

SERVICE MODEL FOR THE ADOPTION OF WASHABLE DIAPERS

Master Thesis by Carolijn Schrijver
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Preface

It is my ambition to become a designer that enables people to create a better future. I want to break away from using design as a tool to encourage consumption and use it to help people to make the choices that will make them, their loved ones, their communities, and all the people they have never met, happier.

This report has been made on request of the future diaper project, a foundation committed to rethinking the future of diapers. I would like to thank them and all people who have supported me with their expertise and encouragement.

Executive Summary

Research

Disposable diapers require a large amount of new material and put a large pressure on Dutch waste disposal services. Washable diapers are a cheaper and supposedly more environmentally friendly alternative to disposables. Yet they are a niche product. This project aims to design a product service for Toddy to increase the acceptance and adoption of reusable diapers.

After doing desktop research, semi structured interviews were done with current users and employees of day-cares who either use washable diapers or had used them in the past to see how washable diapers were purchased, used and perceived.

After gathering existing information and a series of in-dept interviews two main reasons were isolated: Unfamiliarity and unreliability. It was decided to focus on unfamiliarity.

Several ideas were generated and evaluated. This process was structured by focussing on Rogers' theory of diffusion and finding solution principles. These are used to eventually find concepts and select the most viable one to develop further in the design phase.

Result

The baby gift box (Doorgeef doos in Dutch), is a product service combination that introduces families to washable diapers by offering diapers in a pregnancy box together with other reusable baby products for a reduced price. This box gives access to information on how to use the diapers and can be passed on to a friend or family member in the future.

The idea behind the final design is to conceptualise the box as a blank slate that people can decorate and personalise themselves. This way the box visually shows its legacy, reminding people of the shared responsibility of taking care and passing on the box. The simple cardboard box also fits within todody brand identity, the design can be implemented quickly and is relatively cost effective.

The aim of the baby gift box is to get people to eventually buy a full washable diaper set from Toddy. Therefore, the gift box is made to guide people through the acquisition process. The box focuses on familiarising people with washable diapers by creating awareness of the product during the orientation phase and creating practical experience during the try-out phase. This is also done by linking the gift box to existing products and services provided by Toddy. To show the underlying process that facilitates the baby gift box, a service blueprint was made.

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1 PROJECT OBJECTIVE

1.1 Diapers in the linear economy

A lot of raw material is used to fulfil human needs in our linear economic system. We take, make and waste. Currently, environmental pollution is excessive and waste production is massive. If we continue with business as usual, the earth will be exhausted eventually.

If we want to create a fully circular economy in 2050, like the Dutch government aims, we need to rethink our relationship with single use products that cause a lot of waste. In the Dutch government-wide program on circular economy the statement has been made to reduce residual household waste to a maximum of 100 kg per person in 2020 and 30 kg in 2025 (Ministerie van Infrastructuur en Waterstaat, 2016) (see figure 1). In 2019 incontinence materials were responsible for 7.9% of the total

residual waste production of households. One of these products is diapers. An average child in the Netherlands wears 5300 disposable diapers until it has developed full control of its bladder at the age of 3 (Ten Grotenhuis, 2021) (Vermandel, 2017) and about 200 to 300 kg of disposable diaper waste is created per child annually (Rijkswaterstaat, 2021) (Milieu Centraal, n.d.). 40 to 60 kg of this waste is non organic material like super absorbent polymer and plastic and cellulose pulp (Colon, Sanchez, Gonzalez, & Puig, 2010). This highly polluted mix of organic and inorganic material is of very low value and is currently mainly incinerated, resulting in carbon emissions, loss of valuable materials and putting a significant burden on the Dutch waste management system.

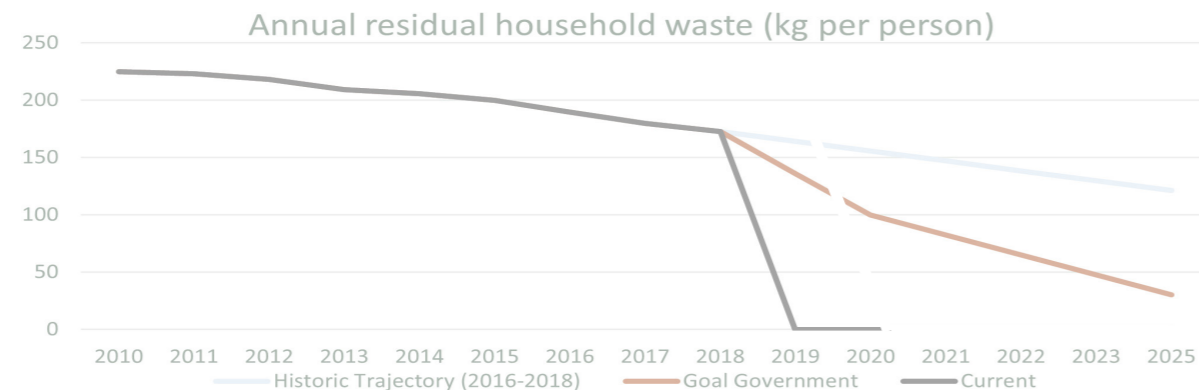


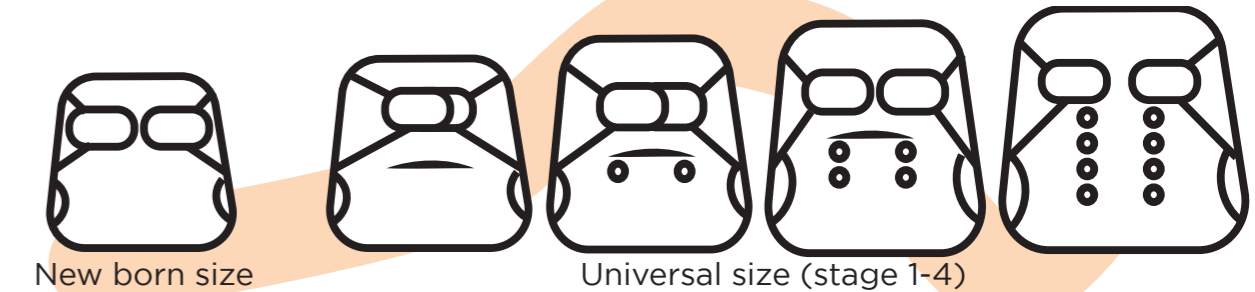
Figure 1: Annual residual household waste, based on the afvalmonitor databank and a linear projection (Rijkswaterstaat, 2021)

1.2. The alternatives

The government, municipalities and consumers are looking for alternatives that produce less waste and are more circular. Most focus is on recycling diapers, but current examples (like the RECALL project in Italy which costed 36 billion euros and has been fully funded by the EU) show that recycling is expensive and only able to recover a couple of valuable materials like high-quality cellulose and speciality plastics (Eco-innovation, 2018). It increased the already significant economic cost of managing waste that taxpayers have to carry. Other options, like making diapers fully biodegradable or reducing material are either technically immature or only have the potential for incremental improvement. We should continue to investigate these options, but from the point of view of circular economy it is relevant strive to eliminate waste at the source as much as possible.

One alternative in this area is the reusable diaper. A reusable diaper (also called washable diaper, cloth diaper, cloth nappy or real nappy) is a pre-shaped diaper that can be washed and worn again, replacing thousands of disposable diapers with a few dozen reusable diapers.

Figure 2: New-born size diaper and the 4 stages of a universal size diaper



1.3 What are reusable diapers?

In the 19th century it was common to use a folded square or rectangle of linen cloth fastened with safety pins. Today, this type of diaper is referred to as a flat and rarely used. Modern cloth diapers are hourglass shaped and have an absorbent inner layer made from bamboo and/or cotton cloth and a polyester outer layer with a Polyurethane laminate (PUL) to waterproof the diaper and prevent leakage (see figure 3). Elastic at the legs contains faeces and urine. Diapers are generally sold in one size for new-borns and one universal size that children can use from around 4 to 6 kgs up to finishing their toilet training. This universal size is achieved by snaps that shorten the diaper by folding it inward (see figure 2).

There is significant variability in the environmental impacts of reusable diapers, depending mostly on the user behaviour but a meta-analysis by the UN environment programme (UNEP, 2021) shows that, even though they still produce waste (like machine runoff, disposable liners, and the diapers themselves) in general reusable diapers have lower environmental impacts than single use diapers. They are only outcompeted by disposable diapers when washing and laundering are done inefficiently or when used only a few times. The UNEP gives the overarching recommendation to promote the adoption of reusable diapers.



