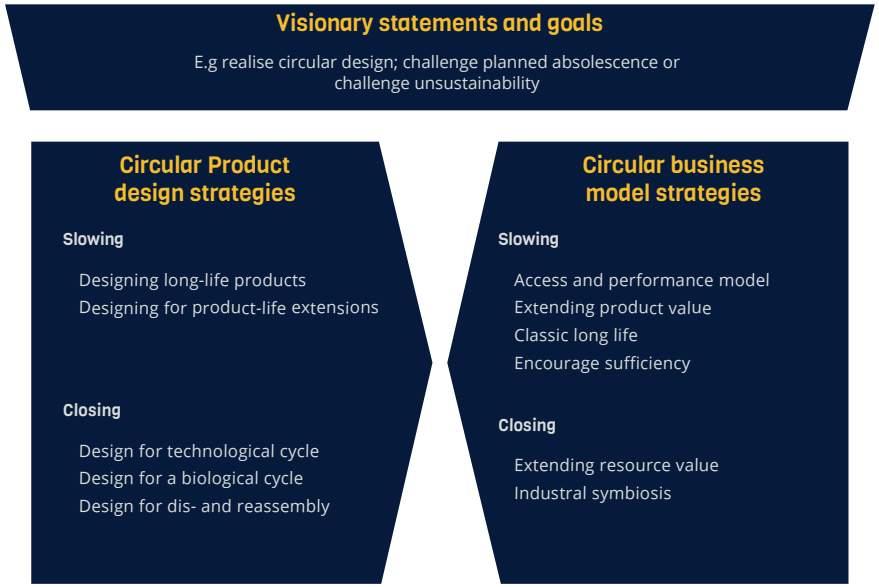


Figure 13: Overview circular Product Design & Business Model Strategies (Bocken et al., 2016)

Tukker's 8 Product-Service Systems Categories

Based on the focus and aim of this thesis to create a circular Product-Service-System (PSS), Tukker's 8 PSS classifications are briefly outlined. PSSs are part of the performance economy school of thought by Walter Stahel, focusing on the servitization and a service-oriented value proposition. The value proposition shifts orientation from delivering products to deliver functions. According to Tukker (2004), depending on the increased weight on the service aspect, eight different PSS can be distinguished that are clustered into the three groups: product-oriented, use-oriented, and result-oriented (Fig. 14).

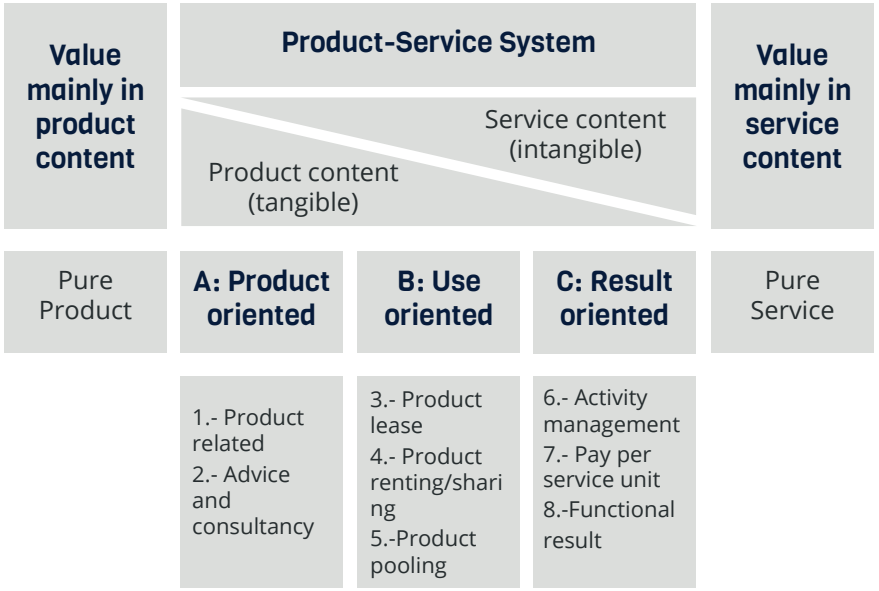


Figure 14: Product-Service Systems Categories (Tukker, 2004)

Reflection

Since this thesis project is about designing a PSS and thereby helping a start-up to establish and create a new business, we found it relevant to look into different product design and BM strategies even though this area is not completely within our scope. Building up basic knowledge within this and especially when connected to circularity, opened our approach, showcased possibilities and thus helped to make some choices along the process more consciously.

After investigating the CE with its theories relevant for this thesis, a look into the co-design approach was taken and how design thinking can support developing sustainable projects. Especially the co-design approach was explored and how involving participants can be of benefit.

How can Co-Design support Sustainability & Circularity?

Co-Design

And Co-Creation

Since co-creation is a broad term, we would like to use the definition created by Sanders & Stappers (2008) and define it as a collaborative development to create a "something"; The "something" can range from physical to metaphysical things and includes the creation of concepts, solutions, products and services. The collaborators as well can range from different stakeholders; experts, suppliers, consumers etc. When talking about co-design, we refer to the same collaborative development but specifically during the whole design phase (Sanders & Stappers, 2008).

One can see co-design as a more specific way of co-creation, a subgroup sort to say. Co-design frequently refers to the collaboration between the designers with the use of their different skills such as creativity, and people outside of the design realm working together throughout the design process (Sanders & Stappers, 2008).

The benefit of using co-design is that the roles can be mixed, non-designer can be given the position of an expert, and therefore participants have an important role in generating new ideas and concepts. Contrary, the designer supports and guides this process by providing tools and dynamics to enhance the creativity development. (Sanders & Stappers, 2008)

Service Design and Co-Design for Sustainability

In the last few decades, the issues of sustainability have moved from strictly environmental issues to a complex intertwined blend of socio-ethical, environmental, political and economic issues (Ceschin & Gaziulusoy, 2016; Vezzoli et al., 2017). This means that in order to achieve sustainability, a multi-scale process is required, based on interdisciplinary and system approaches guided by a vision rather than an optimisation approach (Ceschin & Gaziulusoy, 2016).

At the same time service designers can become effective agents for sustainability because it is the social actor above the others that has to deal with the everyday relationship between the humans and the products and services that they interact with (Vezzoli et al., 2017). The designer can deal with one of the core problems of sustainability that is "the change towards sustainable ways of being" (Vezzoli et al., 2017). It is worth mentioning, that sustainability is not just about how we design products and services but also how these products are used by the different users, since as previously mentioned to achieve sustainable development it relies a lot in the way people interact with the offered product/service (Chick & Micklethwaite, 2011).

In a similar way to the multidisciplinary complexity when addressing sustainability, "Product-Service Systems focus on the integration of different products and services rather than just individual products allowing the opportunity of new business models" (Chick & Micklethwaite, 2011). PSSs can be defined as "a mix of tangible products and intangible services designed and combined so that they are jointly capable of fulfilling final customer needs" (Tukker & Tischner, 2017).

In the design field, in order to successfully develop this type of project, it is common to use co-designing, participatory design, etc. These methodologies share the emphasis of involving the user and other stakeholders into the design process so that they are also in charge of ideating the solution. As previously mentioned, co-designing shifts the role of the designer to the one of a facilitator, and as a facilitator he uses different tools and set of skills to guide non-designers to create. (Sanders & Stappers, 2008)

Reflection

Co-designing is a big part of service design and therefore we found it relevant to look into literature discussing the benefits of doing so - especially when it comes to sustainability projects.

Co-design enables opportunities to collaborate with various stakeholders and people with different expertise. If used well, it can contribute in effective ways to problems that require systemic approaches that consider many different elements simultaneously, just as PSS and environmental development concepts. Therefore, co-design was one of the selected approaches for this thesis.

Having workshops and ideation sessions with the start-up, helped to successfully bring together the elements of the CE and the ideas of the start-up with a user-friendly experience. The first part of the chosen theory introduced co-design in a simple and clear way including the benefits and characteristics of it. After, the chosen theory explores the importance, benefits and capabilities of designers when involved in sustainable projects. Lastly, the literature chosen, outlined and explained PSS, and how it can be used as a link to sustainability and co-creation

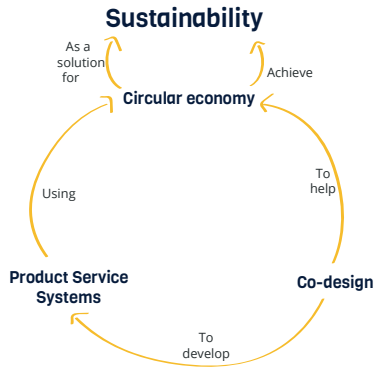


Figure 15: Relation between Circular Economy, Product-Service Systems and Co-Design

Conclusion

The purpose of this literature review was firstly to provide an overview and build up a base around CE and sustainability and secondly, investigate how service systems design can support sustainable and circular projects.

The literature included in this review started by discussing the connection between sustainability and circularity. Both concepts have the overall goal of addressing environmental issues but their approach differs in some cases. One of the main differences outlined, was the fact that the CE requires a complete systems shift from the traditional, linear economy. Sustainability on the contrary, by being open-ended, can be applied to the already existing, linear businesses by e.g. improving parts of a process. This might also lead to their difference in scope. Sustainability, often being applied to improve already existing parts and processes of companies, focuses on achieving the triple bottom line.

Economic sustainability is necessary in order to run a company and thus, the focus in these sustainable operations is usually put on the social and/or environmental pillar, while keeping the financial aspect in balance when doing so. In contrast, the CE and the required systems shift, mainly concentrating on the environmental pillar, leaving specifically the social aspect out. Therefore, investigating if and how service systems design with its holistic and user-centered approach can support the systems shift into circular projects and at the same time ensure user convenience was crucial for us. Especially, the importance and benefits of co-designing and involving participants in circular and sustainable projects were investigated and supported and motivated our further process in the thesis.

The knowledge acquired through this literature review helped us to not only build a base knowledge around the broader topic of sustainability and circularity in connection to co-design but also helped us to widen our perspective and thus open up our approach to the thesis project. Through the case study and the collaboration with the start-up, the theoretical topics and theories could be explored and tested.

Discover

Discover Phase

Introduction

As previously mentioned, our main tasks in this thesis project revolved around the logistics of the service, providing an efficient, and user-friendly service; Solving the delivery, researching possible selling channels, creating the value propositions and generally mapping the system. Nonetheless, since the start-up was in the early stage when starting the thesis, before looking into the aspects of the logistics, we had to do research about the products, packaging, and user attitudes towards cleaning products as well as to define how many and which products the start-up should launch with.

The different variables of the type of packaging and the diversity of products have a great impact on the system of the logistics. For example, it is not the same offering tabs that dissolve in water compared to offering already pre-made liquid soap. The choice of the "texture" of the cleaning product, e.g. tabs, fluid soap, or bars, influences the packaging e.g. disposable card boxes, glass bottles, and thus the transportation method and its environmental impact.

In order to find out what was the best solution according to the goals and vision of the start-up, research was conducted regarding the different possible materials for the packaging, how the recycling system in Denmark works, different trends regarding cleaning products, and which products were the most suitable to sell for the launch of the start-up.

Generally, secondary research was conducted, however also primary research and own data was collected by doing an online survey, in-depth interviews and field research. The collected data was visualized and later shared with our start-up partner.

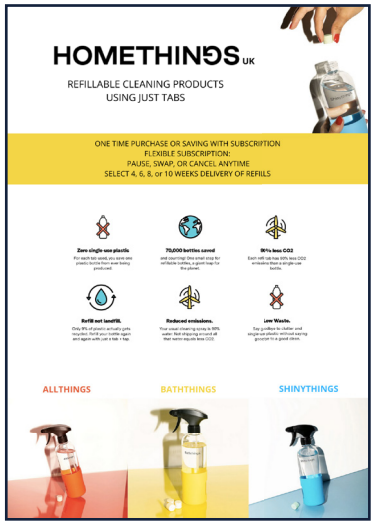
Desk Research

Competitors / Similar Services

The desk research started by looking into similar projects in other countries in order to gather useful insights and see different ways of providing the service concept.

We gathered information, compared and discussed their value propositions, and their positive aspects as well as possible improvements. We researched a total of five projects similar to the idea of the start-up, two from the UK (Homethings, Splosh), one from Denmark (Nuuii), one from Mexico (Desplastificate), and one operating in the US and South America (Cleancult).

One-pagers of the different companies illustrating and describing their value propositions and BMs were created in order to give an overview of their differences as well as giving ideas for different possibilities for the start-up. (Appendix 1)



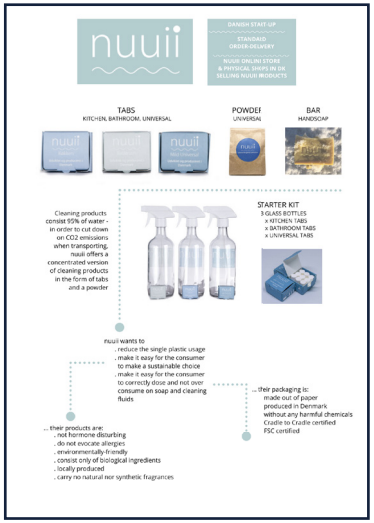


Figure 16: Competitors / Similar Services

Analysis Competitors / Similar Services

All five companies offer their service on a subscription basis as well as the possibility of single purchase. The subscription option usually offers some financial savings for the customers. Four out of the five companies offer kits for the consumers and correspondingly refills. The refills vary in their texture (tabs, liquids, powder) and thus also in their packaging. Only one company - Desplastificate - offers the service of delivering full bottles that are then picked up again. Thereby, Desplastificate is keeping full ownership of the bottles and thus coming the closest to zero waste from a circular perspective.

Homethings and Nuuii are quite similar, both offering kits and tabs, producing and delivering locally, and both are very transparent when it comes to ingredients and their way of working. They offer three main cleaning products and the belonging bottles to them (as a kit). A main difference between the two services is that Homethings does not only sell cleaning products, but gives their customers the option to become a part of a community. They not only offer a spotify playlist for cleaning but also a blog where users can engage with the Homethings community as well as inform themselves within topics such as plastic and waste, cleaning in general, and the climate crisis, to mention a few.

Looking at Cleancult and Splosh, they share the similarity of offering a lot of different products with a lot of different scent options. Cleancult delivers their refills in tetra pak's and informs their customers thoroughly about the recycling options of tetra pak. Splosh delivers in refill pouches that are packed in cardboard. Splosh's advantage from a user experience's point of view is that the pouches are packed quite narrow which allows the refills to be put into mailboxes which means that the customers do not have to be home to receive the refills. Moreover, Splosh offers the option of returning the empty pouches for them to either reuse or recycle.

To summarize, all of the companies have their advantages and disadvantages, depending on the perspective taken. Investigating and mapping out the different companies, their value proposition and BM helped us to open up for different concepts and gain inspiration.

Materials

After analysing similar projects we discovered that selecting the correct packaging is a key factor that influences the logistics aspect greatly as well as the system of the service.

The start-up we collaborated with, wanted to be as sustainable as possible, using circular economy streams and be as close to a zero waste company as possible. Thus, choosing sustainable and natural packaging might seem to be the logical consequence when creating this company. However, when researching this option of natural packaging (packages that are made from organic materials like corn, avocado seeds etc), it quickly became clear that the technology is still in progress and most of the solutions have not matured yet. Therefore, we purposefully decided to not take these options into consideration.

With the mindset of being sustainable, using circularity and zero waste as a goal, it is really important to choose the best packaging for the products. It is important to know the characteristics of the different materials as well as their environmental impact. One has to take into consideration how easy a certain material can be reused or recycled. Below we provide a comparison between common packaging materials such as plastic, glass, cardboard and tetra pak.

When selecting a material for the packaging of the products, one needs to be aware that there is not a white or black answer in regards to sustainability; There is no packaging that is 100% sustainable (Ourgoodbrands, n.d.). That is why, when choosing a package, many different factors need to be considered that affect the environment in diverse ways and according to the specific context.

In order to evaluate the different materials in relation with environmental impact, a "sustainability check" can be done (Gleick & Cooley, 2009; Kellogg, 2019; Murphy, 2020; Ourgoodbrands, n.d.).

In the sustainability check, different factors are considered that include the raw material used, weight, transportation footprint, manufacturing costs, reusability/recyclability rate and the end of life disposal.

We used these factors and grouped them into three steps:

Production: Material used, manufacturing costs (emissions and energy for its production)

Transportation: Weight, transportation footprint

End of life: Recyclability rate, reusability, end of life disposal

In the next pages, we firstly describe some characteristics of the different materials (glass, plastic, cardboard, and tetra pak), followed by a comparison graph and lastly, a general conclusion on the most suitable packaging for the start-up is provided.

Glass

Production

Glass is made from natural resources like sand, limestone and recycled glass. The downside of glass is the scarcity of these virgin resources (Kellogg, 2019). Furthermore, the mining of limestone destroys the natural environment and thereby kills animals (Murphy, 2020). Additionally, the raw material for glass needs to be transported to a batch house where it is then melted down in temperatures as high as 1500 Celsius. It only then proceeds to the finishing process before having the final end product (Kellogg, 2019).

Transportation

For glass as packaging, the transportation part is its big downside. This is mainly due to glass being heavier than plastic or cardboard, which means that more energy is needed in order to transport. Additionally, since glass is fragile, extra packaging for protection is needed in most cases which results in more waste (Murphy, 2020). The big advantage of glass is that it is nontoxic for humans.

End of life

Glass can be 100% and endlessly recycled without losing its quality. By recycling glass, instead of producing new glass, energy can be saved since the temperature of the melting point does not have to be that high (Ourgoodbrands, n.d.). Nevertheless, and as mentioned previously, glass is quite heavy which means that a lot of energy is used when transporting the empty glass bottles for recycling. As a general rule of thumb and as explicitly outlined by the CE, reusing is always better than recycling, and that obviously also applies to glass. In Denmark, sorted glass is either reused or melted into new glass (Københavns Kommune, n.d.).

Thomas Fischer, head of circular economics at the German environmental nonprofit Deutsche Umwelthilfe (DUH) says: “Glass bottles can be refilled up to 50 times, plastic bottles between 20 and 25 times.” (Osterath, 2018). Glass takes about 1 million years to decompose.

Plastic

Production

Plastic is made from oil and natural gas. The oil and natural gas are extracted from deep down in the earth which destroys not only the environment but also endangers our health (Murphy, 2020). This extraction as well as the generating and release of carbon dioxide are the downsides of plastics. There are seven major plastics, all with different characteristics and properties. Furthermore, the fact that in many cases it is cheaper to create new plastic products than recycle them, is seen as an important factor to consider when it comes to choosing materials (Kellogg, 2019).

Transportation

Plastic is lighter than glass and therefore it has a low transportation footprint, especially in short distances (Murphy, 2020). Nonetheless, this lightness also enables plastic being used for long distance shipping which in some cases can result in higher environmental costs and harms through the transportation than the actual creation and production of plastic. A huge advantage of plastic is that it can be packed really tight together and that it does not break easily.

End of life
Plastic only has up to 30% of a recyclability rate, not to mention that many soft plastics cannot be recycled at all (Ourgoodbrands, n.d.). Furthermore, plastic is always downcycled into a lesser quality item, meaning that it cannot carry the same value more than once.
Therefore, plastic often pollutes the planet after its disposal and takes up to 500 years before decomposing, meanwhile releasing toxic chemicals (Gleick & Cooley, 2009). In Denmark, sorted plastic is reused for new products (Københavns Kommune, n.d.).

Cardboard (boxes for tabs or powder)

Production
Cardboard is made from paper, which means that it is 100% biodegradable if it is not inked (Ourgoodbrands, n.d.). With a proper forest management, there can be a continued supply for paper as well as other purposes. It is a renewable material and generally the production of paper and thus cardboard has not a major footprint when making it. However, if the resources come from illegal deforestation, it has a negative impact on the environment. Here, certifications such as for example the FSC (Forest Stewardship Council - www.fsc.org) can give guiding to make social - and environmental-friendly decisions.

Transportation
Cardboard is pretty light - especially compared to the other materials. Nevertheless, it is not resistant to water by itself and therefore needs to be handled with care or would require a layer of plastic or another packaging which would result in more materials used.

End of life
Cardboard usually has around 1-2 months of a landfill lifespan. Cardboard is biodegradable as well as it can be recycled between 5-7 times (Ourgoodbrands, n.d.). Nevertheless, most cardboard packages are intended for one time use only. In Denmark, clean cardboard is recycled into new products (Københavns Kommune, n.d.).

Tetra Pak

Production
Tetra pak's aseptic packaging which is used for liquids, is mainly made out of 75% paperboard, 20% plastic and 5% aluminium (X, 2020). These different materials are layered and fused together which means that the material is not pure anymore. Additionally, there is often ink used for the labelling on the packaging and even though there are alternatives such as using soy based ink, the usual ink used is petroleum based. However, the carbon footprint of manufacturing tetra pak is still considerably lower than glass and plastic.

Transportation
As plastic, tetra pak as packaging is light and since it usually has the boxy characteristics it can be packed tightly and does not require a lot of protection when shipping.

End of life
Most tetra pak packages are meant for one time use only. Theoretically, tetra pak is 100% recyclable, however not every recycling company can recycle it since it requires a complex process due to the many layers of different materials it is made of. Furthermore, when producing new tetra pak, there is always the need of using virgin wood fibres. For tetra pak to be successfully recycled it relies a lot in the country the product is sold and how developed their recycling system is. Therefore, around 60-70% of tetra pak packaging is not recycled at the moment and ends as waste (X, 2020). In Denmark, tetra pak is not part of the sorting system and therefore it ends in the general waste which is getting incinerated to produce electricity and heat (Københavns Kommune, n.d.).

Overview of the positive and negative aspects of the different materials, mostly related to the environmental impact they have:

	GLASS	PLASTIC	CARDBOARD	TETRA PACK TYPE
POSITIVE	It's 100% recyclable, endlessly Can be reused Made of natural materials, not toxic	Lightweight Long shelf life Cheap to make if high volume	Lightweight Cardboard landfill life span is 1-2 months 100% recyclable and biodegradable	Lightweight Can be recycled Semi-biodegradable
NEGATIVE	Heavy and fragile material. Extra materials and energy when transportation Takes 1,000,000 years to decompose Extraction of raw material affects rivers and beaches	Plastic containers take +450 years to decomposed Huge carbon footprint in manufacturing Recycled plastic is more expensive than creating new Use of non-renewable resources	Not waterproof Short long shelf life Inks usually petroleum based Meant for one time use	Complex process for recycling Low percentage of recycling packages Not built for long term use Always requires virgin material

Figure 17: Overview of the materials

Reflection on Materials

As mentioned above, there is no clear answer on which the best packaging material is. It depends greatly on the context and the service as a whole and therefore various factors need to be taken into consideration and need to be weighed up against each other.

The part of recycling is one of these factors and concurrently, has a lot of room for improvement that needs to be investigated. Even though a lot of packaging material can theoretically be recycled, only a minority of it actually ends up being processed and recycled due to its complexity (Kellogg, 2019; Murphy, 2020; Ourgoodbrands, n.d.).

Differently, it is also important to emphasize and to remember that "in any case, reusing is always better from an energy and climate protection perspective" (Osterath, 2018). This means, reusing should, if possible, always be preferred over recycling as also illustrated by the Ellen MacArthur Foundation in the 'Butterfly Diagram'.

Consequently, recycling systems need to be improved but in the long-term, new systems and ways of handling materials need to be innovated and implemented (Kellogg, 2019; Murphy, 2020; Ourgoodbrands, n.d.).

Especially when it comes to plastic, new solutions need to be found. Plastic is still one of the biggest pollutants created by humans and it is a major cause when talking about environmentally sustainable development. Most plastic is produced for single use only which does not align with the aim of long-life products within the CE nor sustainability generally (Murphy, 2020; Ourgoodbrands, n.d.; X, 2020).

Since awareness grows and thus the motivation to change current, harming processes rises, the use of single-use plastic probably decreases in the near future. Therefore, next to focusing on the popular transitional "Rs" of Reduce, Reuse and Recycle, a new and equally important "R" should be considered: Replacing - Replacing and substituting current fossil-based energies with renewable resources as well as replacing current single use plastic with long-term solutions and system changes.

After the table comparing the materials we decided to discard plastic since it clearly showed it has a high impact in the environment. We inclined ourselves to use glass or cardboard (if the soap was in tabs consistency). Later, "scenario maps" were created in which the selection of a certain material as packaging and its impact were clearly illustrated and thus could be used to play around in order to create different scenarios with different impacts (environmental, costs, user experience).

Trends

Doing trend research can be beneficial in order to make correct decisions along the process. As seen in the second semester course "Technological and Organizational Trends", looking into current as well possible future trends can be very valuable when designing.

By exploring new forms of collaborations and examining different stakeholders to be sustainable change agents, one might come up with

better solutions and foresee possible future scenarios that influence and guide the design process.

Therefore, we found it relevant to look into trends and possible future scenarios related to cleaning products as well as sustainability and in particular CE. CE is one of the main pillars of this thesis, since the goal is to design a circular service.

The outlined trends were mainly found by doing desk research and only the ones perceived as important and of relevance will be briefly outlined to give an impression.

Trends Sustainability & Circular Economy

Firstly, there is a strong transition from single-use to reusable packaging (3 Circular Economy Trends That Defined 2020 | Greenbiz, n.d.). There is an increased number of policies and laws like the "Circular Economy Action Plan" - a plan from the EU - with the intention to move towards a regenerative growth model. (New Circular Economy Action Plan, n.d.)

At the same time there is an increase in tools to calculate and track circularity. Examples are the release of the Circular Transition Indicator by the World Business Council for Sustainable Development or the establishment of a new standard of waste by the Global Reporting Initiative (GRI) (3 Circular Economy Trends That Defined 2020 | Greenbiz, n.d.). Furthermore, tools such as the Life-Cycle Assessment (LCA), Product Environmental Footprint (PEF), and the Environmental Product Declaration (EPD) help to evaluate businesses on a system-, product- or even component level (Sönnichsen, 2020b). These tools are quite important and meaningful since they provide evidence backed in data which can be used to measure the impact and illustrate the benefits of circular businesses (Sönnichsen, 2020b). Furthermore, they enable circular businesses, systems and products to be comparable with each other, something that was until now only possible in the linear economy (Sönnichsen, 2020b).

The United Nations' Sustainable Development Goals (SDGs) created a framework for a global strategy towards "achieving economic growth that is consistent with the planet's carrying capacity, society's basic needs and priorities, and the capabilities and stability of the economy" (CISL, 2017, p. 1). The 17 goals outlined are rather broad in order to be applicable to any company and to any extent. The SDGs present goals to achieve by 2030 and companies can use them as a tool to identify opportunities and create a roadmap towards them. Moreover, they can be used as a communication tool and to align expectations and knowledge internally as well as externally. Due to their adaptability, both in regards to how and to what extent they are applied, the SDGs are a common and widespread tool used by many companies. Several goals, but especially their underlying targets and indicators point towards the CE. 'Life Below Water' (#14), and 'Life on Land' (#15) are more indirectly connected, whereas 'Affordable and Clean Energy' (#7), and 'Climate Action' (#13) focus on the environmental aspect and its technology within the CE. The goal #12 is probably mostly pushing the CE, since without the CE, responsible consumption and production is not possible. (THE 17 GOALS | Sustainable Development, n.d.)

Decent Work and Economic Growth (#8), Industry, Innovation and Infrastructure (#9), Sustainable Cities and Communities (#11), Responsible Consumption and Production (#12) and last Partnership for the Goals (#17) are directly targeting and working towards CE.

Generally when doing research, an emerging trend, moving away from the linear economy, could be noticed; Shifting towards the sharing economy and giving up ownership already started around 20 years ago in industrialised countries (Stahel, 2020). Today, the emergency of fighting resource scarcity and environmental depletion pushes the trend further and faster than before. This can be seen in various PSS BM arising, finding holistic systems solutions such as offering access to performances and incorporating take-back systems instead of selling pure ownership of products (Stahel, 2020). Nevertheless, we personally believe and therefore find it important to mention that even if there arise more options that counter the linear economy, it also needs to be kept in mind that at the same time, consumerism is at its high and people have ownership of many more products than ever before.

Trends Cleaning Products

For cleaning products, it was important to investigate the user habits and preferences. This investigation could be clustered for specific types of products e.g. a certain trend for buying more powder based products instead of liquid ones. However it was also important for this thesis to understand if there were certain trends that favour ecological and more sustainable cleaning products.

Consumer habits are always changing, but there is growth in online purchases in almost all sectors. A healthy lifestyle is becoming a more feasible choice rather than a luxury in Denmark, and at same time consumers consider a clean home and clean clothes to be equally important to good health (Prophecy Market, 2020). According to Euromonitor International, Laundry Care has the most retail value followed by dishwashing products and surface care (this study does not include personal hygiene products) (Algo Chemicals, n.d.).

Concentrated products become more popular which also impacts the packaging it comes in. This trend is mainly being led due to the increased environmental awareness (Algo Chemicals, n.d.). Furthermore, consumers are also looking for comfort, which results in a growth of “easy-to-use” products (Prophecy Market, 2020). Moreover, there is a growing demand for eco-friendly products (Prophecy Market, 2020). This awareness has also increased the use of cold washing.

The consumer’s awareness of eco-friendly packaging and products mainly refers to recycled and recyclable materials, as well as products that do not harm the environment. According to Algo chemicals (n.d.) “Fresh scents have overtaken whiteness, and concentrates are gradually overtaking powders in terms of both laundry and dishwashing detergents”.

Field Research

Introduction

After doing desk research and alongside a survey, we decided to add another research aspect in order to gain more input around the most common cleaning products. Supermarkets like Netto and Føtex, and online grocery shops like Nemlig and CoopMad offer a variety of many different households as well as personal hygiene cleaning products ranging from shampoos to chlorine. Therefore, as part of our research, we counted, categorized and arranged the different products of six stores. The data that we collected worked as an add-on to the answer of the surveys.

The graph in the following page (Fig. 18) is a data visualization showing the average number of products offered by the six different stores*. They are divided into the three broad groups, also used in the survey: Personal Hygiene, Household and Textiles (products for cleaning textiles). Some of the groups then are subdivided into smaller groups e.g. the household group is divided into: Dishwashing, floor cleaning, toilet cleaning, etc.The chart is divided by hierarchy into blocks, meaning the bigger the square, the more number of products the stores offer.

Reflection on the Field Research

By looking at the graphs we could observe that the most variety of products correspond to the group of personal hygiene. The most common product offered (in all of the six supermarkets) within the cluster of personal hygiene are shampoos.

Looking closer into this specific product group, it could be observed that they come in a variety of different sized packaging, with different smells, for different hair types and different hair colours which explains the high quantity of shampoos offered. The assortment of shampoos had an endless variety which made us reconsider the value of quantity of a specific product availability in the store. Even though there might be a big demand, which is supported by the amount of products offered, the variety of one certain product might also be indicating that consumers are very picky with that specific product. Consequently, first conclusions could be drawn and products could be eliminated. In our case, offering a shampoo might not be a product that can target a wide group of people and thus might not be the product the start-up should launch with, at least not in the beginning.

Regarding household cleaning products, we could see that spray products are the ones with more variety since they have a huge range of different applications from glass cleaner, toilet, limescale and universal. We could observe how in dishwashing soap, the liquid products have more variety than tabs.

In textile cleaning products, the laundry detergent is the most common product offered, more specifically, the color laundry detergent.

* To see each individual graph please go to the Appendix 2

Overall Products

Average Number of Products

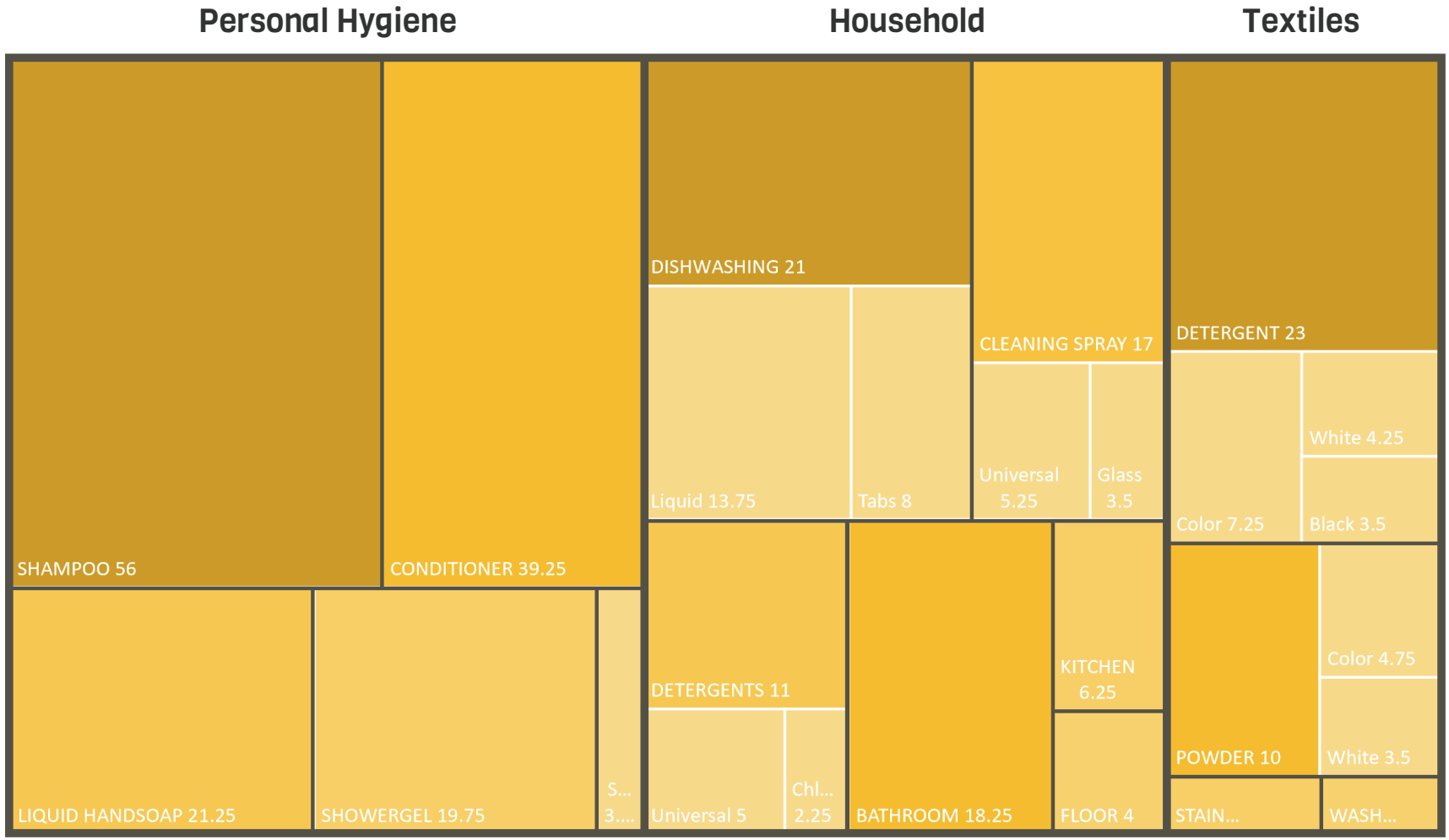


Figure 18: Overview Field Research Results

Survey

Introduction

Alongside with the field research, we agreed on conducting a survey. Due to the fact that there could not be any data found around the most used household cleaning products nor the most used personal hygiene products, a survey was prepared to gather data on this topic. The purpose with this survey was firstly to get an idea of which are the most used products and secondly, if people have another attitude or buying behaviour towards personal hygienic products compared to household cleaning products. The latter was based on assumptions that we wanted to validate or annul before proceeding. The information collected with the survey should then help to decide if the products should both cover personal hygiene and household cleaning products or if the focus should only be on one and ultimately help to narrow down the product range and point out important factors to include in these products.

The survey as a tool was chosen since a broad group of people can be targeted and consequently a lot of different insights can be collected (Stickdorn et al., 2018). The questions were kept rather open in order to not only gather quantitative data but also get some qualitative, thick data. Therefore, and by making this decision, we could not only gather quantitative data in the form of how many people use one certain product, but also - at least to some extent - qualitative data on why they choose a certain product over another. The questions that proposed options for ticking certain answers, also had the option to comment and add their own answers.

No demographic questions were asked, since that was not the aim of this survey. The survey was used as a tool to explore which products were most used and what qualities people seek and value in their products. Therefore, the age or gender were not relevant at this stage.

The survey was structured and divided into three parts of household cleaning products, textile cleaning products and personal hygiene cleaning products. The categories of household cleaning products and personal hygiene cleaning products were kept similar, just slightly adjusted to the products. The category of textile cleaning was added in between since we wanted to get data on it but it did not fit in any of the other two categories.

The aim with the questions was to get data on the products mostly used among different households. This question was pure data collection since no supporting data could be found for this. Furthermore, their loyalty towards a certain product or brand was investigated. This question should help us to identify if there are certain products people care more about than others; also in comparison if people care more about the products they buy for personal hygiene vs. household cleaning. Further questions asked into the most important factors as well as general important aspects when choosing and buying a product. These questions should help us identify if there are certain factors that need to be included in our service in order for people to like it. Lastly, a question regarding their monthly cleaning habits was asked. This question was mainly asked in order to understand how many times they use the products in order to estimate the frequency of the potential offered PSS.

The survey* was shared in several groups on facebook and among friends living in Copenhagen. After six days, we had 56 responses. We organized an online meeting to go through the answers together in order to get an overview. For the open questions, we went through each and every answer and put them into clusters with the same or similar answers. For this, we exported the results into 'Google Spreadsheet' which helped us to make the clusters and to count them. After grouping and counting them, we had a good overview of the most given responses and could see some first trends and thus draw some first conclusions.

* The survey can be found in Appendix 3

First Conclusions of the Survey

In all three categories (household, textile, personal), over half of the survey participants stated that they are product and/or brand loyal - and even $^{2}/_{3}$ being loyal when it comes to personal care products. This partially confirmed our hypothesis that people care more about their personal care products than their household cleaning products.

The environmental aspect alongside quality were generally mentioned as the most important factors when buying products. The chart below (Fig. 19) showcases the most important as well as other important factors ranked according to the category.

Furthermore, through the survey we received insights into the most used products as well as how many times a month people approximately use certain products. This data was mainly collected with the idea to be able to use it further along in the process in order to create a service fitting their needs.

Household Cleaning Products	**Textile Cleaning Products**	**Personal Hygiene Products**
53,6 % buy the same cleaning product / brand again. The most important factors: 1. Environment 35% 2. Quality 23% 3. Price 20% Other factors: 1. Price 34% 2. Quality 24% 3. Environment 22%	57,1 % buy the same laundry detergent / brand again. The most important factors: 1. Environment 29% 2. Quality 25% 3. Price 21% Other factors: 1. Smell 23% 2. Environment 23% 3. No Perfume 21%	68 % buy the same product / brand again. The most important factors: 1. Quality 29% 2. Reputation 27% 3. Environment 14% Other factors: 1. Smell 27% 2. Quality 22% 3. Price 22%
How many times in a month they use cleaning products: 1. Once a week 46% 2. Every day 18% 3. Once every two weeks 11%	How many times a month they do laundry: 1. 4-6 times a month (1-2 times a week) 2. 1-3 times a month (every two weeks) 3. 7-9 times a month (twice a week)	How many times a month they buy new products: 1. Every two months or more 2. Monthly 3. Less than a month

Fig. 19: First Conclusions of the Survey

Reflection of the Survey

Choosing the survey at this point of the project was of great benefit since data could be collected (where there could not be found any other data online) about an important aspect that could guide and help the decision making process for the advance of this project.

As mentioned before, we have consciously chosen to conduct this survey with mostly open questions (and otherwise always giving the opportunity for the person to comment on it) and not providing them with answers to choose from in order to not limit or bias the respondents. This helped to not only get quantitative data but also qualitative, and more personal insights and rich data.

Nevertheless, this way of conducting a survey takes longer to analyse since the different answers need to be gone through and clustered into groups. Here, mistakes or personal biases in regards to which answers belong together could influence the results. Furthermore, open questions invite the respondents to interpret and thus, certain answers would not cover our intentions with the question and therefore were not for further use. In this survey, this misinterpretation did only apply to two or three respondents mentioning cleaning product brands or certain machines or tools they use for cleaning.

Lastly, being critical and in retroperspective, the question of how many times in a month they use the cleaning products should have been asked more specific to certain products. Also, the fact that we asked the time period of a month, might be too “long” of a span to ask for certain products that people most likely use on a daily basis. This, plus the fact that we cannot be 100% certain that their numbers given/ answered were actually “calculated” up for a month, makes us not take these answers (of this specific question) too much into consideration.

Define

Define Phase

Introduction

After collecting data and information in the discover phase, we entered the define phase with a co-creation workshop that had the aim to exchange the collected information with the start-up owner as well as to narrow down certain aspects of the service. After the workshop, first challenges and doubts were encountered that made us iterate and refocus on the users and their pain points. After exploring the linear user journeys and mapping out possible pain points, in depth interviews were held in order to confirm or reject the hypotheses. Out of the main findings or the interviews, user segmented personas could be created. During this phase we could redefine our initial problem statement, especially due to the challenges we came across after the co-creation workshop.

Co-creation Workshop

Exploring Solutions & Narrowing Options

After the desk research, field research, the survey, and analysing all the collected data, a meeting with Luis, the owner of the start-up, was arranged. The purpose of the meeting was firstly, to give each other a status update and to talk about the most important findings and secondly to share interesting and relevant research results. However, the main purpose of the meeting was to have a co-creation session where different aspects of the service, like the products and the packaging material could be discussed and eventually defined.

As previously mentioned, our research could be clustered into five groups that need to be defined (with some of them overlapping): Products, their consistency (form), the type of packaging material, transportation, and lastly the general BM of the PSS. The activity of the workshop session was to co-create different scenarios and once they were mapped out, evaluate and adapt according to efficiency, costs, user experience and positive environmental impact. Prior to the workshop, we created the clusters with the different options as a result from our research.

Luis could choose between the different options of the clusters and thereby - step by step - build a scenario.

The first scenario in Fig. 21, was the result of the initial service Luis had in mind. He did that by choosing the prepared post-it stickers and placing them into the belonging space on the poster. It is worthy to mention that the first scenario mapped out by Luis, Fig. 21, was made before we presented and explained our research and our main findings. This was purposely intended, in order for us to see Luis' unbiased perception and ideas of the service and to compare if the scenario would change when giving insights of our research regarding the different products and materials. Therefore, only after mapping out the first scenario by Luis, we presented our research and our main findings to him.