Figure 3: Examples of different types of reusable diapers. Upper row, left to right: poplini ultrafit, Close Pop In SIO, Lower row: Close Pop In SIO, Grovia One (The Green Butt, 2022)

1.4 Future diaper project

ReTHNk B.V. is a thinktank founded end 2020 by Guus Meijer and Nathan Volkers. They are a small, mission driven corporation, committed to promoting sustainable consumption across different product categories, but have decided to start by focusing on diaper use. Therefore, Guus Meijer and Nathan Volkers, together with Jitta Meijer founded the future diaper project (FDP).

The FDP is a non-profit foundation and the commissioner of this research report. Their goal is creating awareness about the impact of disposable diapers and investigating opportunities to make diaper use more sustainable. The goal is to develop financially feasible

innovations that focus on three different topics: creating more awareness for the importance of potty training, researching, and developing more sustainable versions of the disposable diaper and improving and promoting washable diapers. This report is part of the third research theme and is meant to help FDP find ways to reduce environmental impact and provide insights for the development of products and services.

ReTHNk B.V. also launched a consumer brand called 'Toddy'. The goal of Toddy is to use the insights generated by the FDP and launch the innovations and generate revenue. This revenue can be partially used to finance further research by the FDP. Toddy currently provides six products:

One beginner set with disposable diapers, three versions of boxes with ecological disposable diapers (one that can be ordered bi-monthly, one aimed at newborns, one free trial box with the option to add one reusable diaper for a reduced price) see figure 5 (Toddy, 2022).

This has resulted in a brand identity that strongly focussed on sustainability, providing information and visually associated with cardboard boxes. Additionally, their house style incorporates a lot of space elements (rockets, planets, astronauts, etc.) to highlight their focus on a larger, global perspective in a way appealing to young children (see figure 5).

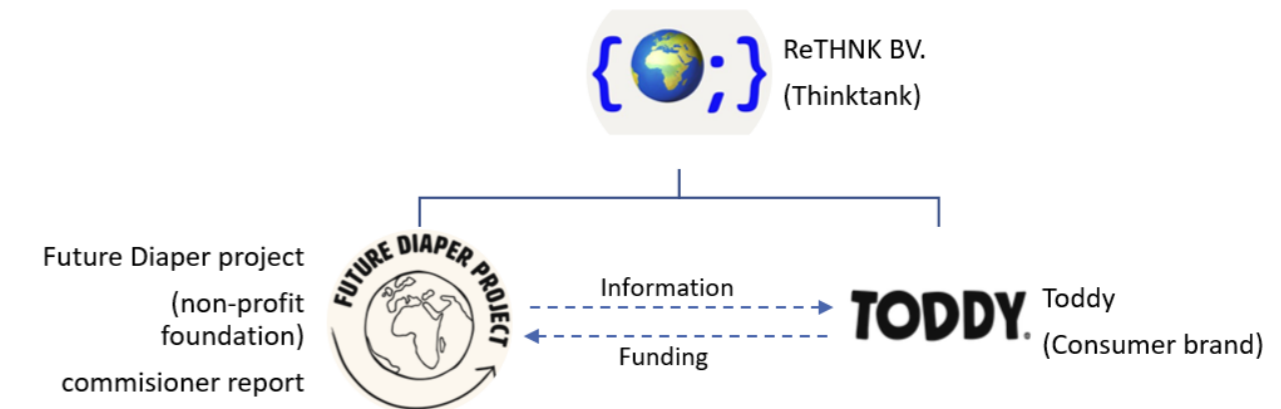


Figure 4: Organisational structure of The Future Diaper Project and Toddy

ALLE



Luierbox - Onze ecologische wegwerpluiers
vanaf €49,00

Newborn luierbox - luiermaat 1 en 2 voor de kraamtijd
vanaf €29,95

Proefbox - Probeer onze luiers
vanaf €0,00



Wasbare luierbox - Startpakket met 6 wasbare luiers

Zindelijkheidstraining - Met o.a. online plasklas, app en handige box.

Figure 5: Presentation of Toddy's current product portfolio on their website

Translation:
Diaper box - Our ecological disposable diapers, from 49.00

Newborn diaper box - diaper size 1 and 2 for the maternity period, from: 29.95

Trial box - Try our diapers, from 0.00

Washable diaper box - Starter pack with 6 washable diapers, 175.00

Potty training - Including online toilet training class, app and handy box. 32.95

1.5 Research goal

Currently reusable diapers are a niche product for environmentally conscious families. Outside of this niche it remains an unpopular choice. To improve the adoption of reusable diapers I aim to look beyond the design of the product and to take a holistic view on how the whole system around it, can better facilitate adoption. In this project I investigate the current product and user experience and adoption of reusable diapers to identify the barriers of adoption.

The overall purpose of facilitating adoption is to eventually reach climate and circular economy goals set by the Dutch government and EU. To create a solution that fits within the circular

economy a similarly holistic view of the entire life cycle is needed. I aim to analyse the current impact of reusable diapers compared to disposable diapers and identify hotspots within its life cycle where there is room for improvement.

The goal of this project is to design a service model to increase the acceptance and adoption of reusable diapers and lower their impact during the user phase. The outcome of this project will be a service model because service models can bring together several stakeholders and orchestrate, infrastructure, communication, and material components to create a pleasant customer experience, minimise the environmental impact and maximise business potential.

The outcome of this project should eventually be suitable for Toddy to launch. This means the concept developed in this project should be financially feasible, actionable for a small, young brand like todody and have a high level of technological readiness. Preferable it assists in making Toddy's other endeavours more successful as well.

1.6. Process

For this project, the classic double diamond design approach is used as a foundation (see figure 6). This approach consists of four parts; discover, define, develop and deliver (UK Design Council, 2019) To suit it better to this project, it was renamed to research, problem definition, ideation and design. The research phase focused on gathering existing information and interviewing to generate more information. These insights were gathered and converged in a into comprehensive visual of the main problems around the adoption of washable diapers. This problem definition was used as a basis for brainstorming different ideas that were eventually developed into the Toddy gift box. In practice, like with all fuzzy front-end problems the process was far from linear and included a lot of additional exploration.

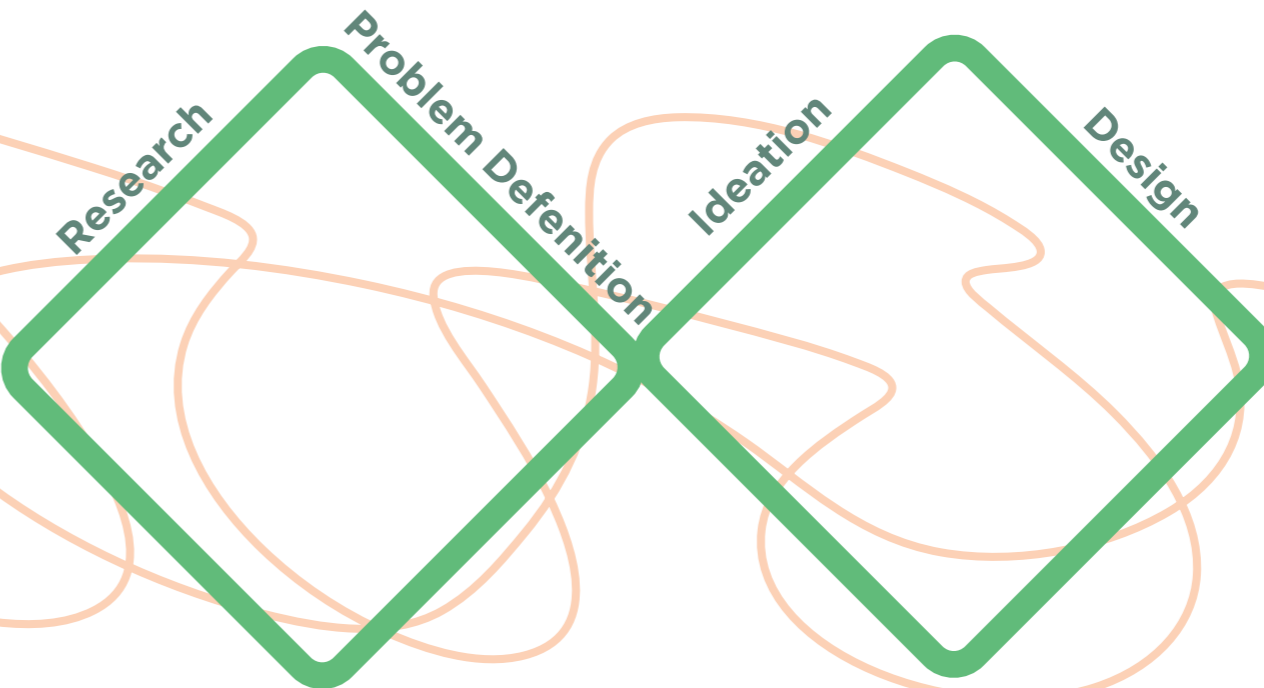


Figure 6: Research process



RESEARCH PHASE: WHY ARE WASHABLE DIAPERS NOT BEING ADOPTED MORE WIDELY?

Washable diapers are a cheaper and supposedly more environmentally friendly alternative to disposables. Yet they are a niche product. The research phase is dedicated to finding the underlying reason for why this is the case by identifying the relevant bottlenecks for adoption. Therefore, the journey of reusable diapers was examined to identify bottlenecks for adoption throughout the entire journey from awareness to disposal. This process includes 3 steps. Firstly, in chapter 2 the

current state of the disposable diaper market is investigated to establish a baseline and context. This is done with a combination of literature analysis and other online sources. After this all phases of the user journey are analysed based on interviews done with users and ex-users in chapter 3. This phase results in a list of bottlenecks for adoption. In chapter 4 these will be clustered to extract the overarching causes of why washable diapers are not being adopted more widely.

2 DISPOSABLE DIAPER MARKET

In this chapter the current state of the disposable diaper market is investigated to create a baseline and context for further analysis in chapter 3. The two topics that are investigated to do this are the current range of diapers available and the characteristics of the current user base. This is done with a combination of literature analysis and informal online sources. Then Rogers theory of adoption is used to determine the effect of these characteristics of the product and market on adoption.

2.1. Product range

There is no exact data on the size of the market on washable diapers but Ilka van der Poel from web shop Nappy's.nl estimates they account for 2-5% of Dutch baby diaper use (AD, 2017). Currently reusable diapers are only available in the Netherlands via specialised web shops (e.g. <https://www.kaatjekatoen.nl/>, <https://www.greenbutt.nl/> and <https://www.billenboetiek.nl/>). These web shops typically offer a wide variety of diapers. Overall reusable diapers can be categorised in 2 variants: One-part systems and two-part systems, with the two-part system generally being the most common (see figure 8).

2.1.1 Options and trade-offs

Diapers are assembled out of different parts and the exact composition varies depending on several different trade-offs. The main trade-offs a user has to make are:

The two-part diaper system requires more work while changing but more reliably prevents absorbent parts of the diapers from sticking out. The diaper cover can also be used several times before washing, meaning the cover will wear less quickly. All-in-one diapers feel more familiar to disposable diapers and are faster to change.

- *Diapers usually exists out of a mix of bamboo and cotton. People may choose more bamboo for its superior absorption capacity, or more cotton for its faster absorption and drying time.*

- *Diapers can be closed either by poppers or velcro. While poppers are more wear resistant and uses less plastic, they are easily confused with the size adjustment poppers. Velcro creates an easier distinction between the two mechanisms but can still require several similar looking pieces that are supposed to overlap that are not instantly intuitive to close.*



Figure 7: Different colours of diapers available (happy baby company, 2022)

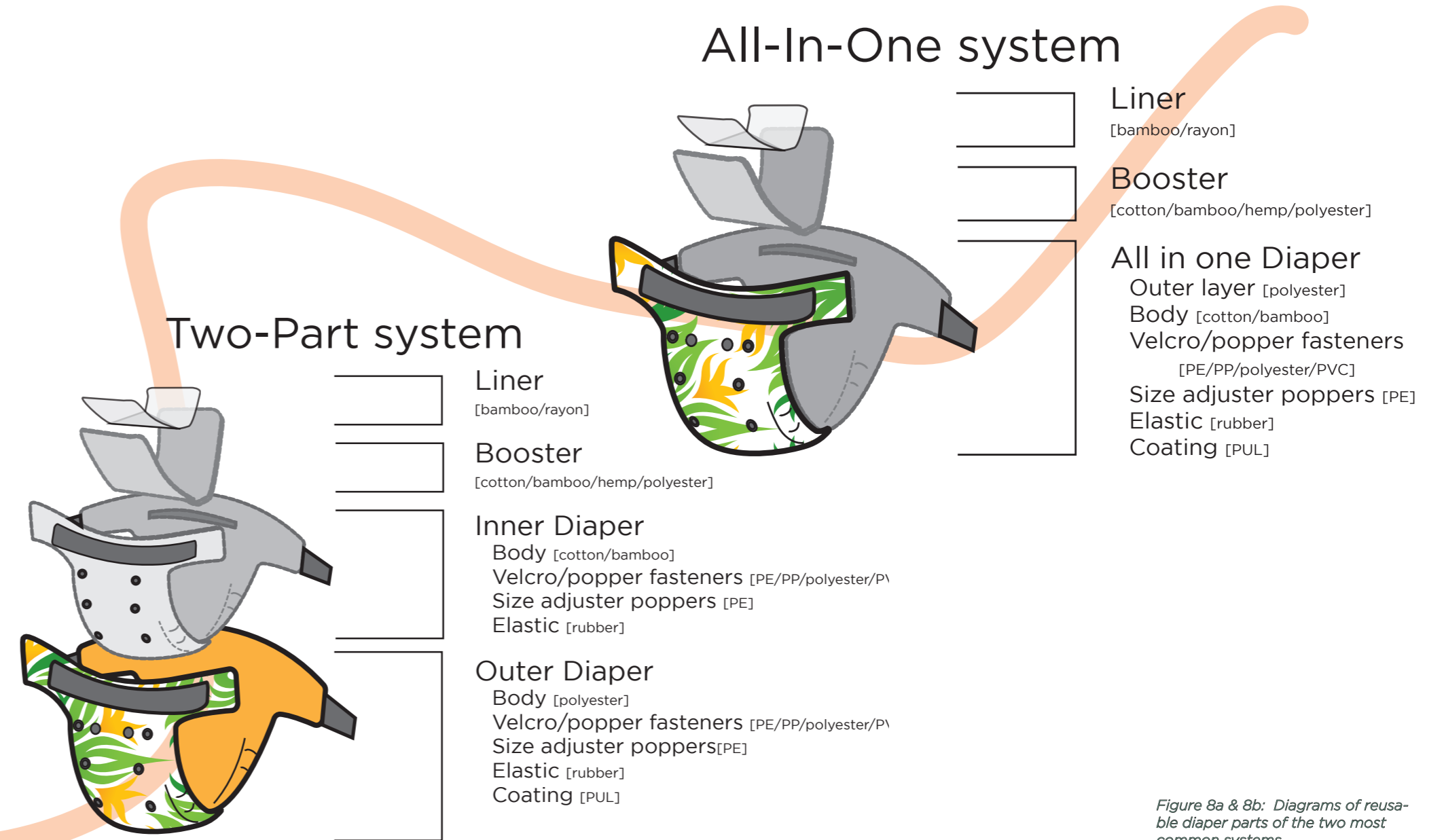


Figure 8a & 8b: Diagrams of reusable diaper parts of the two most common systems

Boosters are optional extra pieces of cloth that can be placed in the diaper to improve absorbency. They are used at night and for older children. Several boosters can be used at once.

- Boosters can be attached in several ways. Some diapers have a special pocket to place booster (pocket diapers), some diapers have a special popper on the inside of the diaper (Snap-in-one diapers) and sometimes the booster is simply placed on the diaper without attaching it further. This has a higher risk of the booster shifting while it is being worn, but makes the diaper change less time consuming.

- Boosters come in a wide variety of materials ranging from high absorbent capacity like hemp and bamboo, to a high absorbance speed, like cotton and polyester. It is recommended to mix materials to prevent the diaper from overflowing directly after a child pees, but also enable the diaper to absorb for several hours before needing to be changed.

- Depending on the anatomy of the child, the booster can be folded. It is recommended to use double folded boosters in the front of the diaper for boys, and a flat, unfolded booster for

girls.