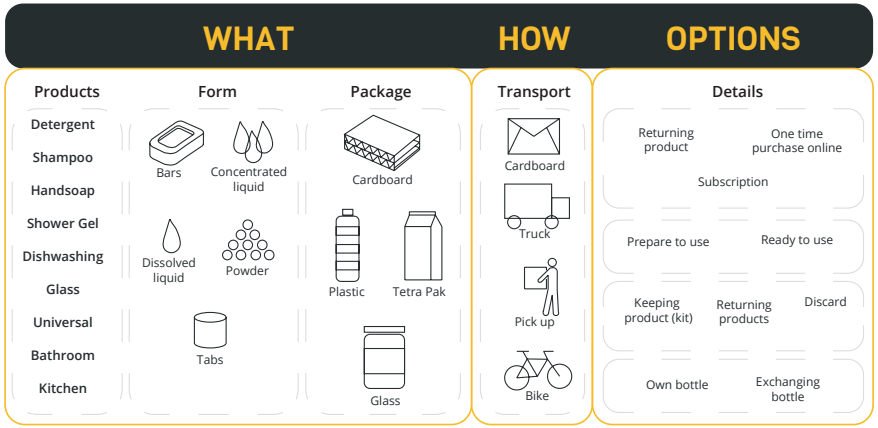


Figure 20: Scenario Template

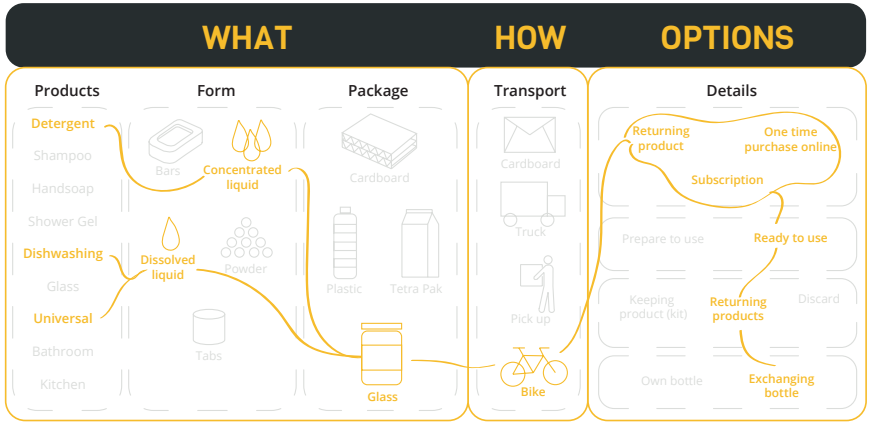


Figure 21: Luis initial Scenario draft

After that, many different scenarios were discussed and “played through”. The poster with the prepared post-it stickers turned out to be a good tool for that - not only to visualize the service but also to be able to rapidly exchange certain parts and thus illustrate the influence that had. After playing around, we ended up co-creating two more possible scenarios. (Fig. 22 and Fig. 23)

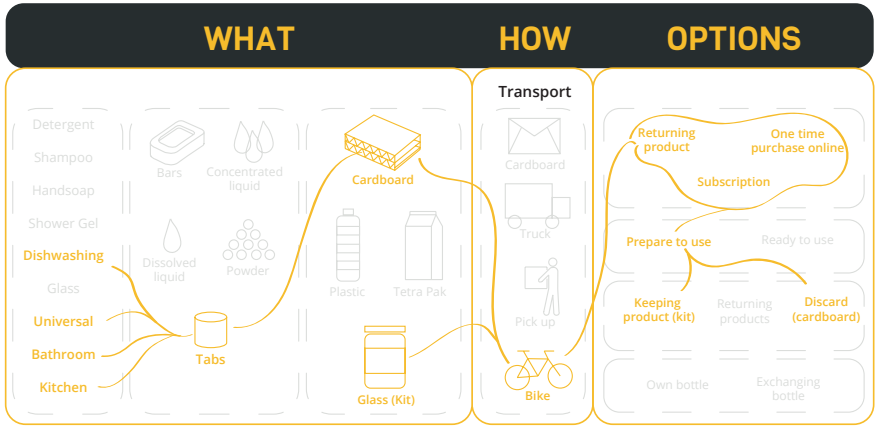


Figure 22: Co-created Scenario draft 1

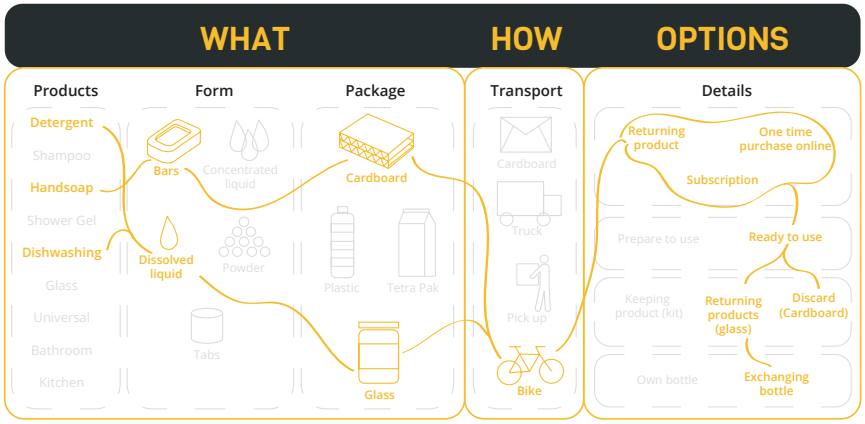


Figure 23: Co-created Scenario draft 2

Having three “final” scenarios outlined, highlighted already certain aspects of the service to be preferred over another, e.g. glass or cardboard packaging over plastic packaging. Furthermore, the product range could be settled to the following: Handsoap, (hand-) dishwashing soap, and laundry detergent as a group of products being used on a daily basis and an extended product range including: Kitchen-, bathroom-, and universal cleaning products.

Evaluation

After having three scenarios outlined, a round of going over the scenarios, discussing, and trying to “rate” them, was conducted. The rating was done in regards to environmental aspects as well as to customer-experience aspects. Every decision in every step was compared to the linear way and then rated whether the certain decision was positively (+), negatively (-), or just neutral (0) influencing the environmental aspect as well as the experience aspect of it. This, again initiated discussions and gave an idea, of which scenario tended to be more environmentally-friendly and/or which one was more user-friendly.

Out of this last round of evaluating, the base of two scenarios could be extracted and were chosen to work further on.

Figure 24: Co-creation Workshop

Scenario 1

A PSS that delivers filled glass bottles and picks up the empty ones. This scenario creates minimal waste since the company keeps ownership of the bottles and therefore makes sure that the bottles are picked up, cleaned and refilled to reuse. Clearly being the most sustainable option, the customer experience with this scenario needs to be further investigated - especially when it comes to the exchange of the bottles.

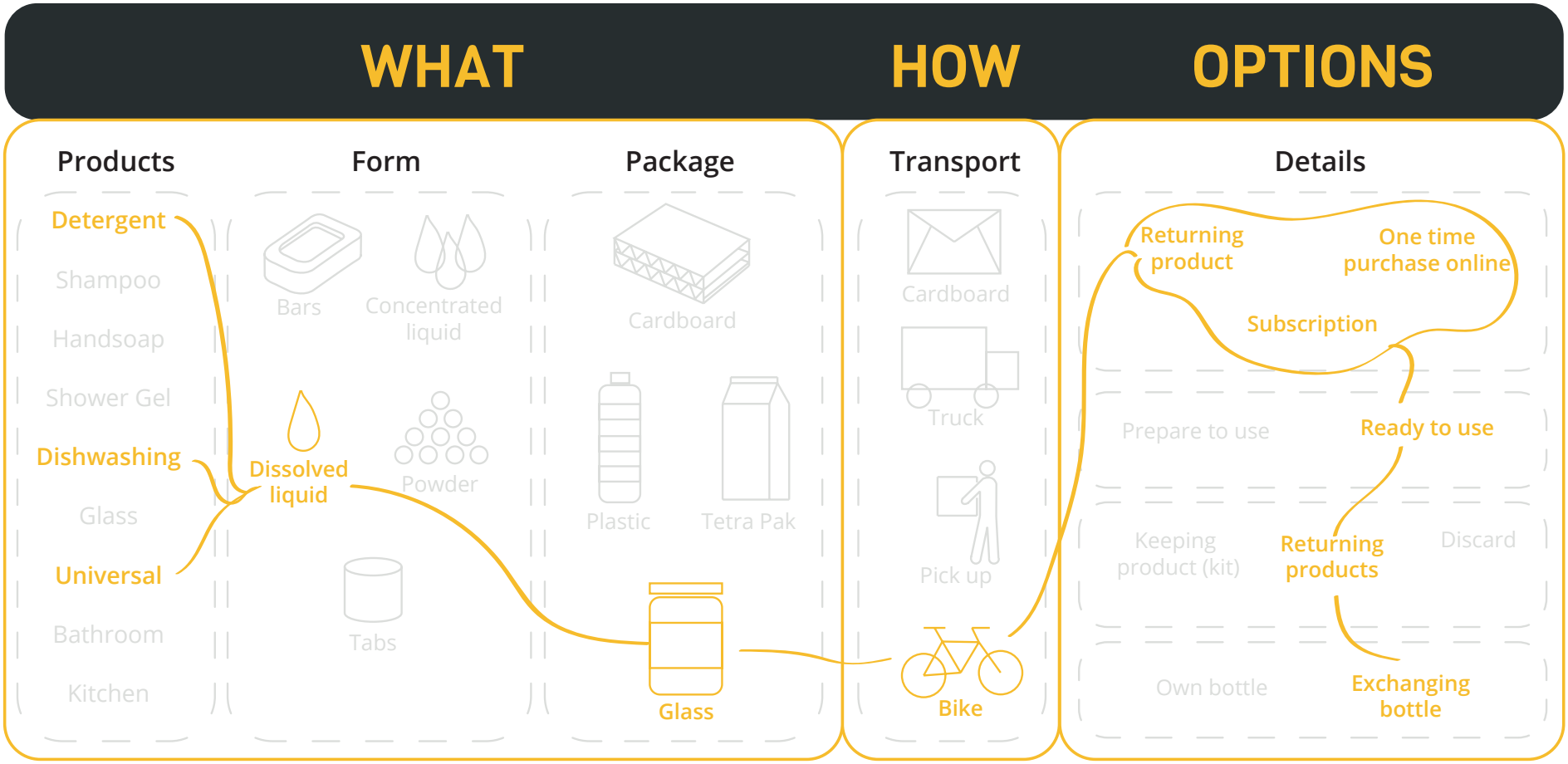


Figure 25: Scenario 1

Scenario 2

A PSS that offers a kit of refillable bottles and delivers the refill as concentrated soap in small glass bottles. The small glass refill bottles will then be picked up when delivering new ones. Here, further options need to be investigated and defined e.g. the small bottles could be sold in stores, or the refills could be delivered in another consistency than liquid such as powder or tabs.

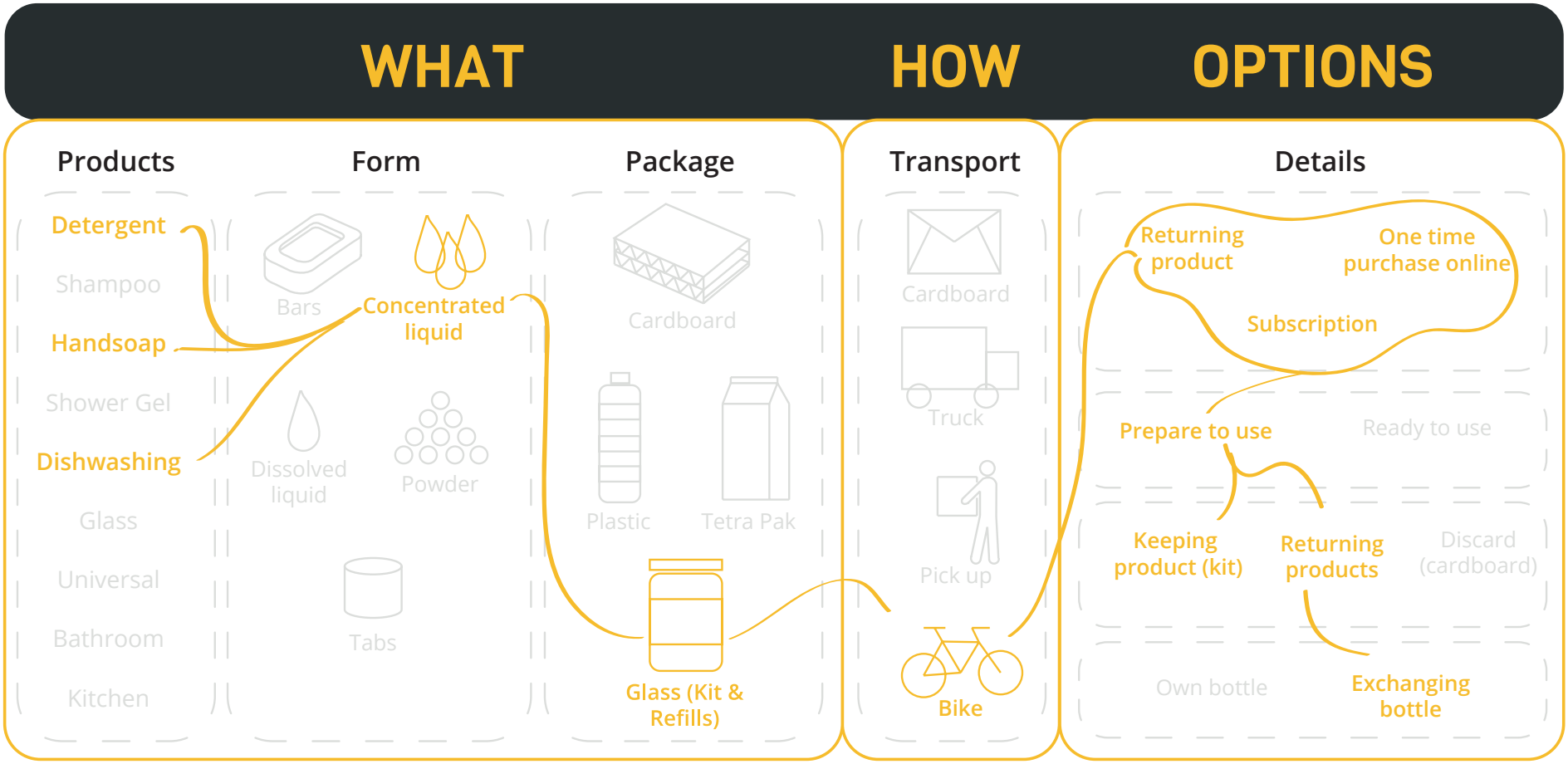


Figure 26: Scenario 2

Reflection, First Challenges & Doubts

The co-creation workshop was a good and interactive way of discussing, creating and visualizing different possible scenarios and thereby playfully updating each other, realizing preferences and thus narrowing down and defining certain aspects of the service. Nevertheless, the session also brought up some doubts and challenges in regards to the profitability of the service.

Due to the fact that cleaning products are not used on a frequent basis, especially cleaning products as e.g. bathroom and universal cleaner, a bottle of cleaning liquid lasts rather long. Even though at this point of the process the service was not defined yet, the general frequency of using cleaning products being rather rare (compared to other products) would result in customers ordering on a very infrequent basis which raised the doubt of how to make the service profitable. Especially when looking at our scenario 2 (Fig. 26), offering a kit and some kind of refills which would then prolong the order frequency even further.

We are well aware that as designers, the focus should not lay within profitability, but due to the collaboration with the start-up we would like to consider it. Furthermore, constraining oneself with limits - in this case profitability, and the question of if we actually can make money with this - might help to spark creativity on another level.

Iterate: Focus back on the User

Our first step regarding this doubt was to adjust the product range and divide them into two groups of three products each. One group aims for products used on a more frequent basis, such as dishwashing soap, hand soap and laundry detergent. The other group aims for products used less frequently: Kitchen, bathroom, and universal cleaning products.

Furthermore, the outcomes of the co-creation session as well as the profitable issue were discussed with both our external and internal supervisors.

After that, we determined that at this stage of the thesis, the more important focus point should be the user itself rather than the profitability. Therefore, our focus shifted back on exploring and solving the fundamental question of:

What are the problems? And how will our PSS solve these problems for the user?

By investigating and solving these questions, not only a competitive advantage can be gained but also a demand created.

It was realized that by just offering a sustainable and environmentally-friendly service might not be enough motivation for the users to buy into our service. There needs to be a problem that is being solved for the customers in the most convenient way possible. Therefore, only if the problems are identified, innovative solutions can be found and a convenient service created.

Consequently, this iteration also made us reconsider our initial problem statement and we could define it more to the following:

How can Service Systems Design add value to a Circular Product-Service System so it is as (or even more) attractive and convenient than the linear counter product?

Accordingly, with the more defined problem statement and in order to completely put the focus back on the user, the traditional, linear user journeys were mapped out for the previously decided, more frequently used products: Handsoap, dishwashing soap and laundry detergent.

How can Service Systems Design add value to a Circular Product-Service System so it is as (or even more) attractive and convenient than the linear counter product?

User Journey

Introduction

We used the tool of user journey in this part of the process to map out the current linear service. User journeys help to create a clear and common understanding of the ideas as well as they make it easier to identify possible pain points, gaps in a service as well as they outline specific touchpoints that can be improved (Stickdorn et al., 2018).

Even if very raw, and not going into depth, the created user journeys provided a good overall idea of the existing service and helped us to brainstorm and discuss possible pain points. These pain point assumptions could then be used to prepare the in-depth interviews accordingly.