Once children start eating solid food, their faeces stop being water soluble. This means it needs to be removed from the diaper before washing. Disposable liners are optional sheets of nonwoven fabric placed in the diaper to prevent faeces from staining the diaper. While urine will go through the fabric and be absorbed by the diaper or booster, the faeces will stay on the liner and be thrown away.

Disposable diapers are available in a number of different colours and designs (figure 4), often with cheerful graphic prints.

2.1.2 conclusions: product features bottlenecks and gains

The paragraph above presents the many choices a new potential user is faced with during adoption. Washable diapers are an uncommon product. When going to a web shop one has to make many choices that are essential to the functionality of the diaper, but hard to make without prior experience. While for some users this is no problem, it can potentially result in choice paralysis, since one has to spend an fairly large amount of money up front. The diaper itself also often does not close intuitively to everyone. There are many different variants, and it is often not directly apparent how the velcro closes

exactly or uses the same poppers for closing and resizing the diaper.

Aesthetically washable diapers are varied, with many different designs, often more cute and playful compared to their disposable counterparts with period-pad look and faded prints. The more colourful and varied designs may attract customers, but disposable diaper seem more like a medical product making reusable diapers seem less serious and focused on function in comparison, and may also lead them to be perceived as less 'hygienic'.

Bottlenecks:

Overwhelming number of product options and combinations

Not intuitive, takes time to learn

More colourful and varied look

2.2 User profile

Besides the current product range being offered, an important aspect of the current diaper market are the users. In this paragraph we look at the characteristics of current users and how this profile might develop in the future.

2.2.1. Current User Profile: the responsible consumer

Based on observations on social media, women seem to make up the majority of people who decide to use disposable diapers. This is backed up by the data from respondents from reusable diaper trials in the UK (GFK NOP, 2013) and consumer research done by duwtje (Duwtje, 2021). A washable diaper trial by milieu centraal (Kok, 2018) found that reusable diapers are more popular among younger users (aged 20-30) with lower income and leftist political orientation. Duwtje found that the people most likely to be interested in reusable diapers are 'responsible consumers', characterised by wanting to live a more sustainable life due to a socially critical world view. These people are looking to discover new things and develop themselves. They are, to a certain extent, willing to pay more for a sustainable choice.

2.2.2. Future of responsible consumerism

It is relevant to look at how this responsible consumer segment will develop in the

future. The age at which people have their first child has remained relatively stable the past 25 years (CBS, 2021), meaning that within a few year most parents and caregivers will be Gen Z (people born between 1995 to 2010, currently aged 12-27). Looking at consumer trends many sources predict a growing importance worldwide of responsible consumerism for Gen Z. Climate change and protecting the environment are the leading personal concerns among Gen Z adults (Insider Intelligence , 2021) and McKinsey even names ethics one of the three defining aspects of their consumer behaviour (McKinsey & Company, 2018). This focus on ethics is likely the leading cause behind green activism, low-carbon lifestyles and lower stigma associated with second-hand shopping and peer-to-peer commerce (Euromonitor international , 2022).

The underlying socially critical world view also seems to be growing in the younger generations. Gen Z worldwide is significantly more sceptical of big businesses and more than half of them do not assume businesses are having a positive impact on society (Insider Intelligence, 2021), which is the likely reason for the growing demand for transparency (Forbes, 2021) and ethics checks to see if businesses work towards measurable progress against their goals

(Mintel, 2021).

2.2.3. Conclusions: Responsible future

The current customer segment of responsible consumers is likely to grow. Future consumers seem more willing to look critically at their available options and take the externalities of their choices into account. To capitalise on this, more awareness needs to be created about the impact of disposable diapers and more clarity needs to be created about the impact of washable diapers. Additionally, it should be assumed customers are more likely to scrutinise all surrounding processes around a potential new product. Therefore, any messaging about values behind a potential product should be backed up by concrete results and transparency.

Bottlenecks:

Sustainability becomes more essential for consumers

Responsible consumers are more critical and feel more need for control

Rogers Diffusion of Innovations characteristics

Relative advantage is the degree to which an innovation appears superior to existing products.

According to the United Nations Environment Programme (UNEP, 2021), washable diapers are often **more environmentally friendly** and **cheaper**, two important relative advantages over disposable diapers. However, these effects are sometimes **disputed or unclear** (the exact environmental benefits will be determined in next chapter).

Compatibility is the degree to which the product matched with existing values, past experiences, and needs of potential adopters.

While there is a **rise in environmental awareness** and willingness among consumers to invest in eco-conscious practises (see chapter 2.2), practically the reusable diapers are often not compatible with the need for services like **day-cares**, who tend to be sceptical of the product and refuse to use them. **Disposable diapers have also shaped the expectations and desires** around diapers. There is a high expectation of convenience, hygiene, and a slim fit.

Complexity is the degree to which the innovation is perceived as difficult to understand and use.

While the variation among disposable diapers is very limited, there are **many different types of reusable diapers**. The process of washing also requires **more steps**, making the overall process more complex. Information can be **overwhelming, inconclusive and contradictory**.

Observability is the degree to which the results of the innovation are visible to others.

All diapers are typically **covered up by clothes**, making it impossible for others to tell what type of diaper is being used. Additionally washable diapers are much more rarely seen in **stores** compared disposables. The environmental **benefits of diapers are very dependent on user behaviour** and are therefore hard to quantify accurately, let alone communicate back to others. Saving money is also something that gradually happens and is not very noticeable to either the user or people around them. The reduction of waste and avoidance of plastic is however a relatively concrete proof of environmental benefits compared to other environmental benefits.

Trialability is the degree to which the innovation may be experimented with on a limited basis.

Reusable diapers are **not available in drug stores or baby stores**. The **high upfront cost** prevents trialability. Some web shops rent out diaper sets or offer personal consults to offset this, but these have a fairly high boundary to entry.

2.3 Rogers' Diffusion of Innovations characteristics

After having identified some of the most important characteristics of washable diapers, Rogers' Diffusion of Innovations theory (Rogers, 1962) can be used as a framework to determine what factors contribute to an innovation's success or failure. Rogers compared a large number of innovations across multiple areas in a series of studies on diffusion. Diffusion is defined here as "the process by which an innovation is communicated through certain channels over time among the members of a social system". Rogers found that innovations that have certain characteristics are likely to succeed over innovations that do not. These are: relative advantage, compatibility, complexity, trialability and Observed effects.

Looking at the presence of Rogers' characteristics of innovations in reusable diapers provides an explanation for why they are yet to be widely adopted and highlights opportunities for improvements.

2.3.1 Conclusions: presence of rogers' characteristics of innovation in diapers

Like mentioned at the start of this chapter, looking at the presence of

Rogers' characteristics of innovations provides an explanation for why they are yet to be widely adopted and highlights opportunities for improvements. The exact presence of each characteristic varies per individual, but from the perspective of new parents, who value environmentally consciousness, Washable diapers score worst at trialability, observability and compatibility. The trialability is low due to the high upfront cost, observability due to the invisible use of diapers and hard to find point of sale and compatibility due to the differences from the norm set by disposable diapers. All these aspects intersect with each other and particularly the low trialability and visibility increase the image of washable diapers being a weird, unusual product that lies outside of the norm. The diffusion of washable diapers would benefit from addressing these aspects (and to a lesser degree also the other characteristics) holistically in a future design.

Bottlenecks:

Trialability of washable diapers is low

Compatibility is low due to the norm set by disposables

Minimal visibility washable diapers

3 JOURNEY OF WASHABLE DIAPER USERS

After gaining an understanding of the reusable diaper product range and users, it should also be recognised that users of reusable diapers go through a very distinct journey. The goal of this chapter is to follow diaper users chronologically through this journey. This process starts during a pregnancy before the diaper is even considered. This period will be investigated in paragraph 3.1 where the stakeholders among which potential adopters find themselves are identified based on desk research and previous research by Duwtje (Duwtje, 2021). After this focus shifts to gathering data for the following stages by conducting in depth user interviews. These results are interpreted using foggs behaviour model

to reconstruct the different phases of the acquisition process of washable diapers. Furthermore, the interview results are used to analyse the user perception during use. Lastly the use phase and end of life will be addressed, and the research question of why washable diapers get adopted less frequently will be answered.

3.1 Awareness before adoption

Even though the process of getting a baby is unique for every family and does not always involve a pregnancy, in most cases the choice for diapers is (consciously or unconsciously) made during or right after a pregnancy. Afterwards families usually stay loyal to their system of choice

(Duwtje, 2021). To see what plays a role in the adaptation of reusable diapers it is useful to understand the process and what parties influence the choices of families throughout a pregnancy.