Current User Journey

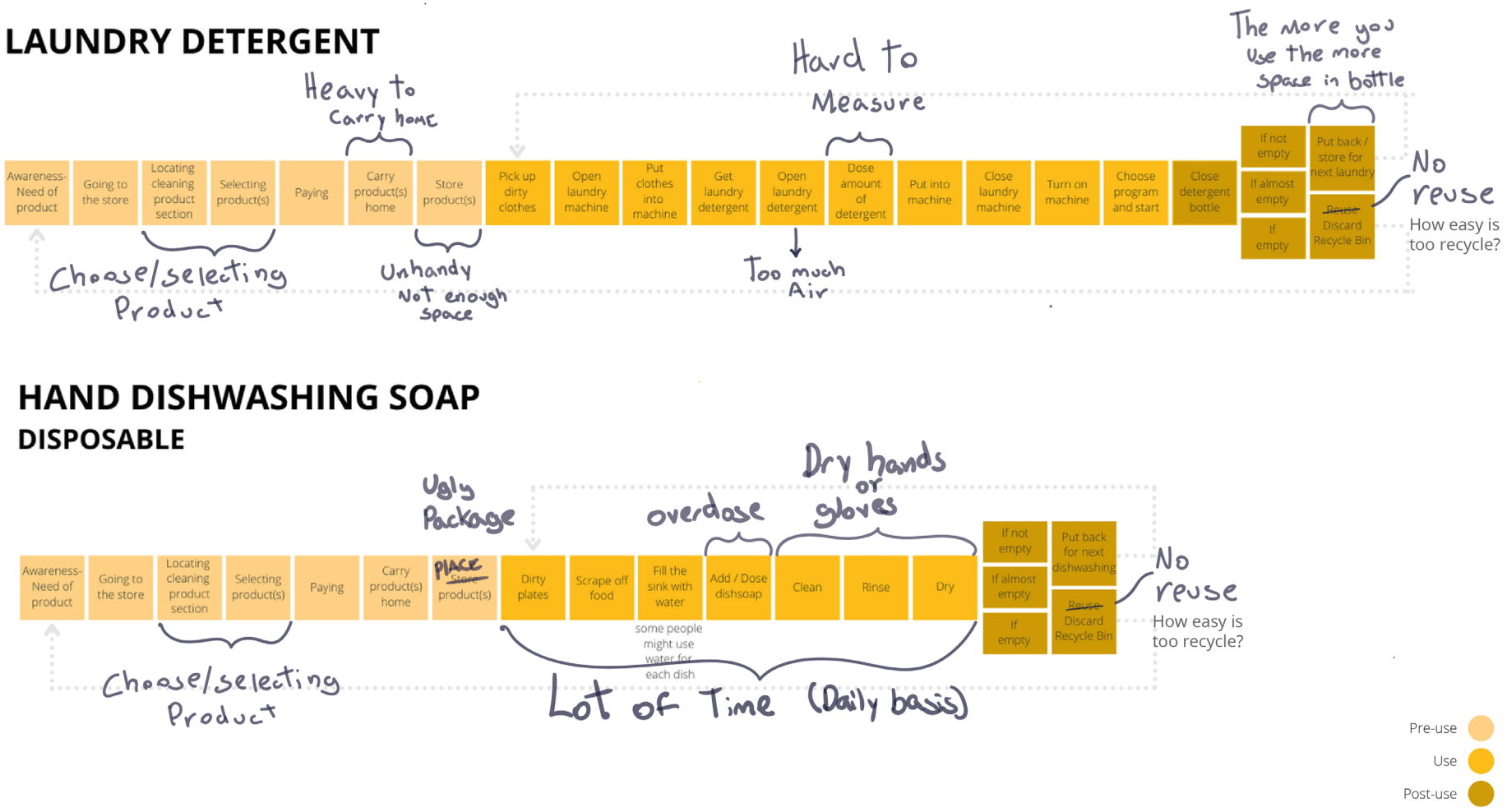


Figure 27: Current User Journey with Laundry Detergent & Dishwashing Soap

Current User Journey

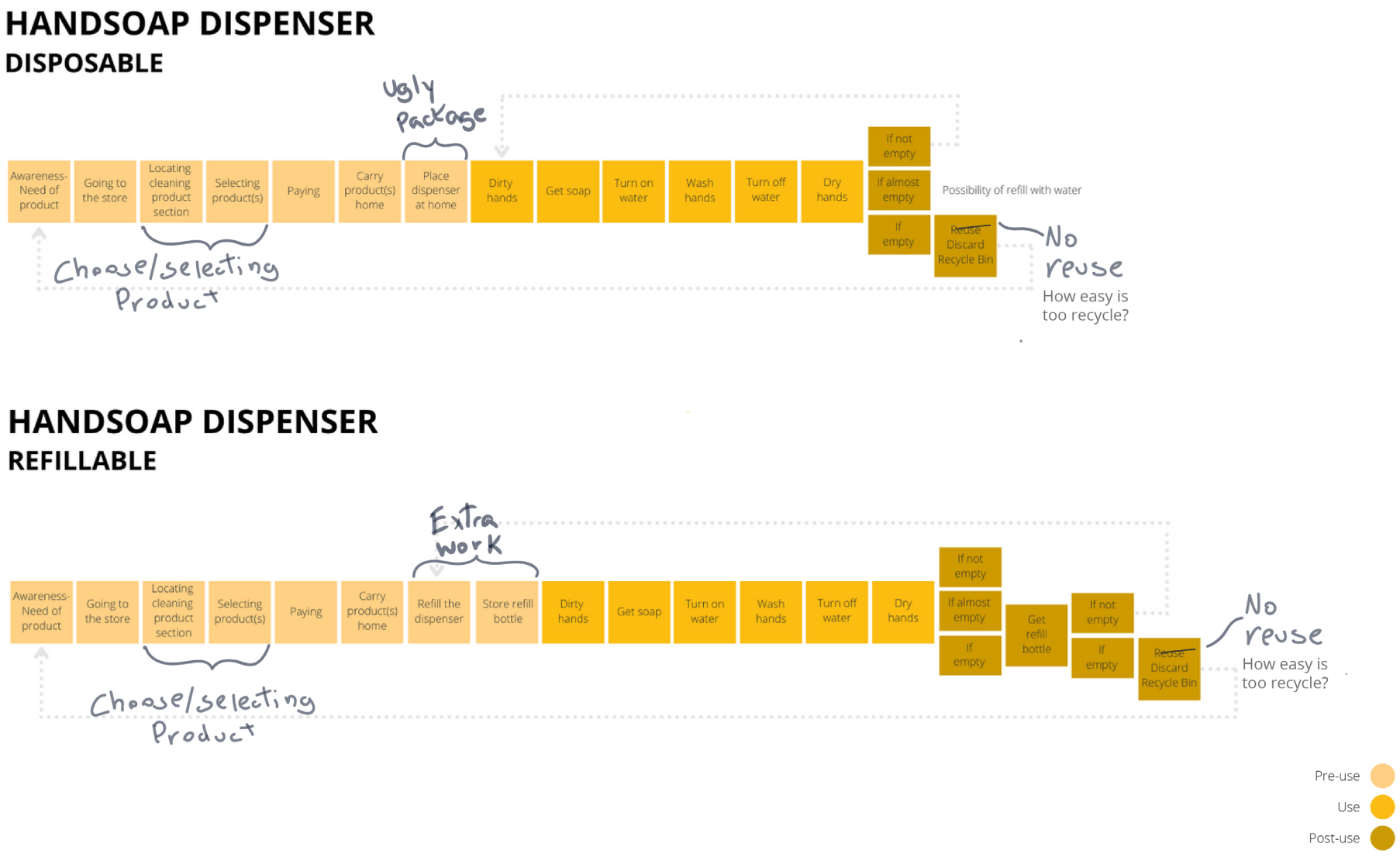


Figure 28: Current User Journey with Handsoap

Possible pain point assumptions to be validated or rejected:

1. Too much choice; Hard to choose the right product
2. Laundry detergent is heavy to carry home
3. The storing of the laundry detergent is very unhandy due to the shape of the bottles
4. The laundry detergent bottles take up a lot of space, especially considering when they are half empty
5. Both the dishwashing soap as well as the hand soap often come in not very aesthetic bottles even though they are usually placed quite visibly at the sinks
6. The dosing of the laundry detergent is very unhandy - underdose/ overdose
7. The empty product containers/bottles should be sort wasted which takes extra effort

Additionally to creating hypotheses to validate or reject, different possible target segments were brainstormed in order to better aim at selecting interviewees, making sure to cover all possible target segments.

The segments were grouped according to “how many” people live in one household: A single (1 person), a couple (2 people), a flatshare (3+), a family (2+ at least one child). Small to medium sized enterprises (SME’s) mostly in the service field such as restaurants and bars were also considered but the current situaton made it difficult to reach out and get in touch with them.

We found it important to differentiate families and flatshares, even though the amount of people living in one household might be the same in both segments, due to the hypothesis, that families (especially with small children) might do the laundry more often than a flatshare with four adults for example. By dividing them into two clusters, we could make sure that both segments would be interviewed and our hypothesis could be confirmed or rejected.

In-Depth Interviews

Introduction

In-depth interviews is a method usually used when in need of gathering more specific data or to understand different perspectives (Bjørner, 2015; Stickdorn et al., 2018).

In-depth interviews can be done in a structured or semi structured way, where the latter leaves room for flexibility, enabling the interviewee to clarify questions or give more extended answers (Tukker & Tischner, 2017). When done well, they can provide detailed information, new insights and valuable data (Bjørner, 2015; Stickdorn et al., 2018). More specifically, researchers can learn about specific expectations, concerns of the users and particular needs or assumptions (Stickdorn et al., 2018).

In our case, the in-depth interviews were conducted mainly to receive knowledge about the users' possible pain points and to confirm or reject our hypotheses around that.

Preparation

In order to prepare the interviews, firstly an appropriate interview method needed to be chosen based on what we wanted to get out of it. The aim was mainly to get a deeper understanding of possible problems the consumers encounter throughout their journey. We wanted to confirm or reject our own assumed pain points and investigate if the interviewees experienced other issues we have not even thought about. Furthermore, based on asking interviewees from different possible target segments, their similarities and differences regarding their experiences wanted to be investigated.

The interview method chosen was the "narrative interview" which "is particularly appropriate to person-centred studies of everyday information behaviours" (Jovcheovitch and Bauer, 2000 as cited in the book Bjørner, 2015, p. 82).

The topic - in this case buying, using, and storing cleaning products - was presented in a storytelling manner by using the already prepared, linear user journeys from Fig. 27 & Fig. 28. The timeline could "be used to schematically represent the beginning and the end of the event" (Bjørner, 2015, p. 83) and through that build a base and a common understanding of the time frame we would like to get the interviewees insights into. After setting this frame, we let the respondents tell their narration including things they consider as inconvenient or annoying.

After the active listening to the narration of the interviewees, questions into the narrative itself or into missing parts of the narrative were asked. Here, we tried to be as unbiased as possible, striving to cover all the parts of the user journey into detail and hopefully get the interviewees narrating their thoughts, opinions and pain points without us asking directly into them.

After ending the narrative interview, in-depth questions into their specific preferences when buying products and their cleaning schedule were asked, similar as in the survey in order to support it. Additionally to interviewing people covering the segments, we did an interview with a couple using 'Homethings'. In this case, instead of an interview, a more informal talk was conducted. Although questions were prepared beforehand, we took the liberty to jump from one topic to another without a rigid structure. The aim with this "informal interview" was to investigate the motivations and reasons this couple had chosen this service as well as their opinion and areas to improve. Moreover, since Homethings covers a bathroom-, kitchen- and shiny surfaces cleaner, other cleaning products still need to be purchased through the conventional, traditional way. Here, the opinion about the fact that

not all was covered by Homethings was investigated as well as their linear user journey with the products not provided by Homethings.

The summary of the interviews with the most important findings outlined can be found in the appendix 4 and the recordings are attached.

Findings in-depth Interviews

Conducting seven interviews, qualitative, and thick data could be collected and first patterns and consequently first findings could be summarized:

Laundry detergent:

- This was the product, the interviewees narrated their user journey the most detailed and had most opinions about
- Powder detergent leaves a rest in the machine - and most people are aware of it; therefore the preference is liquid detergent over powder detergent

Hand soap

- Most interviewees use liquid soap (no bars)
- Aesthetically, the interviewees rather refill a nice dispenser (can be glass or plastic) than use the disposable one
- People that refill, often buy the disposable, plastic soap dispensers and just refill them into their own dispenser. This could point to the fact that there are no refill options available

Dishwashing soap:

- Most interviewees use a disposable dishwashing dispenser; some mention the “wish” to have a refillable option.
- The interviewees that already refill, buy the disposable, plastic soap dispensers and just refill them into their own dispenser. This could point to the fact that there are no refill options available.
- Most dishwashing soaps come in hard plastic. Comments here were that for the refill, instead of hard plastic, a soft plastic would be preferred so that either it does not take too much space in the waste bin or because they somehow believe that it is better for the environment.

Scents:

- The interviewees being allergic, or aware of allergies, or generally dislike perfumes prefer unscented products. The others prefer scented products.

Out of these rather broad findings, the following opportunities could be seen:

- There was an opportunity in making the laundry detergent bottle shapes more convenient and less space taking.
- For all three categories, aesthetic- as well as refillable options seem to have created an opportunity.
- The fact that most people used liquid hand soap turned soap bars into a possible opportunity needed to be investigated further.
- The fact that some interviewees already refill their dispensers (glass or metal) could be investigated further in regards to their motivations (aesthetically or environmentally) to do so.

Validation & Rejection of the Hypotheses

Out of our seven assumptions of possible pain points, four could be confirmed. However, some of these confirmations resulted from personal judgement when conducting interviews and thus might be biased. In order to remove the bias, our reasoning behind is briefly explained below.

1. **Too many options; hard to choose the right product**
   Confirmed since it was mentioned several times, by both couples as well as by the interviewee of the flatshare.

2. **Laundry detergent is heavy to carry home**
   Partially confirmed. The interviewee of the flatshare mentioned that she prioritized other products than the laundry detergent - since it is heavy to carry home.

3. **The storing of the laundry detergent is very unhandy due to the shape of the bottles**
   Confirmed by one of the "couple" interviewees. However, one of the "family" interviewee mentioned rather the aesthetic part that is unhandy and that she would really appreciate nicer looking bottles so that no storing is necessary anymore since she could just place it visible in the bathroom.

4. **The laundry detergent bottles take up a lot of space, especially considering when they are half empty**
   This hypothesis could not be confirmed.

5. **Both the dishwashing soap as well as the hand soap often come in not very aesthetic bottles but they are usually placed quite visibly at the sink**
   Partly confirmed by several interviewees. Even though not precisely mentioned, the fact that some refill their own dispensers points for us to the aesthetic reasoning (not the environment since they still buy the "normal" single-use plastic dispensers for refill). One interviewee (couple) even mentioned the non-aesthetic bottles of the laundry detergent.

6. **The dosing of the laundry detergent is very unhandy - underdose/overdose**
   This hypothesis could not be confirmed.

7. **The products should be sort wasted which takes extra effort**
   This hypothesis could not be confirmed.

Reflection in-depth Interviews

The in-depth interviews were a great tool for us to gather further qualitative data and to better understand users' pain points. However, the interviews were conducted with people from our network which resulted in quite a similar age group.

The advantage was that everyone belonged to a different type of household. The different types of households were our first priority to create the different segments, more important than age and gender. We considered that the different households would give us more valuable information than focusing on age range, due to the nature of the project.

In retroperspective, we could have improved the interviews, firstly by conducting more interviews but also by interviewing all the members of a household rather than just one person. This could have made sense to see if within a household there were different opinions and thoughts. For example it might have happened that we talked to the person in the household that rarely buys cleaning products and thus has another perspective on it than the person mainly responsible for it. Moreover, it is important to mention that unfortunately not all interviews could be recorded and thus the summaries had to be written from our notes. When this was the case, we tried to keep the interview notes as detailed as possible in order to deliver accuracy and to keep it as unbiased as possible. For the recording of the interviews, permission to be recorded was asked beforehand as well as their demographic information.

Combined Findings: Interviews & Survey

Due to the limited sample size of the in-depth interviews, the findings of the survey from Fig. 19, where 56 people participated, were also taken into consideration and when combined, the following results could be found:

Scent/Smell

Most people prefer scented products. In the interviews, this preference would not show but in the survey, the smell was mentioned as an important factor for both the laundry detergent as well as personal care products. The only interviewees mentioning that they prefer scentless products were the ones either having allergies or being concerned about them.

Importance of Environmentally-friendly Options

3 out of 7 people mentioned the environmental aspect as important when it comes to picking the products. This is supported by the findings of the survey where the environment was in the top three important factors in all three groups. However, even though they care, we do not know specifically what it means for them to care. This was also reflected by the interviews where only one person uses the eco-friendly, refillable laundry egg and the hand soap bar. One was using 'Homethings' but rather by "coincidence", and the one person mentioning trying to only buy environmental products does not sort the waste.

The interviews, combined with the survey, provided enough information to create personas that helped later to define the concept and specific characteristics of it.

Target Segmentation

Personas

"Personas" are a known concept for the design community. A persona is a fictional yet detailed representation of users or target groups and they are normally based on research and inspired by real people (Pruitt & Adlin, 2010). One of the purposes of using personas is to tell a story by describing why people do what they do (Creating Personas | UX Booth, n.d.; Adlin & Pruitt, 2010).

Using personas has a lot of benefits in the design process. They help to understand the user goals, needs and motivations. Moreover, they create a useful tool for user research and give solid arguments when facing design decisions (Adlin & Pruitt, 2010; Cooper et al., 2014).

Even if fictional, personas should be done with significant rigor and precision. It is important to mention that personas are not just documents or data; they are shared and common ideas around who the potential users are or might be. Personas should come to life in the mind of the designers and if done accurately, personas can be highly useful as a communication tool (Adlin & Pruitt, 2010). Furthermore, by using personas, a "bucket list" of different needs can be created, giving them specification that helps avoiding biased assumptions and ambiguous definitions when describing users. In short, personas influence and can support the decision makings during the design process, can be used as a commmunication tool, help measuring the design effectiveness, and can be involved in other design related tasks e.g. branding and marketing (Cooper et al., 2014).

The following personas were prioritized, defined and grouped according to the householding situation; couples, singles, family, flatshare. The results of the survey, desk research of trends and the in-depth interviews were taken into consideration when creating the persona segments.

Reflection

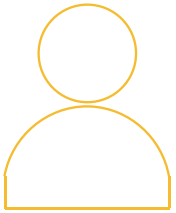
Creating personas, which in our case were user segments, was of great benefit in order to summarize all the insights collected throughout the process and "personify" them. This "personification" of information helped to create a story and thus remember and use better. For our further process, all persona segments were taken into consideration since we did not find it necessary to narrow down and only focus on one, mainly due to the fact that everyone needs and uses cleaning products.

However, that being said, we also believe that narrowing down and focusing on certain persona segments might be beneficial later in the process when finalizing the concept since it might affect some of the aspects as well as it might be beneficial to have a more specific target segment when marketing the final concept.

Persona 1-2

SINGLE LIVING

Age range: 25-32 years old



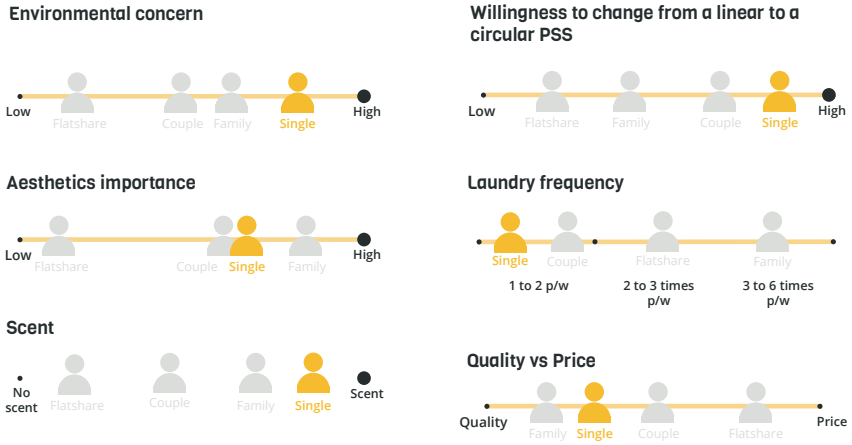
"I choose something that is good for the environment, thats my priority"

Detergent	DishwashingH	and soap
Powder, disposable	Liquid, refilled in glass	Refilled/Bar

General Info

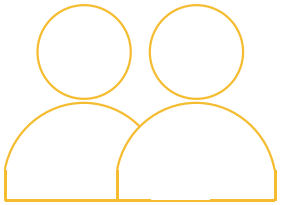
I am I ben and I live alone i n my t wo-room apartment i n the center o f Copenhagen. I work full-time and since I live alone, I only need to do laundry 1-2 times a week which I try to schedule during the weekends. Generally, I like to buy environmentally-friendly cleaning products if possible.

Values & Preferences



COUPLE

Age range: 27-40 years old



"The laundry detergent bottles are weirdly shaped which makes the storing inconvenient."

Detergent	DishwashingH	and soap
Liquid, disposable	Liquid, disposable	Liquid, disposable

General Info

We are Martin and Sofia, we both work full-time, and we just bought our first two-room apartment in the center of Copenhagen together.
We use disposable dispensers for both the hand soap and dishwashing soap but whenever we find a nice, refillable dispenser, we will buy these in order to make our apartment look perfect. For the laundry, we use liquid detergent since the powder never completely dissolves which is annoying. We choose products based on our mood or in the quality we think the price is a guideline of the quality.

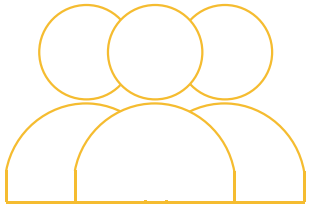
Values & Preferences

Figure 29: Persona 1 & 2

Personas 3-4

Flatshare

Age range: 23-30 years old



"When I am in a supermarket I prioritize buying groceries before buying the heavy laundry detergent."

Detergent	Dishwashing	Hand soap
Liquid, disposable	Liquid, disposable	Liquid, disposable

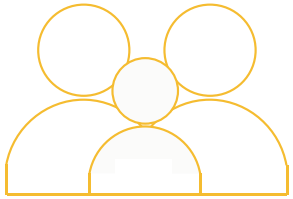
General Info

We are Sofia, Clara and Barbara sharing an apartment together in Copenhagen. Both Sofia and Clara study together at AAU and Barbara has recently graduated and now works for a design company in Vesterbro.
We share the cleaning products, we alternate who buys the products. Clara is allergic to scents, so everyone buys non-scented or very mild products. We try to not run out of producs by having an extra package at hoem. Heavy products like laundry, we usually buy it when we do not have many other products to carry home.

Values & Preferences

FAMILY

Age range: 30 -40 years old



"If the laundry detergent would come in more aesthetic bottles, I would place them visibly in my bathroom."

Detergent	Dishwashing	Hand soap
Liquid & powder, disposable	Liquid, refilled	Liquid, refilled in glass

General Info

We are Andreas, Lisa, and our 6 years old daughter Male. We live in our apartment in the outside of Copenhagen. Andreas works full-time as a software developer and Lise works part-time in a fashion company.
Due to our daughter we are aware of the allegeries cleaning products might trigger. We buy the same 2-3 brands since we know that they suit us.
We do not like to run out of products and because, we buy multiple bottles when they are on sale. We both use powder and liquid detergent, but the powder detergent only for higher degrees since it does not dissolve in lower degrees. For the dish soap we have a refillable dispenser built into our kitchen and for the hand soap, we use a nice glass dispenser that we refill.

Values & Preferences

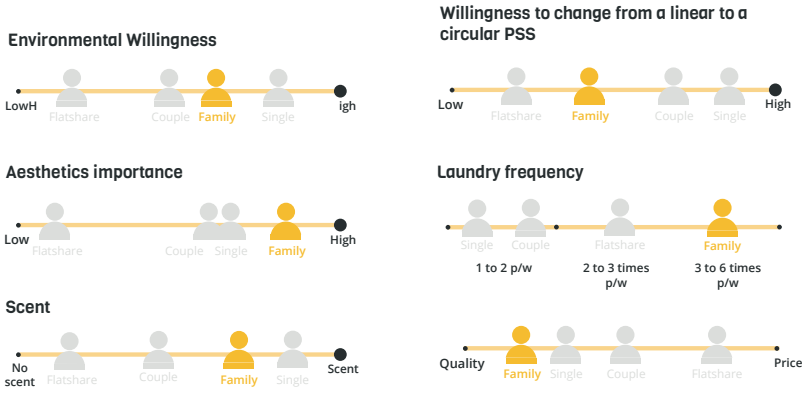


Figure 30: Persona 3 & 4

Develop

Develop Phase

Introduction

In this phase, the concept was developed, evaluated and tested. After previously re-defining the initial problem statement and creating user segments, we were ready to ideate. For this, a co-creational ideation workshop with the start-up owner was prepared and conducted. In the workshop, various methods and tools were used that finally guided us to three, initial ideas. Later, and in order to optimize the potential of these ideas, we iterated in the process and the different features of these ideas were rethought and re-bundled to create better concepts.

Lastly, the tool of pretotyping was used to evaluate the potential BM of the service and further testing was conducted afterwards, focusing on the user experience of the service.

Ideation Workshop

Co-Design

Due to the overall approach of this thesis of co-designing together with Luis - the start-up owner - we planned this ideation session to be a two-days co-creational workshop. Our functions in this workshop included the planning beforehand and the facilitating throughout the workshop.

Ice-Breaker- Warm up

The workshop was started off by doing some specific exercises to warm up creatively as well as to introduce Luis to the design space. The first activity done was "30 cicles" (Kelley, 2018). In this exercise, 30 circles were drawn where we then were briefed to draw recognisable objects in as many empty circles as possible in two minutes (Strimaityte, 2019). It was a short and fun exercise to get into the creative flow and set a base, especially for Luis who was not used to design exercises, showcasing that there was no right or wrong and there were no boundaries set to creativity.

After this first ice-breaker, we continued to do some warm-up exercises surrounding the topic of cleaning products. For this, we used the brainstorming tool '100 ideas in 5min' (Stickdorn et al., 2018) where we should come up with as many ideas as possible within 5min - quantity over quality. This tool has been used by both of us many times before and it was both a good activity to start the ideation out with in order to get into the creative mode as well as it is a good tool to just collect as many ideas as possible to further build up later in the ideation process. Two rounds were conducted, the first one being very open and simply surrounding any ideas around cleaning generally, and the second one more service oriented where we tried to bring the products and innovations previously ideated in the first round into a service system and business. After these two rounds, we had many ideas gathered which we then presented to each other, discussed, and clustered.

Ideation

After these warm up exercises, we felt ready and thus started to ideate around the concept. For this, the tool '100 ideas in 5min' was used again in order to exploit the advantage of this exercise, giving us the opportunity to come up with as many ideas as possible, building a great base for the further ideation process.

Also here, we used the tool twice to ideate around two different parts of the PSS. Firstly, methods of how to bring the products to the customers - delivery and/or pick-up methods - were ideated. We presented the different ideas to each other, discussed them and clustered them into similar ideas. We ended up creating seven clusters that covered our ideas. Secondly, and after the clustering, '100 ideas in 5min' was used again to ideate around the other part, which involved possible BMs. Also these ideas got presented and discussed with each other and finally distributed to the seven clusters previously created. In order to get a better overview of our ideas as well as to narrow them down in a clear and objective way, the 'How-Now-Wow-Matrix' was used as a tool (Innovation Games, 2018).

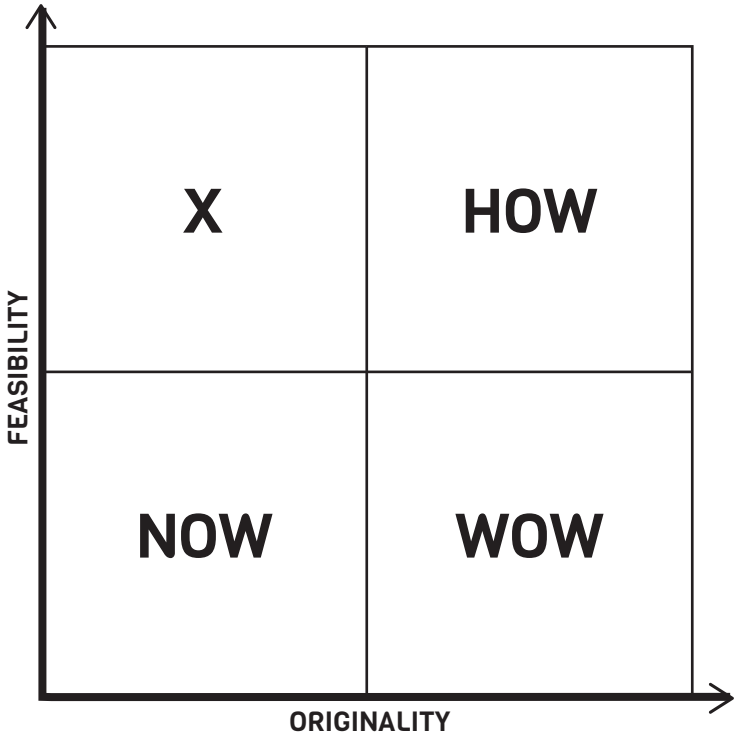


Figure 31: How-Now-Wow-Matrix

X Normal ideas that are difficult to implement. If ideas are placed here, they should be discarded immediately (Innovation Games, 2018).

HOW Innovative ideas that are difficult to implement. These ideas are worth exploring and may overlap with WOW.

NOW Normal ideas that are easy to implement. These ideas are not interesting enough to explore further.

WOW Innovative ideas that are easy to implement. These ideas are the ones we are striving for, but overlap with HOW? might happen.

The matrix helped us to discard three out of the seven clusters since it supported us in realizing that these three clusters were too normal and thus not worth further exploring.

Consequently, four clusters were left where we brainstormed around each category separately with all the ideas previously created. This process was very interactive and by discussing all the ideas and combining them in different ways, raw concepts in each category could be created.

However, throughout this co-creational brainstorm, we realized that one of the four categories worked more as an add-on or future implementation than a concept in itself. Moreover, at this point, one category held two concepts: One that was still producing waste (even if minimized) and one where we saw challenges with the user experience. Therefore, this category was further ideated around with the aim to either improve the two concepts or to discard one and improve the other. After ideating around this particular group once more, we could agree on discarding the idea that still produced minimal waste since we strived to create a circular and zero-waste service. Thus, we could see more potential to achieve this by proceeding with the other concepts. Finally, we came up with three, very raw initial ideas.

Reflection on the Ideation Process

The ideation process started with the workshop where we began with some “ice-breaker” exercises which were an effective activity as a warm-up, especially for the start-up owner.

Since he was not familiar with the design field nor creative processes, these activities helped him to get aware of what type of exercises and tools we usually use in design processes and thus prepared him for the upcoming part. Moreover, the exercises also helped to create a safe space so that all participants felt comfortable with each other in order to share ideas and insights without the fear of being judged or criticized.

The ideation workshop was planned beforehand, taking into consider different tools, exercises and the flow of events so that Luis felt involved and confident to share his insights and ideas. In general our ideation process was quite productive and effective. We came up with three attractive and well sustained ideas that we could use as a base to work further on by defining and testing different elements of them.

In the beginning, the workshop was planned to be a two-day workshop but something unexpected came in between and therefore the workshop had to be done in one day only. Even though one day was enough to go through all the exercises, for another project we could see the benefits of extending the workshop to be more days, taking it slower and adding some more exercises and activities. Furthermore, it could have been beneficial to involve and co-create not only with Luis but also with other potential users. This could have given us a whole other perspective.

Ideas

#1: “Ice-cream Truck”

Infographic and User Journey

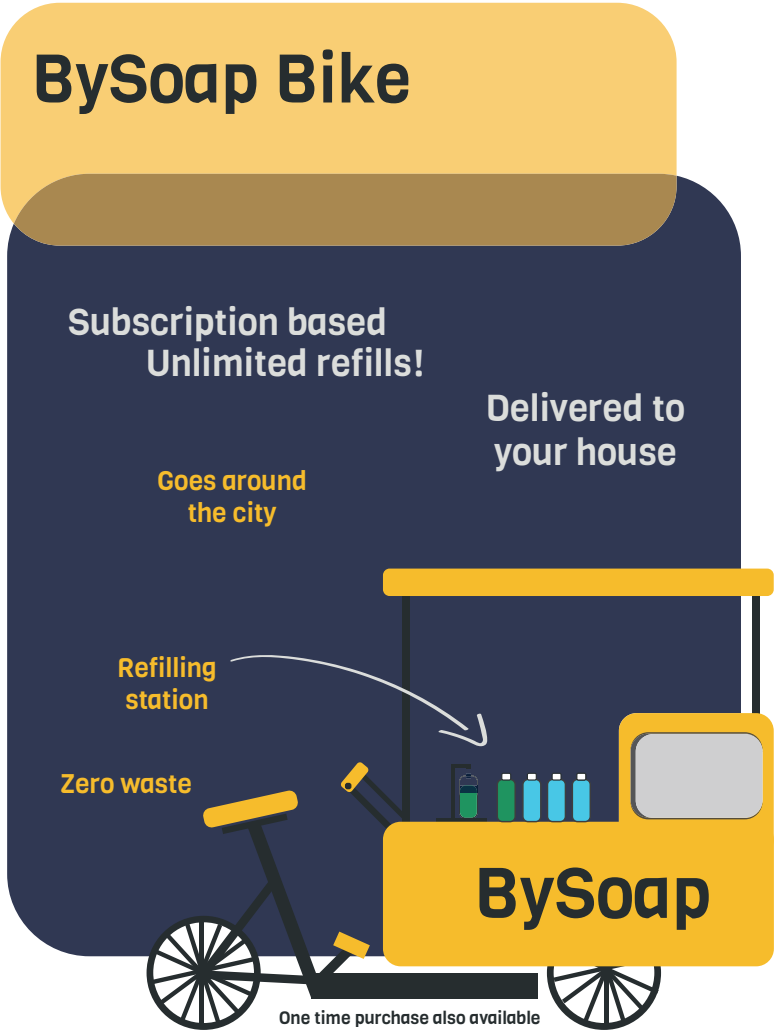


Figure 32: Infographic Idea #1

The first idea is based on the idea of the ice-cream truck, passing through Copenhagen but instead of delivering ice-cream, the cleaning soap to refill is delivered by bike. The refill bike has a specific schedule and time, and a specific route that the customers can follow interactively. The concept is subscription based which in this case means that the customers can refill as many times and with as much soap as they want for a fixed, monthly price.

The customers can subscribe online as well as offline with the refill-bike where they then receive a kit consisting of three glass bottles to refill. Instead of subscribing, there is also a pricier option of refilling their own bottles with one-time purchase.

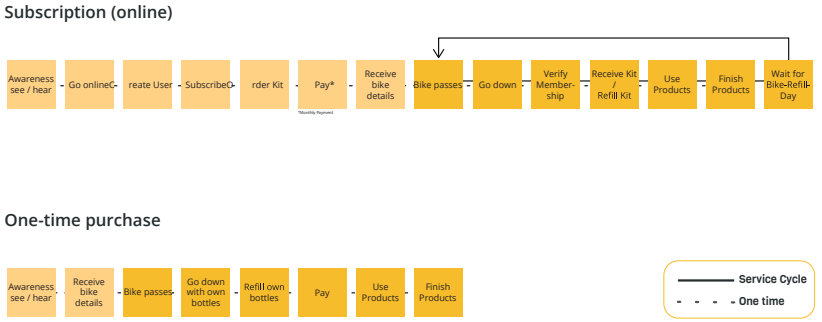


Figure 33: User Journey Idea #1
See Appendix 6

#2: “Vending Machine”

Infographic and User Journey

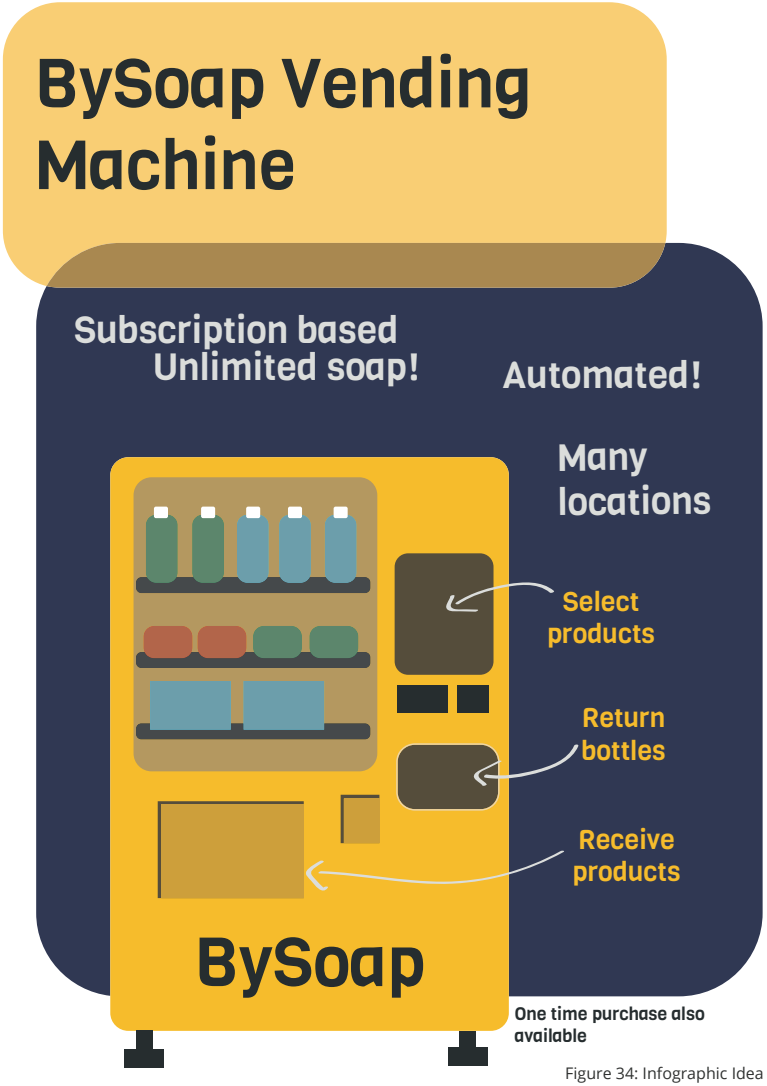


Figure 34: Infographic Idea #2

This idea is subscription based where the user pays a monthly fee but can get as many “free” cleaning bottles whenever returning the empty ones. The cleaning vending machines are placed in busy places around the city and in front of supermarkets as well as kiosks. The vending machines offer a variety of sustainable cleaning products and have an integrated take-back system.

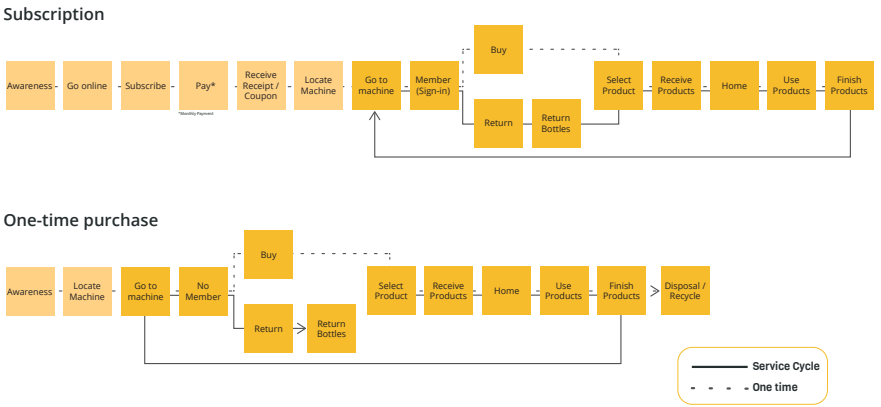


Figure 35: User Journey Idea #2
See Appendix 6

#3: “Home Delivery”

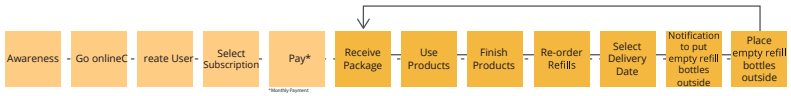
Infographic and User Journey

Figure 36: Infographic Idea #3

This idea works as a usual order-delivery service but instead of delivering the finished product that customers use and discard, a circular refill system is created. The users order online and the delivery takes place by bike on the chosen date.

In this idea, a kit is “borrowed”, consisting of glass bottles for the users to refill and reuse. Concentrated soap is delivered in small glass bottles that can be filled into the cleaning bottles (from the kit) and by adding water, the cleaning product is ready. When ordering new refills, the empty refill bottles can be returned. Due to the concentrated liquid being sent in small glass bottles that fit into the mailbox, the users do not have to be home when the delivery takes place.

Subscription



One-time purchase

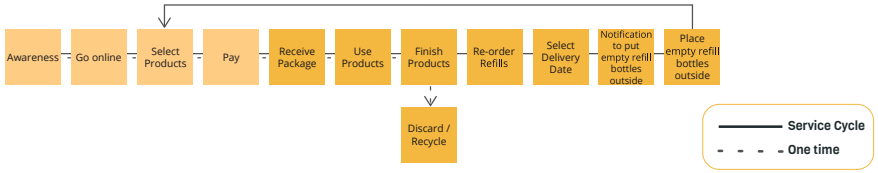


Figure 37: User Journey Idea #3
See Appendix 6

Iterate

The three, raw ideas were presented and discussed with our supervisor, mentors, and Luis.

After presenting the ideas with the help of the user journeys as well as their gaps and possible pain points we realized that some of the outlined pain points in one idea could be solved with the features of another idea. Therefore, it was time to iterate; Take a step back and re-ideate, combine and bundle the features of the three ideas differently.

Challenges

The different features of the three ideas and their various options of different packaging, consistency and general product presentation add complexity when exploring different scenarios. Even more when considering the different impacts on the environment, which made it a challenging process when mixing different ideas with each other. Furthermore, even if it is not the scope of this thesis, the profitability aspect made us reconsider many potential concepts. Considering the take-back system in the most convenient- and user-friendly way, always added extra costs for the company that needed to be compensated somehow. So, as mentioned, even if the profitability part was not a focus in this thesis, the often outlined "economic barrier for companies" to switch to a circular BM, was very well showcased in this part of the process in our thesis.

After the process of re-ideating we decided to focus on idea #1 (ice-cream truck) and idea #3 (home delivery) since we saw it more fit for the thesis due to the very limited service aspect in idea #2 (cleaning vending machine). However, since we had not completely settled on any of the ideas yet, we decided to keep the pretotyping rather broad so that we could still explore the different aspects from all of the ideas. Therefore, we used the tool of pretotyping as a method to test the interest of people in a subscription based, circular cleaning product delivery service.

Pretotyping

Fast Testing

Pretotyping offers an agile method for testing ideas or parts of them in order to make decisions quickly. Pretotyping can clarify rapidly whether an idea is worth investing more time and money in or not. Compared to prototyping, where the main objective "is to answer the questions related to building the product", pretotyping is more concerned with the question of "would people be interested in it?" (Savoia, n.d.). Thus, pretotyping was the perfect tool for us to test the idea rapidly and collect data about the interest in a subscription based, circular cleaning product delivery service from the potential market.

> "The goal with pretotyping is to help you make sure that you are building The Right It before you build It right"
>
> **Alberto Savoia**

The Fake Door Technique

Pretotyping consists of different tools and techniques out of which we decided to use the "Fake Door" because we found it the most relevant and useful for us. The Fake Door as a technique "test[s] the Initial Level of Interest (ILI) in a yet-to-be-developed product or service by creating artifacts that suggest that the product exists and it's available to see if people would buy it" (Savoia, 2015). The Fake Door is a great technique and gives a good indicator of the interest with a very minimal investment. Nevertheless, this technique should also be chosen ethically and with care since a non-existent product or service is offered (Savoia, 2015).

Our Pretotyping

As mentioned earlier, the main aim with the pretotyping was to see people's interest in a subscription based, circular cleaning product delivery service. For this, we decided to run a Facebook advertisement. This way, we could target a broad audience, pretending that our service already existed and therefore unbiased see the general interest in our service.

The advertisement should illustrate and introduce the core of the service: An eco-friendly, subscription based, and unlimited cleaning product refill service. The advertisement ran for six days and we set the target audience to the location of Copenhagen, Capital Region of Denmark, and with various interests slightly matching our service. We kept the target age broad, ranging from 22 - 50 years old.

In order to test the interest in our service more critically, we also felt that a price for the subscription was needed to be included in the advertisement. For this, as it is not part of our scope, raw calculations were made in order to define a more realistic monthly subscription fee.

Next to defining the price as well as preparing the specifics of the Facebook advertisement, the design of the advertisement itself needed to be created. For this, and due to the fact that we are both no graphic designers, some time was spent on creating different layouts and designs. After narrowing the selection down to two, we had some designers as well as non-designers vote for one of them in regards to being more positively outstanding and thus more fit as an advertisement. Based on their voting, we ended up choosing the second option in Fig. 38.

Figure 38: Advertisement Options

Figure 39: BySoap Facebook Advertisement

Additionally to the Facebook page and advertisement, a simple webpage (Fig. 40) was created that people were led to when clicking on the link in the advertisement. The webpage explained the situation of it only being a test but also gave them the possibility to reach out in case they have any comments or questions, or would want to be part of further testing. Even though people showed interest by clicking on the webpage, no further contact was made. As outlined earlier, one needs to be careful when choosing the Fake Door as a pretotyping technique and the webpage was our way of being ethical and explaining the situation of it being only a test and that the service was non-existent (yet).

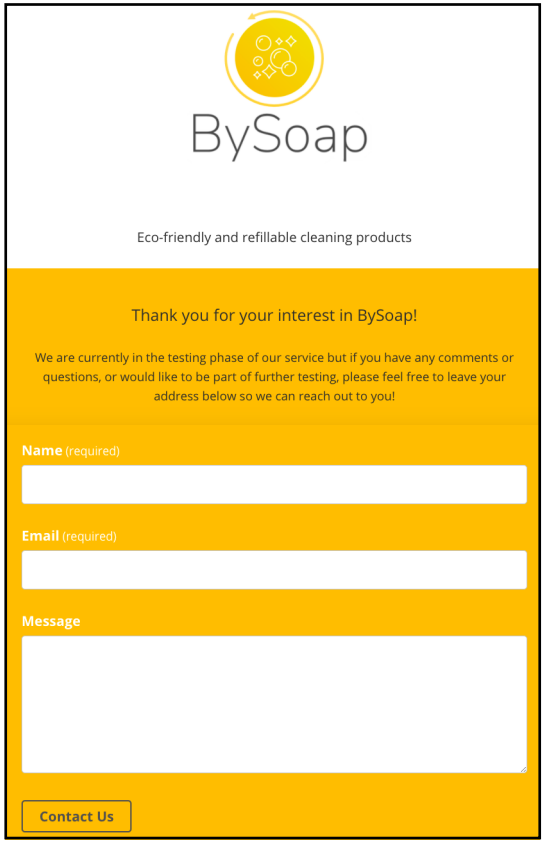


Figure 40: BySoap Webpage

Results of the Pretotyping

After six days, and a reach of 2716 people on Facebook and Instagram, we had 84 post engagements which results in around 3%. This is a very promising result when comparing to "the average click-through rate (CTR) for Facebook ads across all industries is 0.90%" (Irvine, 2020). Another source mentioned that "a good CTR for Facebook ads is between 2-5%" (Albright, 2020) which still validates our results as good.