3.1.2. Awareness reusable diapers

Based on desktop research, the journey of a pregnancy can usually be split up in 6 different phases with distinct activities and stakeholders. In the following paragraph these 6 phases are described during the journey of a pregnant person and the most important influencers of choice of diaper are identified (see figure 9). Due to the decrease in the average number of children per family, this is assumed to be the first pregnancy.

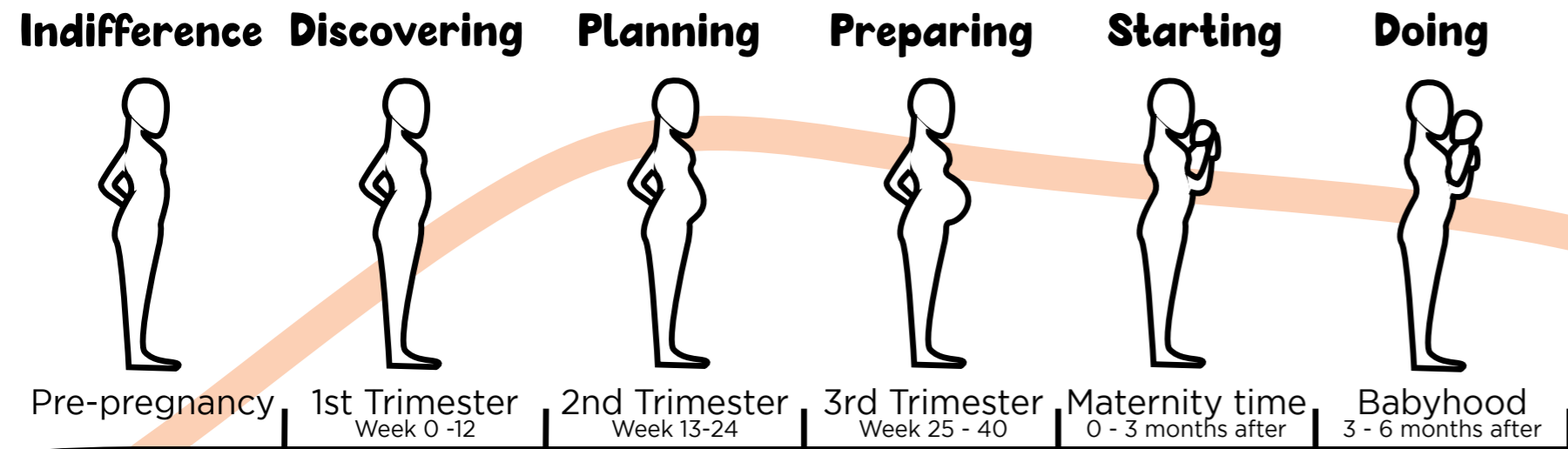


Figure 9: Six phases of the journey of a pregnant person

Indifference

The period of indifference is the time before a family is aware of any pregnancy and choosing a type of diapers is not relevant yet. During this period a subconscious norm is created, usually based on friends and family with young children, and passing encounters with commercials and diapers being sold in drugstores.



Pre-pregnancy

Passive awareness of the existence of different types of diapers

Drugstores:

Drugstores and supermarkets almost exclusively carry disposable diapers, contributing to the idea of disposable diapers being the norm.

- Possibly informs about reusable diaper options
- Exclusively informs about disposable options

Discovering

During the first trimester of pregnancy families discover the pregnancy. The pregnancy is confirmed by an obstetrician. While a pregnant person (and potentially their partner) privately look for information online, the news is usually not shared with friends and family yet, due to the relatively high probability the pregnancy will not be carried to term.

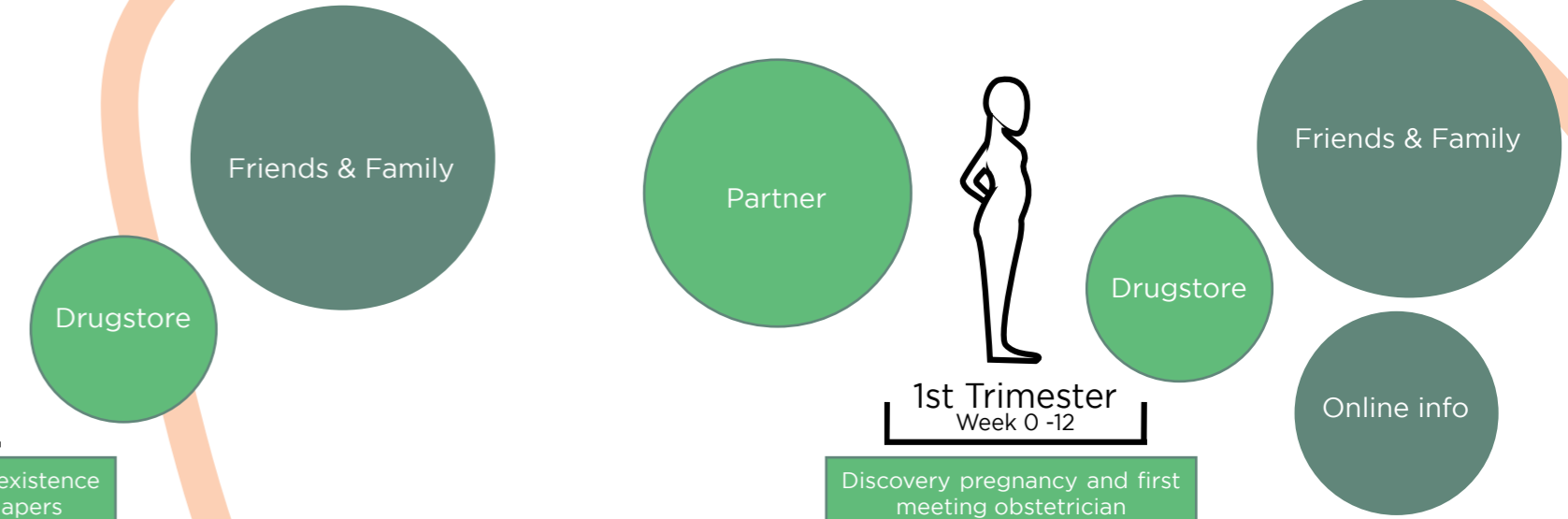


1st Trimester
Week 0 -12

Discovery pregnancy and first meeting obstetrician

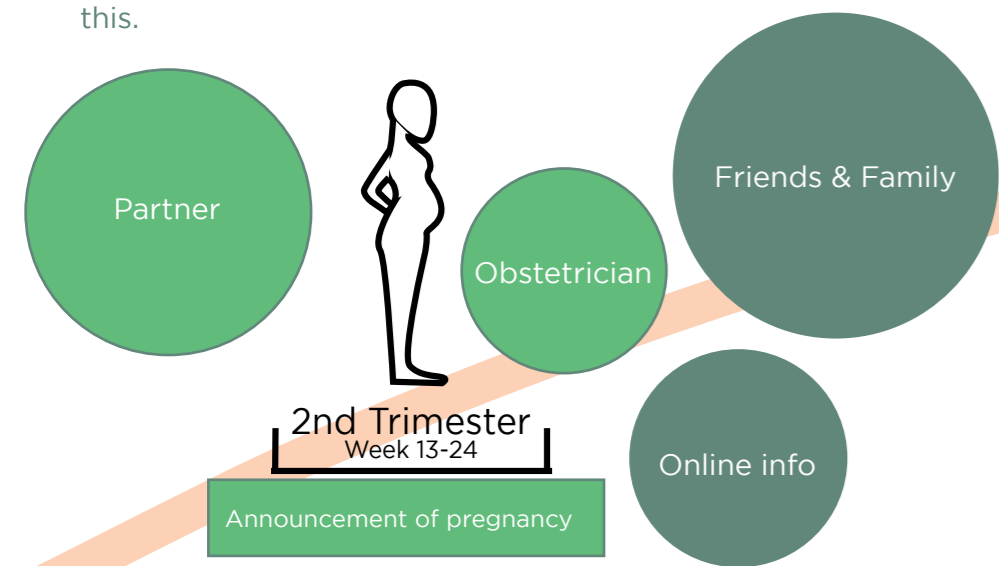
Obstetrician

An obstetrician, or OB is a doctor who specializes in pregnancy and childbirth, and monitors the health of the mother and foetus throughout the pregnancy. An obstetrician will typically advise about diet, exercise, and medications, and answer questions about pregnancy and delivery of the child. While the OB is primarily a healthcare provider, they do provide a guidance on what actions to take and where to find relevant information e.g., a trousseau list with products to buy during pregnancy.