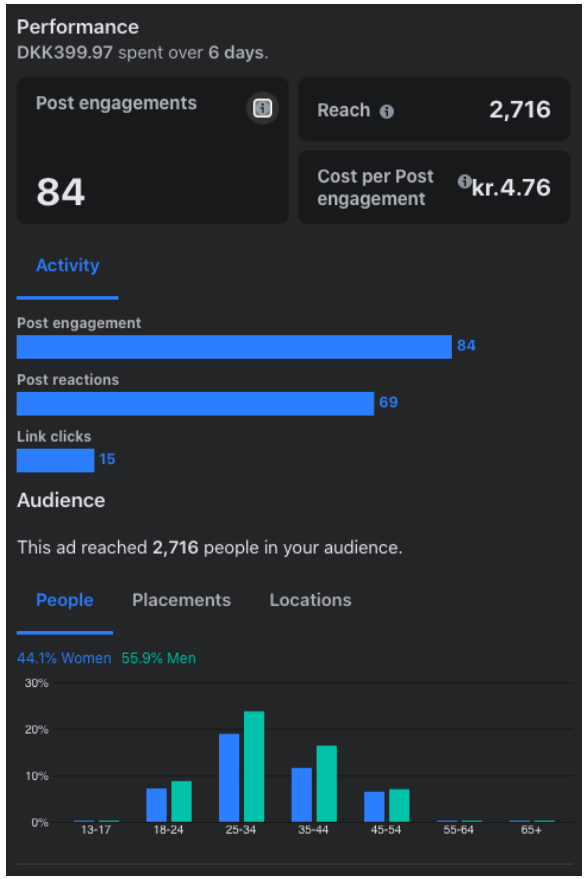


Figure 41: Results of the Pretotyping

Reflection

Generally, the fake door and in our case the Facebook advertisement was a great method to pretotype and test the interest of the subscription based service. Even though the results were great and it gave us good insights and validation, there are certain, general parts and influences we would like to reflect upon.

First of all, the representation of the service itself in an advertisement might affect and influence the engagement a lot which can go both ways, especially since the representation and the design of an advertisement is not in the scope of a service designer. Secondly, forging a service online and in our case on Facebook, meant that a Facebook page needed to be created. The fact that this page was empty with no content, no followers nor likes might have had its influence. Furthermore, the platform used might affect the general perception. In our case, "wordpress" was used to create the webpage which might affect the results, since it is known as a free webpage platform and thus might not be received as serious or legit. Also, somehow our facebook ad did not show our webpage title but "page not found" which unfortunately we did not manage to change.

Generally, we see a great benefit of pretotyping since it can give fast validation with minimum effort and cost. Nevertheless, the points mentioned above, generally might limit the pretotyping outcome. Being service designers means working in a certain scope and pretotyping, especially related to the fake door and creating advertisements and the actual representation of a service, might challenge our scope and other experts such as graphic designers could be beneficial in order to "fake it as good and real as possible".

Testing

Testing the Customer Experience

After pretotyping and validating the subscription based service, we wanted to test the customer experience as part of our concept. The testing, earlier outlined as one of the main constraints, especially in terms of time, was conducted low-fidelity since we already knew beforehand that this was more to support our understanding as well as observe parts of the experience then to really validate it.

One of the main concerns regarding our concept was the fact that people would need to go down in front of their homes in order to get their refill and then carry the filled bottles up again. Thus, this was the part that we wanted to test, not only in terms of timing and feasibility but also in terms of the user experience itself.

We arranged tests with three different people. We scheduled a day with them and gave them a 20 minutes time-frame, in between we would arrive to refill the bottles we had previously given to them. After scheduling the test, a confirmation message was sent.

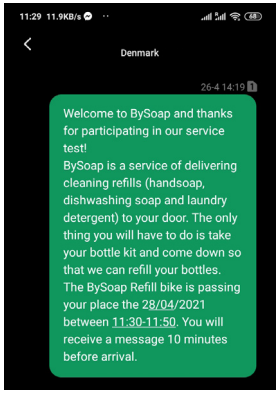


Figure 42: Confirmation Text Message

On the day of the test, a reminder message was sent in the morning. Furthermore, as promised in the first, introduction message, a notification was sent to them, 10 minutes before arrival.

All three participants showed up shortly after we arrived and the refill went smoothly. After they arrived back in their home, a form was sent to them to give feedback. Even though we are aware the feedback form might carry some biases, we wanted to get feedback on their experience and give them a chance to comment on the experience.

Figure 43: Impressions of the Testing

Feedback

Due to the small sample size for the testings - we only had three participants and therefore only had the chance to conduct three tests - therefore, we did not take the feedback too much into consideration but saw it more as a positive or negative indicator.

We decided to start the questionnaire by asking into their general service experience. For this, we used a rating system from 1-6 in order to be able to easily compare the answers with each other and to get an average number for the service experience. We decided on the numbers 1 to 6 so that the participants could not just choose the middle/average number and had to decide whether it was more towards the positive or negative side of the scale. After this, we had two questions asking into both the positive and negative things they wanted to tell us regarding the service experience with BySoap. Essentially we wanted to give them a chance to comment on if there was anything they particularly liked or disliked. As a last question, the full service of it being a refill subscription service for 49 DKK a month was explained and their opinion on why or why not they would buy into this service, was asked. (Appendix 7)

Reflection

As mentioned before, the questionnaire was a little biased since we asked for personal opinions about a service. Additionally, conducting the testing and the questionnaire only with three participants was too little of a sample to actually make conclusions out of it. Thus, the results needed to be handled with care. However, the feedback was overall positive which we took as a positive indicator for the further process of the concept. If there would have been more time, the testing could have been extended and also conducted with more people as well as with people outside our network.

Deliver

BySoap

Final Concept

BySoap is a service in Copenhagen that delivers biodegradable cleaning refills to the user's house. The deliveries are done by bike, and there are different delivery routes that cover the urban area of Copenhagen. The delivery routes and the schedules are fixed.

Through the website or app, the users can check the route and the places where the BySoap Biker will stop to do the refills, these stops are called "meeting points". The meeting points are the places where the BySoap Biker and the user meet, and where the biker refills the bottles that the user brings. The bottles can either be the ones provided by BySoap (bottle kit) for subscribed members but also personal bottles can be brought by not subscribed users to be filled.

There are two ways to access BySoap's service and products: Preferably through a subscription or through the more pricier option of one-time purchase.

Subscription mode

The subscription mode is the core of the service. For a fixed price of 49 DKK per month the user can have unlimited soap refills from the product range of BySoap. When the user registers for the first time, he pays a membership fee and a deposit for the bottle kit. Afterwards, only the membership fee needs to be paid on a monthly basis. The kit consists of 3 glass bottles that the user can use to refill the products. If, at a certain point the user decides to unsubscribe from the service, the bottles can be returned to the BySoap Biker in refund for the deposit.

There are three ways to get the refills as a subscribed member:

1. The user checks (through the website or the app) the fixed schedule of BySoap and meets in the already established meeting point to refill the bottles.

2. The user signs up for a refill on the available dates (through the website or the app). By signing up, BySoap is notified and the fixed route will slightly change so that the bike passes the user's house.

3. If the user signs up for a refill but none of the available dates work, the user can select a specific time and date where BySoap delivers it to the home. This option carries an extra delivery fee and the price is dependent on the user's location.

If, for any reason, the user forgets his BySoap bottle kit, there is a possibility for the user to rent an extra bottle. When the bottle is returned, the user gets the refund. In case a bottle breaks, the user can order a new one and a small fee to cover the costs of the bottle will be deducted from the deposit.

If a user for any reason decides to only subscribe to one or two products the fee will stay the same but the user will only have access to the product refill for the products subscribed.

One-Time Purchase Mode

This part of the service is intended for customers that do not want to commit for a monthly subscription fee, potential users that want to try the products before subscribing, or for occasional buyers. Here the user has to arrive at a meeting point close to his/her address in the

scheduled time and bring his own bottles to be filled. In this modality, BySoap charges per ml. If the customer does not have any bottle it is possible to buy a bottle or the kit for a higher price than the membership customers. When returned, there is a refund.

The BySoap Bike & Biker:

The BySoap bike has a container with the liquids as well as some empty kits in case there are new members subscribing or buying unpredictably at the meeting point.

BySoap has fixed routes. These fixed routes can be slightly modified if subscribed members sign up for a delivery (Fig. 44). The routes are according to the zones of Copenhagen where each day corresponds to a different zone e.g. Monday: Vestebro, Tuesday: Norrebro, Wednesday: Inner city, etc.

The biker is a full time employee from BySoap and is trained to give a good user experience when refilling the bottles. BySoap launches three products: Laundry Detergent, Handsoap, Hand dish washing. All Liquids are biodegradable and produced by Nopa Nordic.

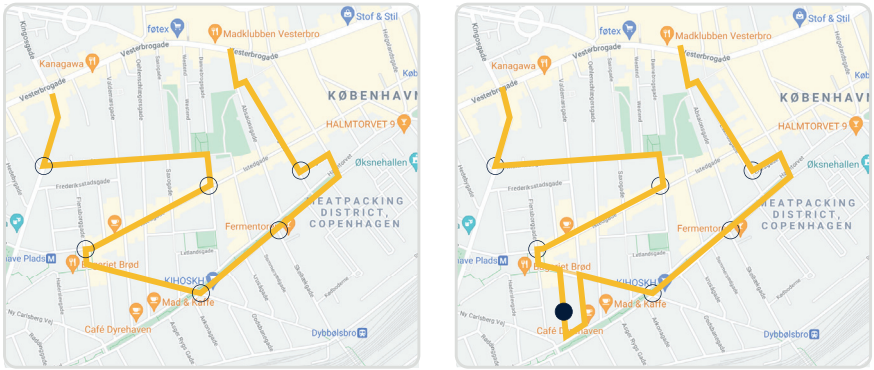


Figure 44: BySoap Initial Route & Modified Route

Subscription vs One-Time Purchase

Subscription - Clean as much as you want	One-Time Purchase
- Free delivery to your home - Kit & unlimited refills - Cancellation of the subscription anytime - Possibility of rescheduling the refills - Notification service - Access to the interactive BySoap biking map	- Access to plastic free soap refills in one of BySoap's meeting points - Pay only for as much as you need - Access to the interactive BySoap biking map

Nopa Nordic

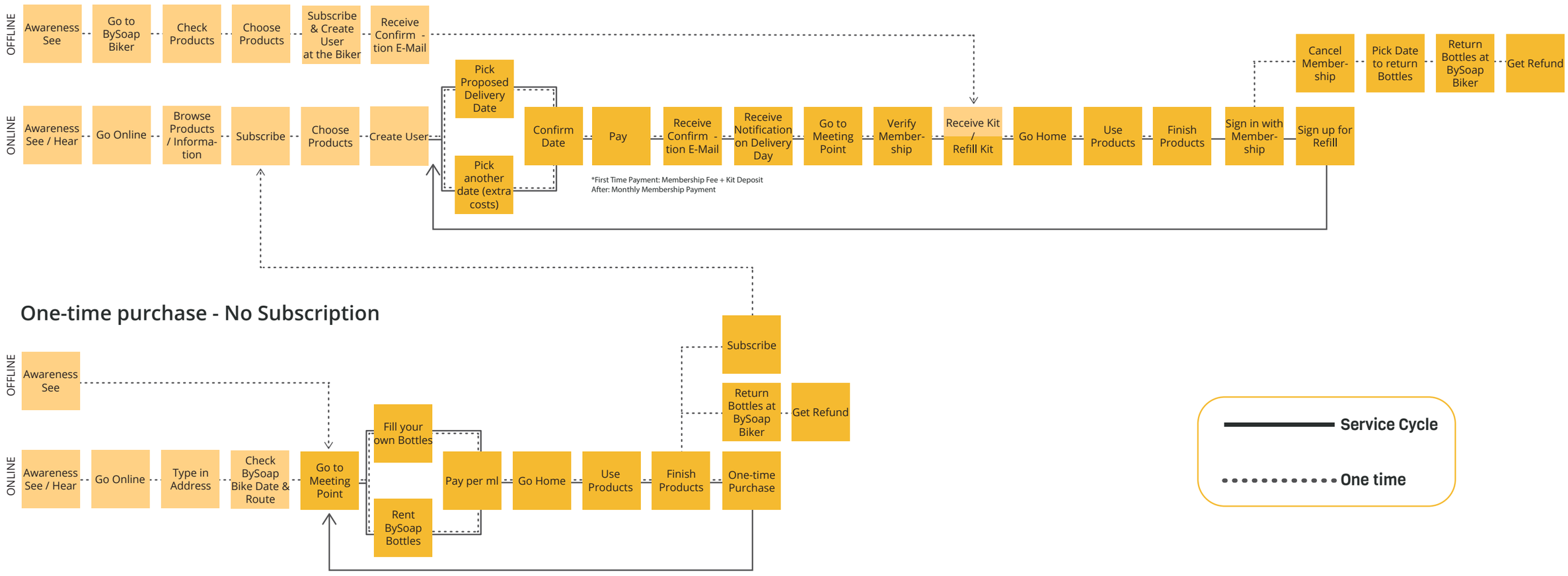
Regarding the soap Nopa Nordic is BySoap's producer based in Jutland. Therefore, the soap needs to be delivered by truck to Copenhagen which causes CO2 emissions. However, due to the fact that cleaning products usually consist of over 90% of water (Ellen MacArthur Foundation, 2017c), it was decided to leave out the water and have it delivered in concentrated form. This way, CO2 emissions can be kept as low as possible. The concentrated soap is then mixed up with water at BySoap's headquarter and delivered by bike to the users. The container used for delivering the soap is returned to Nopa Nordic when empty in order for them to reuse.

User & Biker Journey

Subscription & One-Time Purchase

Illustrating the different user journeys helped to create a clearer overview of the different possibilities of interactions the user might have with BySoap. Next to illustrating the user journey, also the biker journey was mapped out in order to easily communicate and showcase the BySoap Biker's journey.

Subscription



One-time purchase - No Subscription

Biker

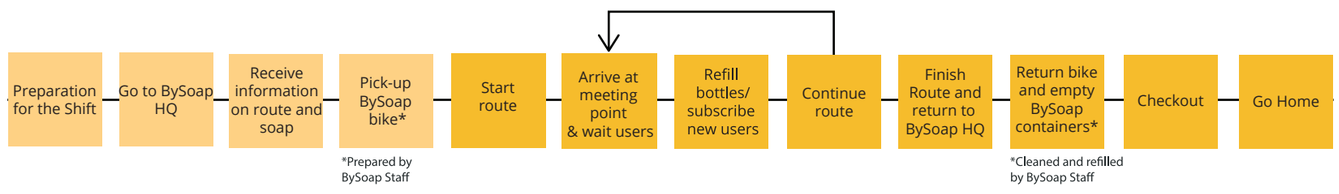


Figure 45: User & Biker Journey

Wireframes

User Journey Online Subscription

Next to illustrating the different user journeys, the tool of wireframes was used to further explain the journey through a schematic and graphic visualization. Due to its purpose of mainly explaining the journey with another tool, the wireframes were kept in rather low-fidelity and not too detailed. Moreover, even if illustrated as an app, the same layout would apply to the BySoap website.
The following wireframes illustrate the user journey when subscribing to BySoap.

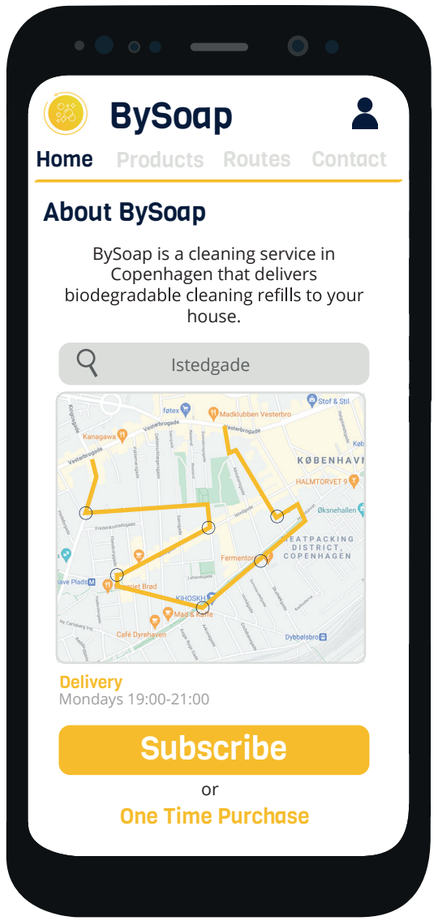


Figure 46: User Journey - Wireframe 1

In the “home” screen, the user has the possibility to type in his/her address, in order to see the BySoap route with its meeting points, the scheduled delivery day for that area and expected time frame. This way, the user can see BySoap’s schedule before subscribing and can decide whether this schedule fits or not.

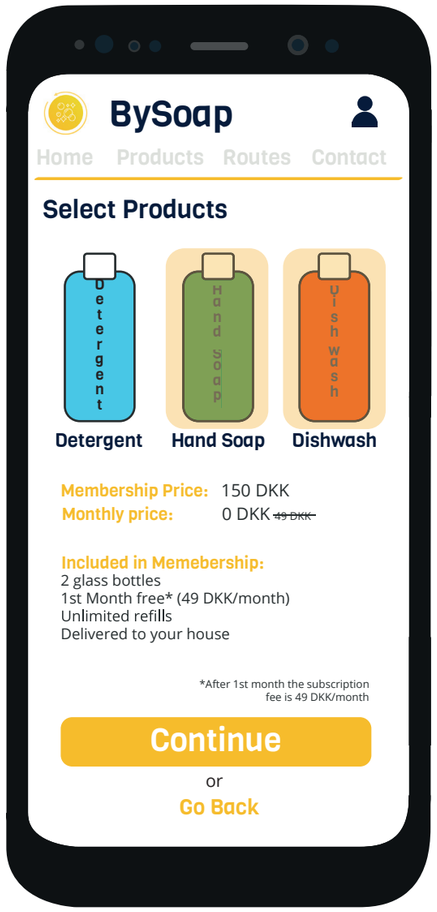


Figure 47: User Journey - Wireframe 2

After selecting to subscribe, the user can select the desired products and the membership price adjusts accordingly.

When subscribing, only the membership fee needs to be paid and afterwards, only the monthly subscription fee of 49 DKK is charged.

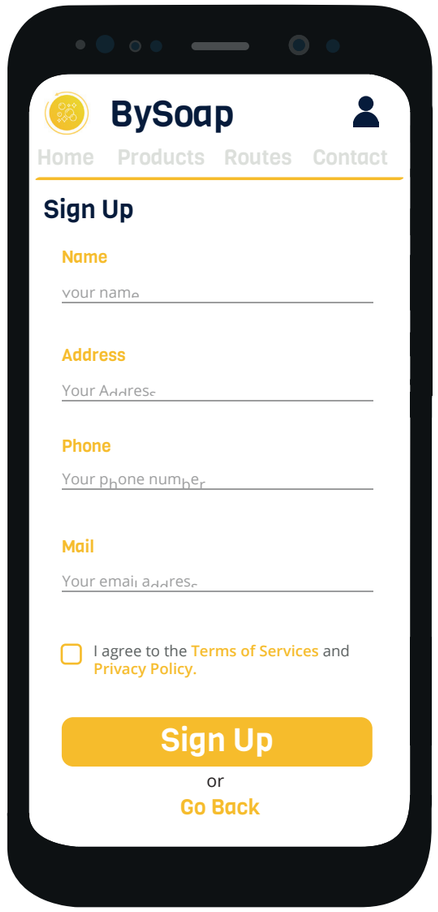


Figure 48: User Journey - Wireframe 3

When clicking the “Continue” Button, the user signs up by creating a user. Here, personal information asked is mainly used in order to schedule the delivery as well as sending confirmations and notifications.