Planning

During the second trimester the pregnancy is considered stable enough to start planning for an extension of the family. This means making a financial plan and thinking of how the house should be rearranged to accommodate this.



Friends and family

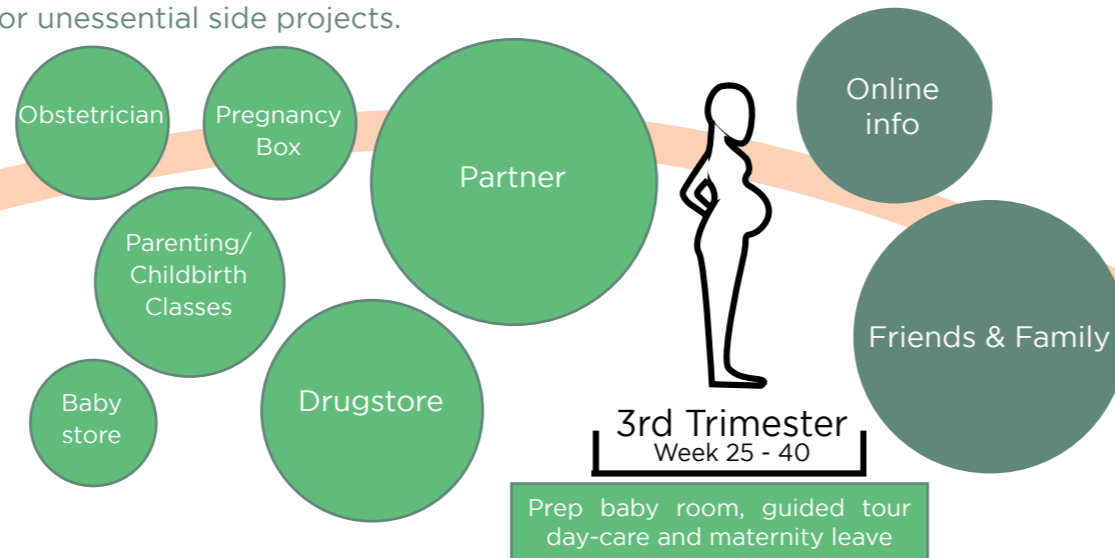
Friends and (extended) family are informed about the pregnancy and start actively sharing tips and experiences.

Online information

Most Dutch baby trossen explicitly mention washable diapers as an option (like www.consumentenbond.nl or www.oudersvanu.nl), but the less extensive ones imply disposables. Cost predictions (like www.nibud.nl) typically only mention disposable diapers.

Preparing

The third trimester is often tiring and uncomfortable. People balance the challenges of pregnancy and prepare for the future (prepare a baby room, finding a day-care). It is typically a hectic, overwhelming time, where people do not have time to expend energy on extensive research or unessential side projects.



Family and Friends

Baby shower are increasingly common. In this American celebration, it is tradition to give parents gifts. Disposable diapers are common gifts, often decorated like cakes or other objects. It is only possible to gift reusable diapers when instructed on exactly what diapers the family desires.

Pregnancy Box

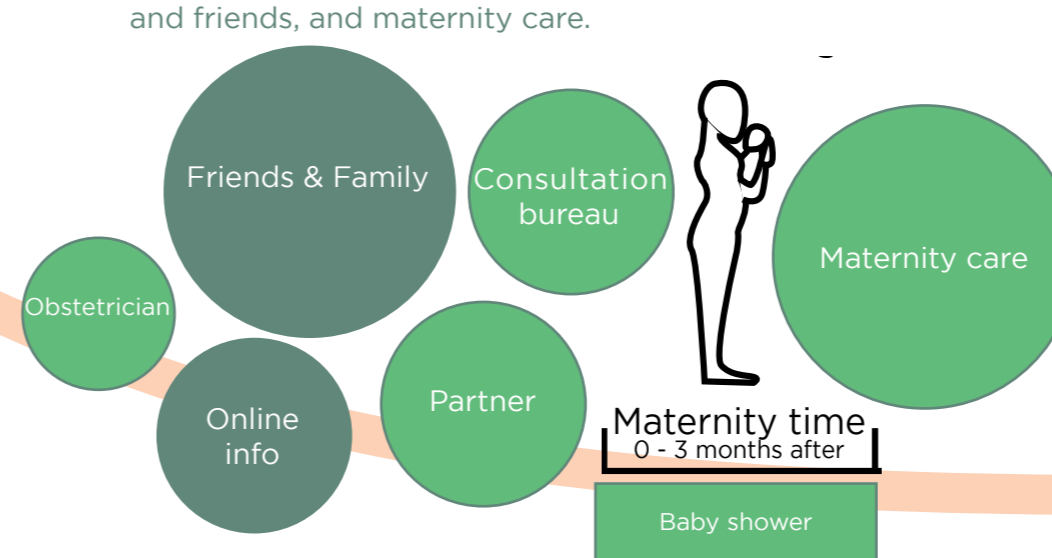
A pregnant person qualifies for free goodies in pregnancy boxes by different providers (de blijde doos by Wij, the Zwanger- en Babybox by Ouders van Nu, the Kiekeboebox by Plus, The Hallo Mama box by Jumbo, etc.). These boxes sometimes contain disposable diapers.

Day-care

During this time parents usually look for a day-care. People often visit the day-care they are considering and sometimes get a guided tour. In other cases people will rely on the website and word of mouth.

Starting

After the birth of the child parent(s) start with taking care of the baby. During this time parents are often both excited and overwhelmed. They are often looking for a moment to rest. The workload is lifted slightly by family and friends, and maternity care.



Maternity care

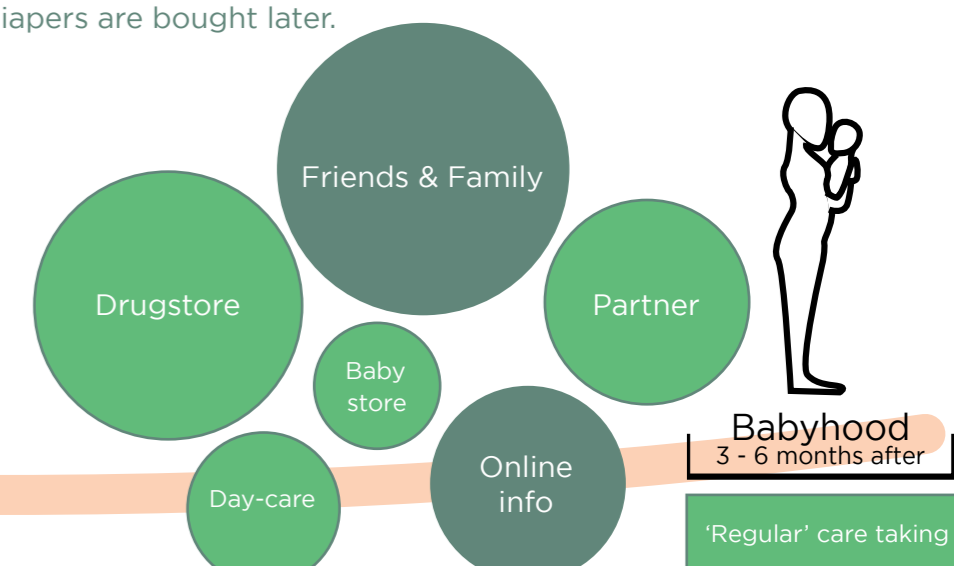
From birth to ten days after birth, a maternity carer (kraamzorgster, or monthly nurse) is responsible for flagging potential issues and assisting in the care of the baby. They are typically there to explain how diapers are used and are regarded as highly esteemed authorities on childcare, but usually only focussed on disposable diapers.

Family and friends

After the birth of a child it is tradition for family and friends to visit the new baby. This is called a maternity visit or kraamvisite. Gifts are usually given, although this does depend on the relationship with the family and if a baby shower was organised earlier.

Doing

After maternity leave has ended, and people establish a new rhythm around living with a baby, the choice of diapers type is usually set. Both the potential financial and environmental benefits lessen over time if reusable diapers are bought later.