Wireframes

User Journey Online Subscription

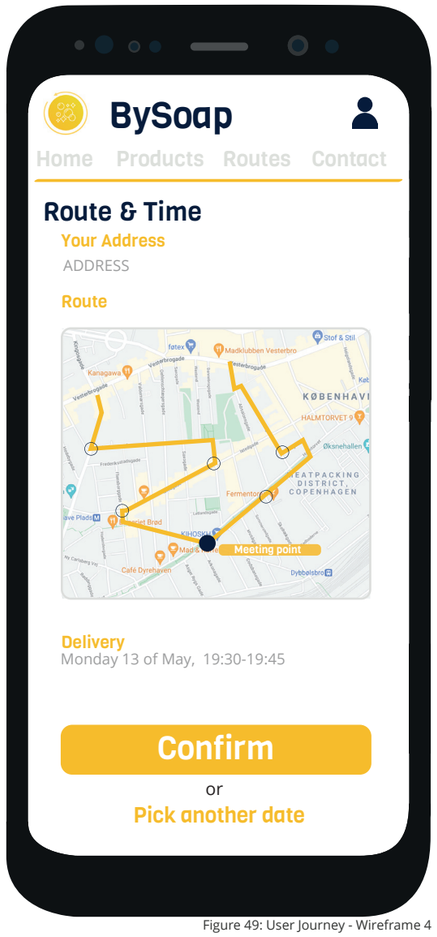


Figure 49: User Journey - Wireframe 4

After creating the user, the BySoap route is shown once more but this time, according to the user's given address, the closest meeting point, the scheduled delivery day and accurate time (15min time frame) is shown. The user can check the route and time again, change the meeting point and confirm.

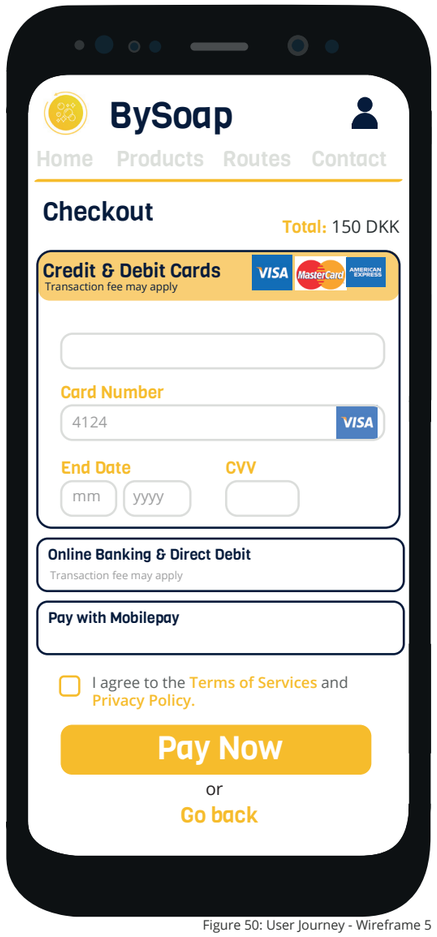


Figure 50: User Journey - Wireframe 5

The user confirms and checks-out by providing the card information. This information will be stored and used for the monthly subscription fee.

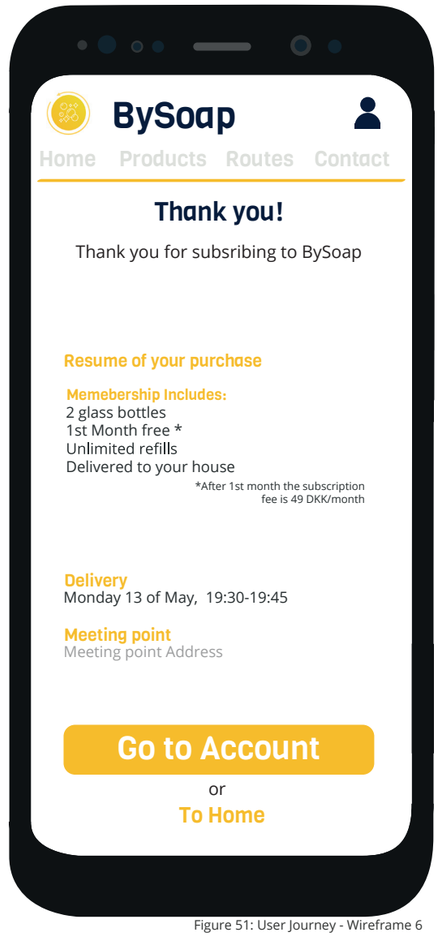


Figure 51: User Journey - Wireframe 6

A confirmation screen is shown, confirming the ordered products and the date, time and meeting point to pick the products up. The user can now choose to go to his/her account to go back to the home screen.

Wireframes

Ordering Refills

After the user has signed up and subscribed to BySoap, the user can easily reorder by entering the profile. The following wireframes illustrate the user journey for subscribed members that want to order a refill.

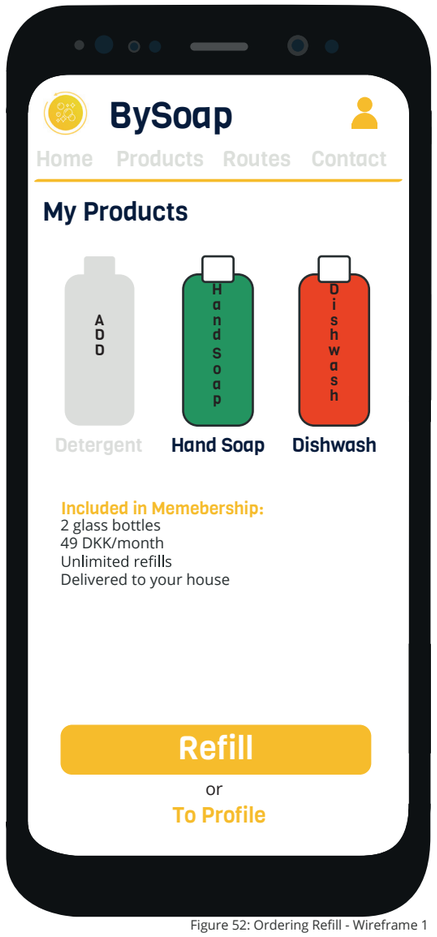


Figure 52: Ordering Refill - Wireframe 1

When entering the profile, the user sees the products he/she is subscribed to and all the belonging information. Here, the user can add products, change and/or cancel the subscription, and reorder refills by clicking the “refill” button.

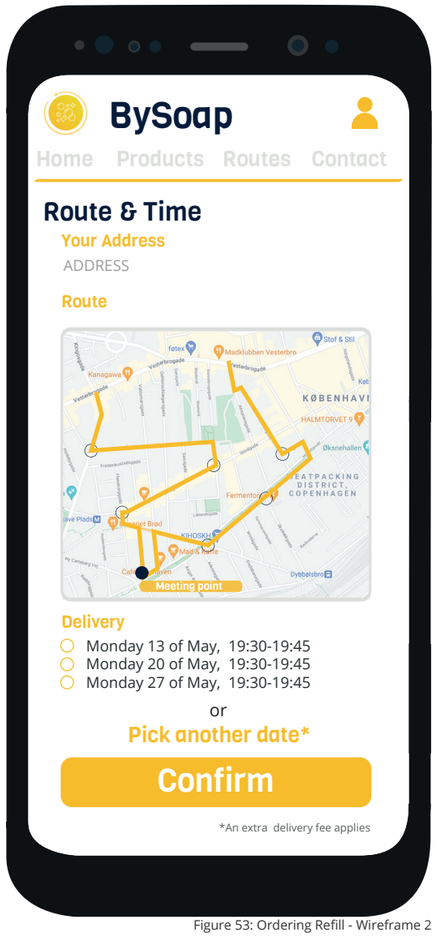


Figure 53: Ordering Refill - Wireframe 2

By clicking the “refill” button, the user accesses the screen with the dates and times of delivery, suggested by BySoap. Here, the user can either select one of the suggested dates or - for an extra delivery fee - pick another date.

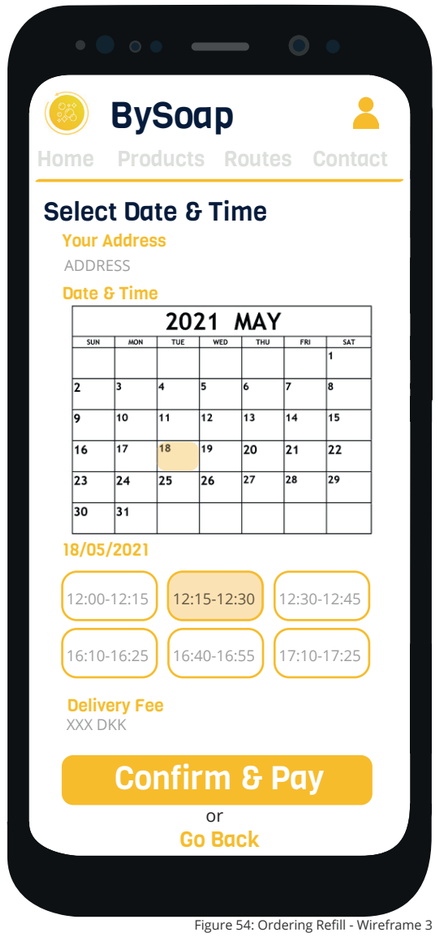


Figure 54: Ordering Refill - Wireframe 3

If the user decides to pick another delivery date (outside of BySoaps scheduled delivery) the user gets to choose both the desired date as well as the time. An extra delivery fee is added and the user needs to confirm this by clicking the “confirm and pay” button.

Wireframes

General

The following wireframes illustrate the menu of the BySoap app and/or website, and each wireframe presents another window.

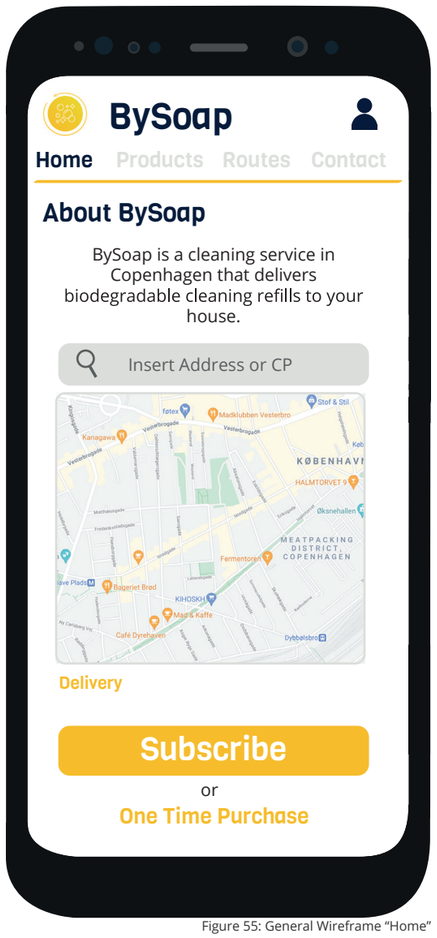


Figure 55: General Wireframe “Home”

Home

The screen where both subscribed and new potential users can see information about BySoap and a map. By typing in the address, the BySoap route with its meeting points and delivery schedule is presented.

Figure 56: General Wireframe “Products”

Product

This screen shows all the available products. These products can only be ordered through subscribing.

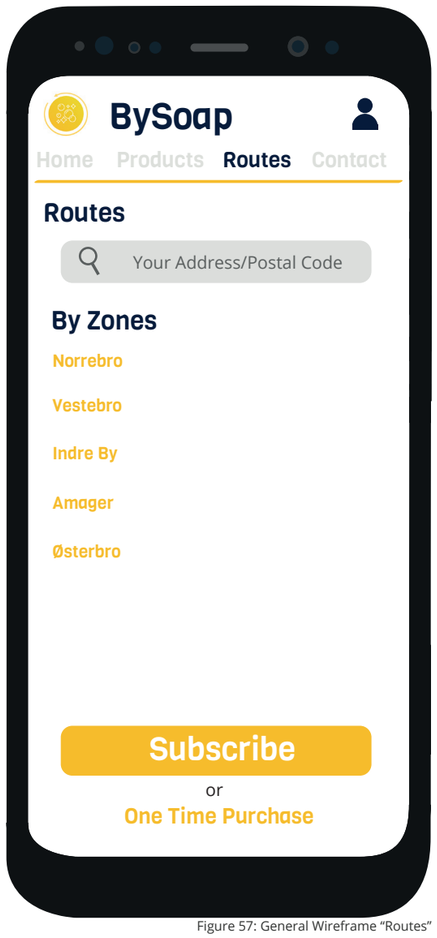


Figure 57: General Wireframe “Routes”

Route

This screen shows in which areas BySoap operates in. By clicking on a specific area, the BySoap Route and the delivery schedule is shown.

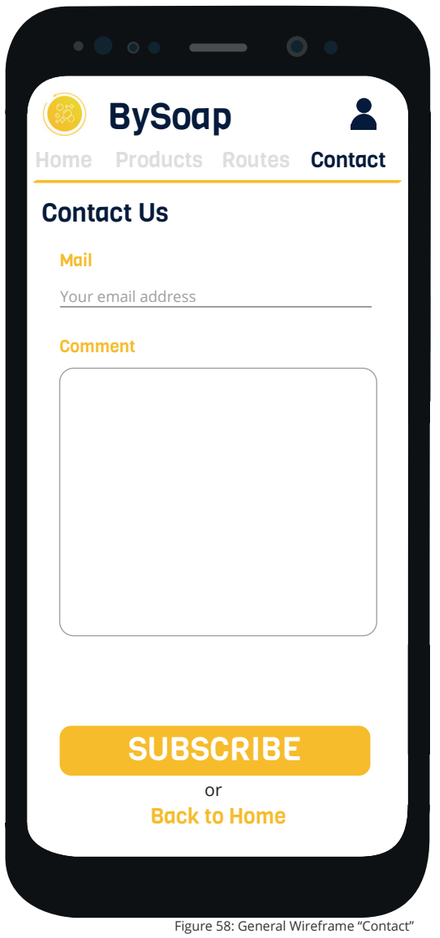


Figure 58: General Wireframe “Contact”

Contact

This is where BySoap can be contacted in case of questions, technical problems, complaints, or any other comments.

Maps

The following part is representing BySoap from a systems perspective. For this, different maps were used as tools to showcase and illustrate different aspects of the service.

Ecosystem Map

In order to understand the ecosystem around BySoap, all the important touchpoints, service providers, access providers and the infrastructure were mapped out. The ecosystem map ensures an understanding of all the actors and touchpoints involved and they have been grouped according to their characteristics.

System Map

Mapping out the system of BySoap supported and ensured that all touchpoints and interactions were well considered. In order to give a better overview, two system maps were created, one illustrating the material flow and the second one showcasing the information flow. The added numbers and letters should help explain the different flows but it needs to be noted that they are not in chronological order and thus the outlined flows might not follow each other but happen simultaneously.

Blueprint

Blueprints ensure a holistic and detailed understanding of the service as well as the backend- and frontend actions. Therefore, a blueprint surrounding the user's actions was created. This blueprint involves the user's first interactions with BySoap (one-time only), the subscribing as well as the refiling - the circular part of the service.

Additionally, due to its importance when working circularly, also the take-back system (reverse logistics) got mapped out in the blueprint.

Circular Business Model Canvas

Even if not completely in the scope of this thesis, we decided to use the tool of the CBMC in order to represent the designed PSS and all business aspects in one page and as a whole. Filling out the components helped not only to clarify certain parts of the business but having to phrase them, supported the communication part around the business and gave a good overview.

Ecosystem Map

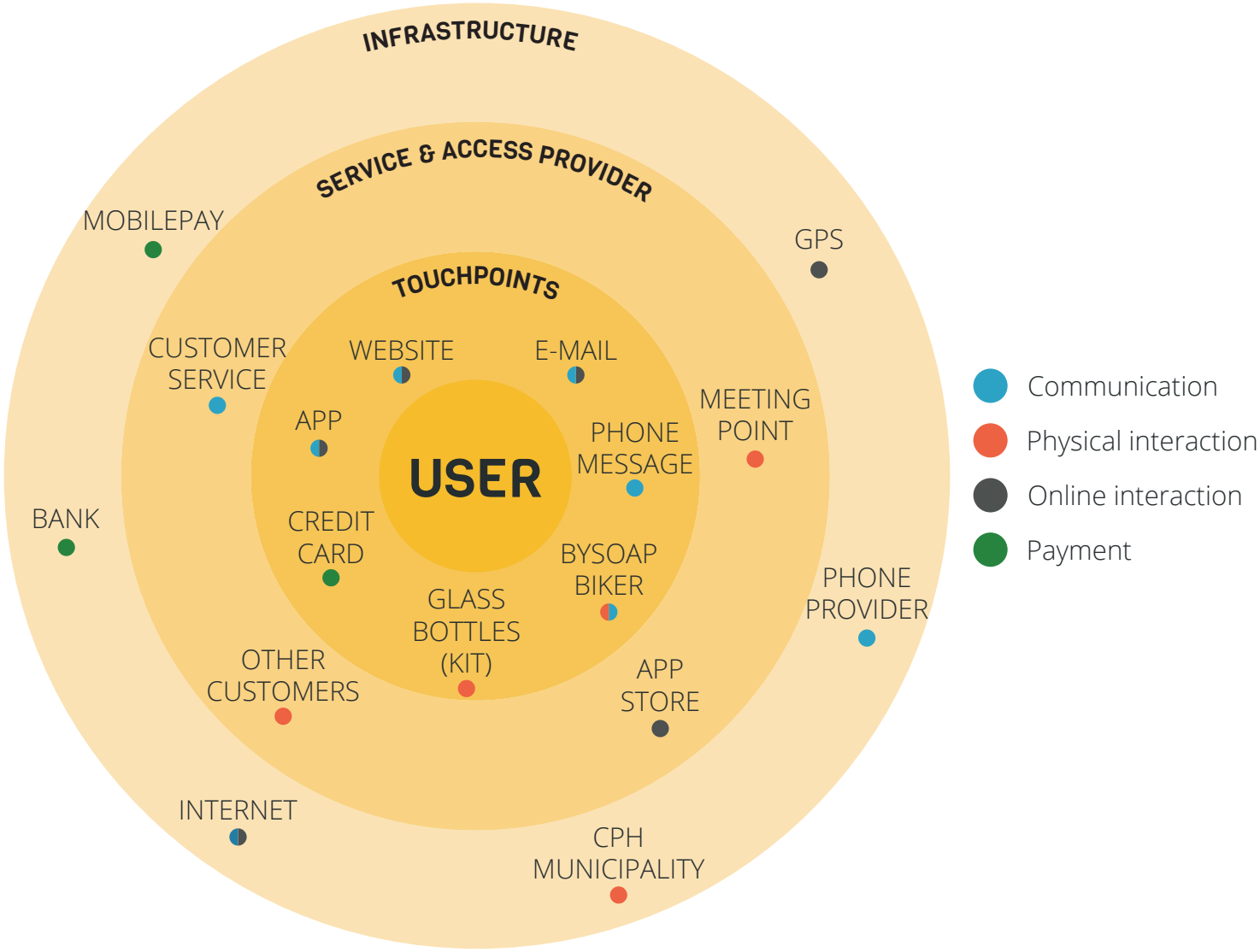


Figure 59: Ecosystem Map

System Map - Material Flow

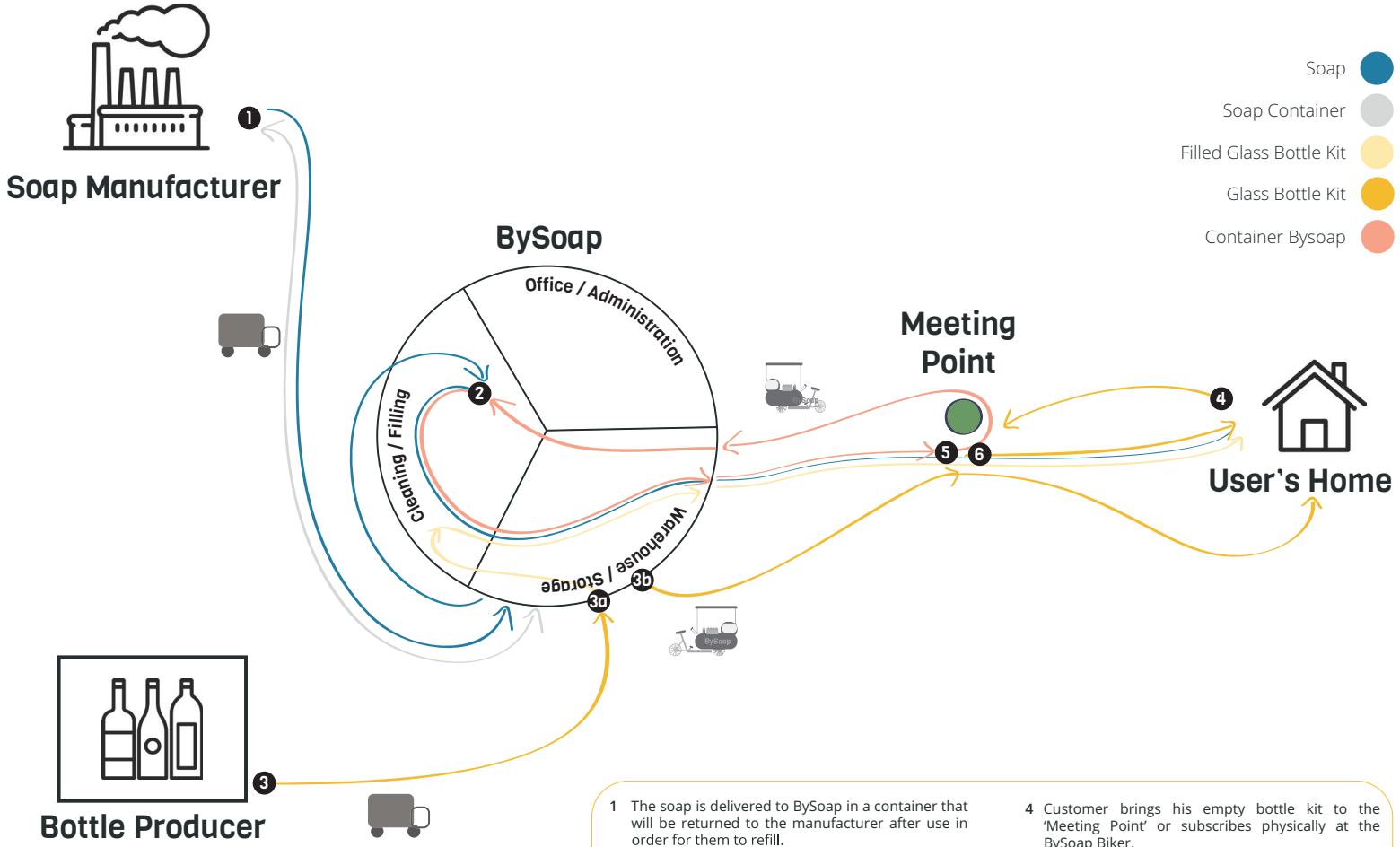
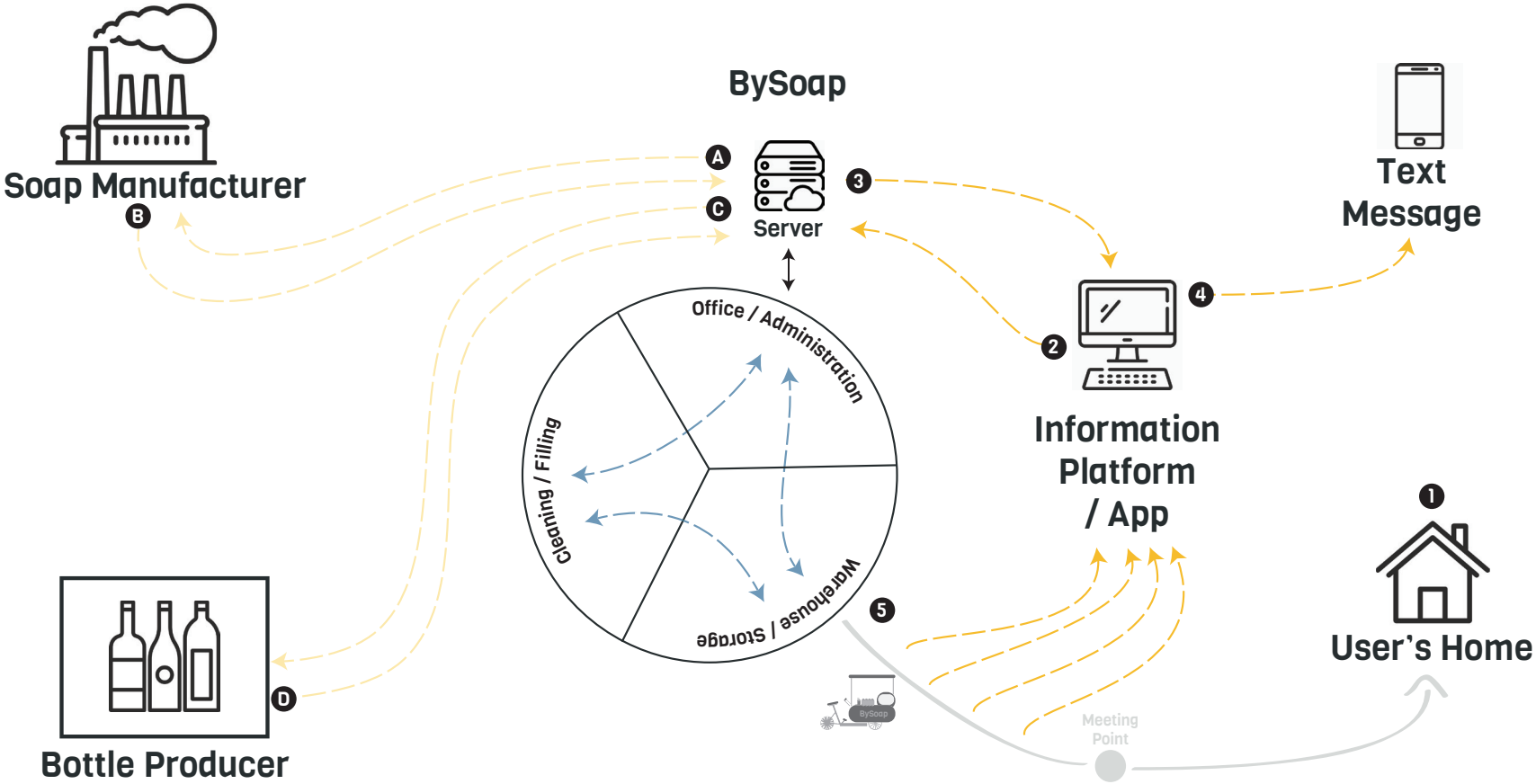


FIgure 60: System Map - Material Flow

System Map - Information flow



Information Flow: BySoap - Factory

- A New orders (Soap)
- B Status update / Tracking
- C Order products (Glass Kit)
- D Status update / Tracking

Information Flow: BySoap - User

1. Subscribe / Log in / Data / Order
2. Order / Payment
3. Information / Route Map
4. Information / Reminder
5. Live Tracking of BySoap Biker

Internal Communication

Figure 61 : System Map - Information Flow

Blueprint

Online Subscription

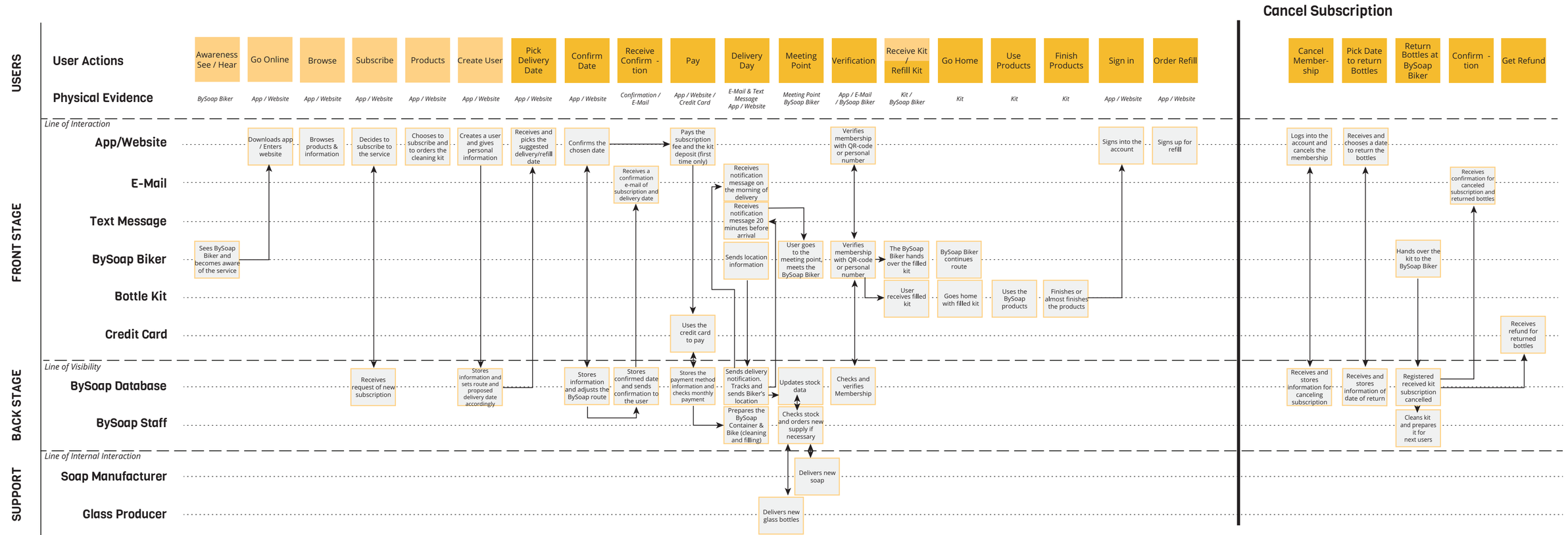


Figure 62: Blueprint

Circular Business Model Canvas

Introduction

The Business Model Canvas (BMC) by Osterwalder & Pigneur (2010) is a great tool to explain one's business in a simple and clear way, using a single page only (Get2Growth, 2021). Lewandowski (2016) investigated the BMC with the perspective of CE and identified the two missing components when it comes to circular businesses: The adoption factors and the take-back system. Accordingly, he extended the original framework by adding these two components and developed the Circular Business Model Canvas (CBMC) (Lewandowski, 2016). Due to their importance when working circular, they have been outlined as well as used to deeper analyze our case below:

Adoption Factors

Adoption factors are reasons why customers might reject a circular BM and thus a company needs to investigate and counteract them (Lewandowski, 2016). The adoption factors can be divided into two parts - the internal and external factors whereas the former relates to the organizational capabilities that are needed to shift towards the circular BM and the latter relates to the political, economical, social, and technological factors (Lewandowski, 2016).

Due to the fact that we work with a start-up, the internal adoption factors are not that critical since everyone working for and with the company knows what the company is about and accordingly accepts how the company operates. Thus, internal adoption factors might be more relevant if an existing (linear) company changes to more circular processes as well as when more stakeholders are involved. Investigating the external adoption factors, the sociocultural factors relating especially the customers, have a significant influence on the success of BySoap. The customer acceptance is likely to be the most important adoption factor, since the customers are the ones providing revenue for BySoap. Customer acceptance in our case means making them switch from the traditional way of buying cleaning products in a store to subscribe to a service offering refills. The switch goes from previously owning to the new value proposition of access-based consumption. Additionally, political adoption factors are worth mentioning since political actors can encourage the demand for our service as well as providing financial support (Lewandowski, 2016). Adoption factors can either be motivating or hindering customer acceptance and in the case of BySoap, as service designers, we tried to minimize if not remove the factors that might hinder customer acceptance by creating a motivating, convenient, user- and environmental-friendly PSS.

Take Back Systems

Take-back systems are an important part of circularity and ensure that companies keep ownership of products and thus be able to keep the value of the products as high as possible at all times (Sönnichsen, 2020). At BySoap, the incorporated take-back system relates to the glass bottles (kit), which can be borrowed by the users to refill their cleaning products. If the user decides to cancel the subscription, the bottles can and should be returned to BySoap where they are going to be cleaned and reused for other customers. The return is incentivized by BySoap putting a deposit on the bottles, which the users will get refunded after returning the bottles to the BySoap Biker. In theory, the glass bottles can be used endlessly and by many different customers and even though BySoap does not have an end-of-life strategy developed yet, the glass bottles will be reused in one way or another, and thus will not be discarded.

Circular Business Model Canvas

Partners

- Factory that produces soap: Nopa Nordic
- Possible future partners: CPH municipality, physical stores, kiosks, glass recycling places, etc.

Activities

Provide access to soap and delivery to the house. Unlimited refills and no packaging - weekly & scheduled

Resources

- Glass Bottles
- BySoap Bike & Biker
- Refill System
- BySoap Staff
- Soap

Value Proposition

Circular PSS

Zero Waste

Providing access to Soap

Take-back System

Competitive Price

Unlimited Refills

House Delivery

Customer Relation

Personal Assistance

Future add-on: The more users subscribe, the cheaper the service gets & Community Building

Channels

Facebook, Instagram, Webpage, App, Physical Bike & Biker

Take-back System

- **Incorporated Reverse Logistics**
- **Reuse of glass bottles**
- **Future add-on: Recycle users other glass waste**

Customer Segment

- Families
- Couples
- Singles
- Flatshares

Cost Structure

- Fixed costs – monthly subscription
- Value driven

Revenue Stream

Monthly subscription fee
One time purchase possible
Extra charge for flexible delivery
Future add on: The bigger the community, the cheaper monthly fee gets

Adoption Factors

Hindering: Customer acceptance , Motivating: Possible political encouragement and financial support

Figure 63: Circular Business Model Canvas

Case Reflection & Future Ideas

Case Reflection

The case study for this thesis brought up some new and challenging parts into the design process. As a service systems designer, the focus is usually put fully on the user but in this thesis project, the focus was not only on the user but also the environment. It was challenging at times to keep a balance between two focal points and it happened sometimes that the focus was put too much on one side. Here, both our internal supervisor as well our external Mentors guided us well back into balance.

Working on a real case project, especially with a start-up, the economic aspect will always be an important part, and the fact that circularity does not come with a low economic price, make it challenging sometimes. This thesis project helped us to realize practically how much the reverse logistics actually influence the company, and especially its economic department. However, due to the start-up owner being fully engaged and interested to start a truly environmentally-friendly company, easened this challenge.

This thesis project started with the aim to create a circular PSS around cleaning products but along the process, we realized that this start-up had the potential to be created without generating waste which was very interesting for us. A challenge within the concept of CE is that as a company, you cannot fully ensure how the user handles your products nor the waste. Therefore, deciding to develop BySoap as a zero waste PSS but still keeping a good user experience was challenging but exciting. We are convinced that we managed - in a balanced way - to create a convenient service, both in regards to the user experience as well as with a low environmental impact, creating a unique and strong circular value proposition.

However, due to the time frame of this thesis, our final concept of BySoap, which was explained above, was still in its beginning phase and other, near and far future implementations were considered throughout the process and thus wanted to be mentioned here.

Future Implementations

The App
A small implementation that could actually already be implemented for the launch of BySoap would be that in the webpage and in the app there could be a track of how many plastic bottles are saved. This tracker could not only show the user's private accomplishment of bottles saved by using the service but also BySoap's accomplishment as a community. This add-on could be especially useful for marketing as well as for a better user experience in regards to empowering gratification.

Product range
The first and near future implementation should be to expand the range of products from BySoap. This implementation is relatively easy since the producer Nopa Nordic can manufacture a wide range of products. The next products could either be a variation from the current ones, e.g adding different scents as well as offering non-scented products, or adding completely new products, e.g. shampoo, glass cleaner, etc. In case of doing the latter, before launching the products, there should be market research done in order to see which product fits best and is most probable to be accepted by the current user and at the same time expands and attracts new users. This future implementation is expected to be implemented between 3-6 months from the launch of BySoap.

Scalability
This implementation aims to cover more areas of Copenhagen, increasing the frequency of delivery times (especially after expanding the product range mentioned just before), adding more routes as well as expanding to other cities of Denmark.

This implementation is directly dependent on the acceptance of the users, and if the company experiences economic growth.

It is important to mention, that since BySoap's core values are within circularity and sustainability, this implementation is not seen as a priority but rather as an opportunity to scale a well functioning and circular system but only without compromising the circular and sustainable elements and solutions we offer.

Broaden its Accessibility
Another future implementation that we consider should be addressed is to have a physical selling point. This selling point could be either a vending machine, a physical store or a collaboration with stores to sell our products. As for now, we consider the vending machine to be most attractive since it is automated and an original concept. Furthermore, it combines quite well with the first planned implementation of BySoap introducing more products. The vending machine could be places in strategic positions to reach new potential users and where there is a lot of pedestrian traffic.This implementation depends on many factors like the acceptance of the concept, economic growth, but also permits and feasibility.

Collection of Glass
This implementation should strengthen the vision of sustainability and would work as an add-on to the current service. This addition would consist of offering the service of collecting the glass waste from our users when they refill the bottles. This idea came to our minds during the ideation workshop when we brainstormed if we could somehow, with our BySoap service, solve more than one problem for the users to make it even more attractive. In Copenhagen, glass waste containers are usually not placed inside the apartment buildings which means in order to recycle, people have to go to certain places in order to discard their waste. This inconvenience might lead to people discarding their glass waste in the normal and not recycling bin.

Therefore, and since BySoap uses glass bottles, there would be potential in offering an add-on service of picking the glass waste from our users, and having a collaboration with either the Copenhagen Municipality, or directly with some glass recycling company or glass producer.
This idea is in its very raw and beginning phase and therefore is yet to be researched further, and thus has no specific set plan to be incorporated.

Membership fee reduction
The idea for this implementation comes from the concept of decentralization, inspired somewhat in how the value of cryptocurrencies are perceived and set. In other words, the more members BySoap gains, the cheaper the monthly fee gets.

The most expensive cost for BySoap is the delivery service and thus, the most beneficial scenario for BySoap would be to have users in the same concentrated area. The cost of delivering products to someone in Nørrebro and then Vesterbro is much higher than delivering to more people in the same area, or even better in the same street, or apartment building. Therefore, in order to foster a concentration of users in the same area, we thought of a strategy of decreasing the monthly fee of current users if new members that live near them subscribe.

With this, we firstly try to encourage more people to use BySoap, as well as to incentivize the current members to promote BySoap by word of mouth not only because they hopefully like the service but also because they will benefit if more users join. Secondly, with this idea, we seek to create a sense of community that shares to be part of a movement towards sustainable and circular change, where people are empowered and their actions have direct, positive impact not only for the environment but also on their wallets.

This idea is in its very initial stage, and many elements would need to be researched further if wanting to implement. Nonetheless, we consider that the core of this idea has a lot of potential and if done properly it could be a perfect case of both incentivizing as well as empowering people, circular and sustainable projects.

Community Aspect
As touched upon many times in the above ideas of implementations, emphasizing on the community aspect we see as a great potential for BySoap to support the shift towards circularity even further and therefore we would like to highlight as well as summarize the above mentioned points. Adding the community aspect can happen in various ways and both online as well as offline. As mentioned, the implementation of telling the users the accomplishments achieved as a

community can have great impact and can create a sense of belonging to a certain movement. We also find it important to acknowledge and point out the importance of further researching and adjusting the offline meeting point where users not only meet the BySoap Biker but potentially also other users. This point of physical interaction should further be investigated as it could support the community aspect a lot. Furthermore, the idea of implementing a price reduction when more than one in the apartment building signs up, fosters the community building even further.

Transformative Implementation
A more ambitious idea that came up during the process, that could actually be more like a transformation of the original concept, was to transform into a circular logistic service consultancy.

This idea could be implemented in two ways, whereas some aspects overlap.

The first way would be to adapt the BySoap service concept to other products that generate a lot of waste and that are consumed on a frequent basis such as for example milk, coffee or diapers. Here, we mean to rethink the current way users access these products and consequently transform and innovate new, circular and sustainable ways.

The second way, touches upon many points of the previous one, but instead of creating a separate service for each specific product range, and thereby creating our own products, we would reach out and form collaborations with existing companies. Here, BySoap would transform into a consultancy agency to promote circular economy and sustainability to other, already existing companies. BySoap could consult and provide the organizations with logistic services in order to minimize barriers for the companies to switch over to a circular value proposition. Instead of providing products in a circular way, the concept of circularity would be provided as a service. For this, we would consider companies that are already selling sustainable products, but still use the traditional and linear way of selling.

Both of the above outlined implementation ideas, that are somewhat more of transformative concepts, were considered as a reflection on how to have a greater impact on the shift of organizations and society into a more circular lifestyle.

08 Conclusion

Conclusion

This thesis explored the hypothesis that service systems design, and designers can be important agents of change towards sustainability in product-service systems. More precisely, it was explored how service systems design can add value into a circular product-service system, so that it is as convenient and user-friendly as the linear counter product. This was exemplified through the case study of a circular start-up, where the collaboration and co-designing let us explore the design process practically.

Throughout the research we concluded that in order to create both a circular and thus sustainable product-service system as well as an attractive and convenient service for the user, the usual approach needs to be adjusted. Unlike the usual service systems design processes, where there is a user centered approach, it was necessary to add the environmental needs at the same hierarchy as the users.

Our research question evolved throughout the process mainly due to the fact that the start-up was just in the beginning phase. Accordingly, there was a great opportunity for exploring, co-creating, and ideating as well as exploring and using different relevant design tools along the process.

Understanding the complexity of sustainability was vital in order to create an effective circular product-service system, and thus the literature focused mainly on the concepts of sustainability, circular economy and co-design. The latter especially focussed on how designers can be important change agents when working with sustainable projects.

By doing extensive user research in connection to the topic of cleaning products, sustainability and circularity, the start-up could be supported with the found insights. The research helped to understand and empathise with the users and thus we could ensure to meet user needs and expectations already from the very first decisions within the start-up and throughout the whole process of co-designing the final product-service system. Furthermore, the fact that service designers work quite holistically, helped to keep an overview and thus present and illustrate all the different possibilities to the start-up including discussing and explaining which path would be the best to take not only for the company but also for the user and the planet.

Working interdisciplinary is especially important within circularity projects since many different aspects need to be considered as well as usually, many stakeholders are involved. Thus, having the ability to keep an overview and general understanding, and being able to visualize and communicate it, is of great benefit.

The concept of the circular economy proposes new ways of handling products and services and thus, a mindset and behavioural shift from the users perspective is inevitable. Service systems design can support if not even push the users to this shift by making the experience of the newly created value proposition convenient and smooth. In this thesis, the behavioural change was not in focus but understanding and empathising with the potential users as well as their surrounding system was incorporated. This inclusion was necessary in order to support designing and creating new solutions for a more sustainable future that at the same ensure customer satisfaction and convenience. Furthermore, having a clear and simply outlined communication, and thereby having everyone understanding how the newly proposed service system works, might remove further possible barriers.

Having not only the user but also the environment - especially through the concept of circularity - in the center of our design process, created whole new opportunities, motivations and thus created a completely new scope when designing a service. Suddenly, different factors needed to be considered and prioritization needed to be done in a different order. This, in combination with working with the start-up, brought up completely new challenges and thus also learnings.

To sum up, this thesis was a great hands-on project, where we could use our service systems design knowledge in a new way, combining and applying it to support and co-create a circular product-service system. For us, service systems design adds subtle but precious and indispensable value to services and thus should play an important role when working with the circular shift in order to create a successful and positive change.

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