Day-care

During this period babies become eligible for day-care. Day-cares are usually seen as experienced care takers, and the products and methods they employ and endorse are seen as trustworthy. Currently only disposable diapers are used.

3.1.3. Conclusions context diaper choice

Firstly, it can be concluded that visibility and information sources for disposable diapers are very sparse. Day-cares, drugstores, maternity care and obstetricians are important and credible, independent sources that do not mention washable diapers. Families who do not know people in their direct vicinity who use washable diapers (friends or other family members) are unlikely to ever be made aware of their existence. If they are, they are still completely dependent on researching most things themselves.

Secondly, the time around pregnancies involves lots of new information and stakeholders. Families have to absorb a lot of information and be flexible for pretty drastic changes to their life. They enter a sort of informal learning trajectory. This can be a very exciting, but also overwhelming period. While people are generally susceptible to learning new information and buying new products during this time, the overall success of transferring information can be increased in 2 ways. Firstly, research during this time should lead to credible, clear and productive information, and not be contradictory and inconclusive. Secondly, the bar to obtain this information should be low. People are less likely to do a lot of additional in-dept research into diaper on top of the flow of new information if it is

outside of the path of the usual 'learning trajectory' they are going through. This is most prevalent in the preparing phase (third trimester) and starting phase (maternity time).

Bottlenecks:

Independent, credible sources often only focus on disposable diapers

Overwhelming period with lots of new information

3.2. User interviews about acquisition journey and user perception

Now that the context in which people learn about diapers is established, the next step is to look more closely at the next phases of the journey. However, for the following phases (acquisition and use of diapers, chapter 3.3 and 3.4) data is not as readily available. To gather the information needed to understand and empathise with these parts of the journey of washable diapers, user interviews were planned. The method and insights will be discussed in this sub-chapter. These insights will be the foundation of the analysis of the acquisition journey and user perception.

3.2.1 Method of interviewing

To see how washable diapers were purchased, used and perceived, semi structured interviews were done with current users (3 mothers) and employees of 3 day-cares who either use washable diapers or had used them in the past (1 current use, 2 past use). The goal of these interviews was to investigate 3 main topics: 1) what did the acquisition look like, 2) how are or were the diapers being used and 3) how are the diapers perceived. The interviews lasted about one hour each and were, when possible, done on location (at home with users or

at the day-care).

Day-care employees were chosen for interviews for 3 key reasons: firstly, only interviewing current users of diapers would show a strong selection bias towards satisfied users with positive perceptions of the product and day-cares with experience are easier to find and reach than individual parents. Secondly, day-care employees have experience with several types of diapers and children with varied behaviours, and lastly, day-cares were identified early on as a potentially important stakeholder in a final design. They were sampled via contacting random day-cares in the area of Zuid-Holland found online and asking if they had experience and were available for an interview. One interview was done over phone, while the other two were done at day-cares themselves. Since there are always more day-care employees present at day-cares, in total 6 day-care employees were interviewed.

The goal of the interviews was to answer the second and third research question (how are or were the diapers being used and how are the diapers perceived) and consisted out of three sections. The first section was about the present past and future of their diaper use. The focus was to learn about their perception and to identify possible areas of frustration

and improvement. The second section involved showing and taking pictures of where diapers were stored and changed and filming the process as demonstrated on a teddy bear. For this section 3 different type of diapers were changed (one-part system, two-part system and a disposable diaper) while employees talked out loud about their thought process and experiences. For the final theme employees were asked about what they would like to see in a potential future diaper service at a day-care by asking to rank three potential services. This final topic was chosen because a service at day-cares was identified early on as a potential design direction.

The mothers were interviewed to answer all 3 research questions (acquisition, how are or were the diapers being used and how are the diapers perceived). They were sampled via personal contacts and social media. 2 Interviews were done via an online video call due to the pandemic, 1 was done on at the home of the interviewed. The interviews were divided into 3 themes. The first section was about the present past and future of their diaper use. As an extra iteration upon the earlier interviews with day-cares, it was decided to also include a short questionnaire with questions to this section. Here users had to score several aspects of their perception of performance reusable

diapers on a scale from 1 to 7 compared to disposable diapers, while being able to give explanations and commentary. These aspects were based on drawbacks and frustrations mentioned by the day-care employees. This sudden inclusion of quantitative questions was chosen to see if users shared these frustrations or problematic aspects of the diapers, even if they are still overall satisfied with the use, or ideologically find the trade-off worth it. For the interview done at home this section included showing and taking pictures of where diapers were stored and changed and filming the process as demonstrated on a teddy bear. For the interviews done online mothers simply showed the products and described their process. The second theme of the interview was about the collaboration with others who changed their child's diapers (like partner, family & day-care), and how they used or perceived the product. For the final theme mothers were asked about the same three potential day-care services.

3.2.2. Notable interview results

The interviews were recorded, and the most important statements were collected in appendix A to B and figure 11 and 12. The quantitative outcome of the surveys given to mothers can be found in figure 10. This paragraph is not an extensive breakdown of all results but simply the most notable insights.

Firstly, it was notable that all mothers had taken a relatively long time to end up using diapers the way they were at the moment of the interview. They had all sought extra information and ways to try

out the diapers before purchasing a full set. After this acquisition the women had also all gone through an iterative process to develop their own unique way to set up their changing station and launder the diapers. This process is further defined in chapter 3.3.

Secondly, the employees from two out of three day-cares had a pronounced negative opinion of diapers and had started to either partially or fully refuse to use them (the employees from the other day-care felt no strong emotions toward the product). Leaks, extra effort,

diaper rash bad smell and concerns about delayed development of physical skills (like rolling over and crawling) due to a more limited range of motion were cited among other things as their reasons to do so. This strongly contrasts the mothers who, experienced the diapers very differently. Even though their scores indicated that they perceived diapers as costing more time and effort, they unanimously recommended the product. This phenomenon is further defined in chapter 3.4.

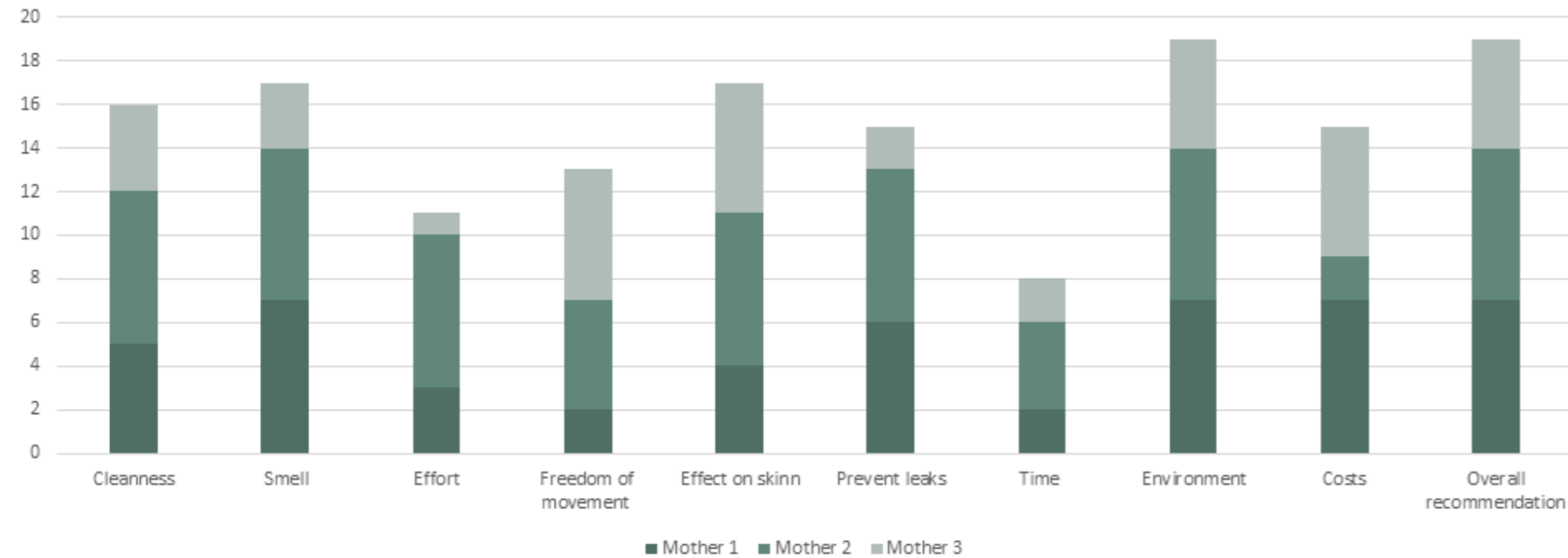


Figure 10: Quantitative survey scores of perceived performance of reusable diapers compared to Disposable diapers (21= best)



Figure 11-12: Pictures taken during interviews



3.3. Consideration and acquisition of diapers

While disposable diapers are bought frequently and immediately, reusable diapers require more purchase effort. To identify the bottlenecks in this process, the theory of Fogg's behaviour model is used to break down what is required for behaviour to occur, so that we can later establish exactly what series of behaviours is required for successfully adopting reusable diapers and create an acquisition journey based on the interviews in the previous sub-chapter.

3.3.1 Theory Fogg's behaviour model

Fogg's behaviour model (Fogg, 2009) shows that three elements must be present at the same moment for behaviour to occur: Motivation, Ability, and a trigger. Motivation is the reason for doing something. In this model this is not merely a rational calculation of costs and benefits but also of sensation (Pleasure/Pain), anticipation (Hope/fear) or wanting to belong (Social acceptance/rejection). Ability refers to the level of self-efficacy perception of performing a behaviour. Basically the 'height of the boundary' that needs to be crossed. This is an accumulation of time required, monetary

cost, physical and mental effort, and how far it deviates from the norm and current routine. The prompt or trigger is the reminder (explicit or implicit) to perform the behaviour. Triggers can be perceptual in nature (like an alarm, or advertisement) but may also be intrinsic.

The level of ability and motivation define whether triggers for behaviour change will succeed. As visualised in figure 13 trying to trigger behaviour change through something difficult to do (low ability) will only succeed with very high motivation while trying to trigger behaviour change through something easy to do (high

ability) may succeed even with average motivation. In the next paragraph this theory will be used to interpretate the insights from the interviews in the next paragraph.

3.3.2. Behaviour during the acquisition of diapers

While Fogg's behaviour model excels in explaining individual behaviours, it cannot be applied directly to a process. Therefore, the acquisition journey as described in the interviews with mothers was simplified to four phases. Transitioning or not transitioning to the next phase requires motivation, ability, and a prompt. This journey assumes an environmentally conscious family or parent. Every user is unique, and there

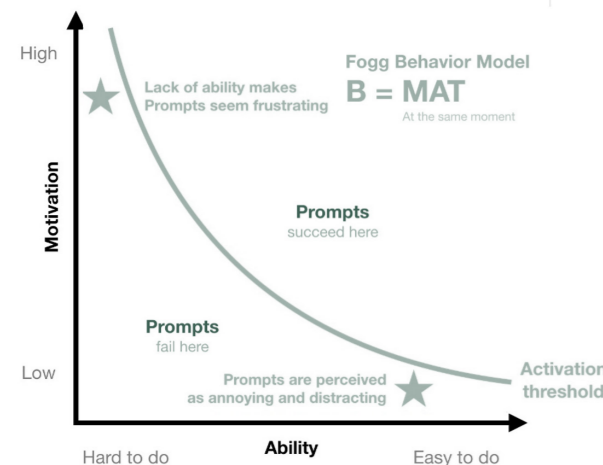


Figure 13: Fogg behaviour model (Toxboe, 2019)

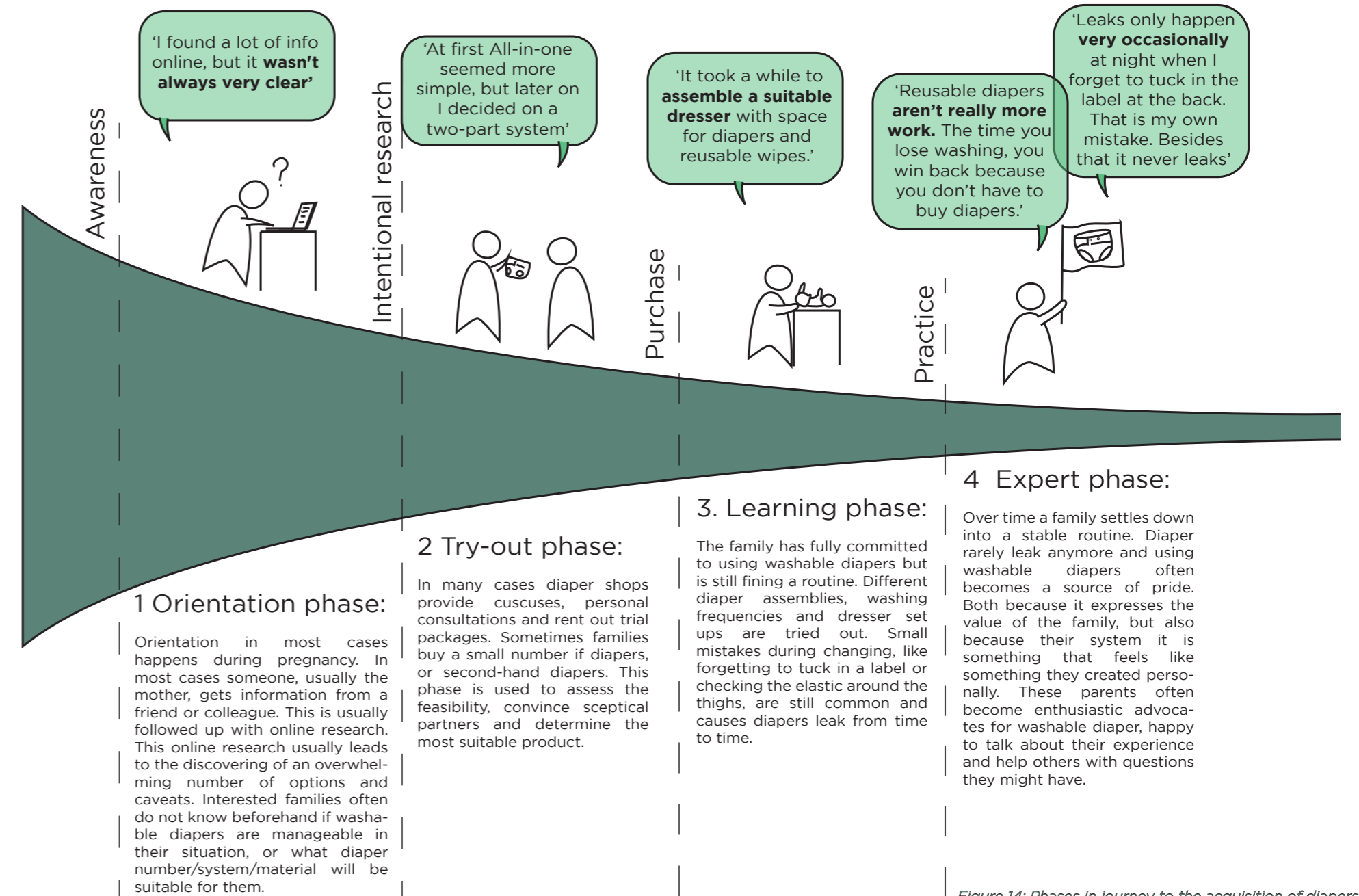
is no single universal trajectory, but based on the commonalities between the interviews a model was created that represents a common journey.

Most often (but not always) phase 1, the orientating phase, starts during a pregnancy (See figure 14). Generally, users have no or limited, initial knowledge about diapers. The motivation and ability needed to start googling for information is relatively low but for behaviour to occur it is also essential for families to be triggered. Many people are either not aware of the existence of reusable diapers or are not reminded of their existence. The reason for this is the limited visibility mentioned in the previous paragraph.

All three interviewed mothers chose to follow up their desktop research with searching ways to try out and experience reusable diaper before making a purchase. This is represented by Phase 2: the try out phase. This phase exists due to the high up-front purchase cost, the fact that during orientation people are often unable to determine with certainty that washable diapers are suitable for them. Online resources can be helpful, but also tend to be contradictory, biased and overwhelm newcomers with options and information. Most parents need additional guidance. For example, one

of the mothers was unable to determine what the most suitable system based on online information, and the advice found during the try-out phase actively changed her mind on what diaper system she thought she needed. Some people have to opportunity to ask from friends with experience, otherwise they often use services provided by diaper web shops, in the form of special trial packages or even personal consults. Arranging this costs time and/or money and already feels like an unofficial commitment to the product, so the ability needed is quite high. This results in only highly motivated people taking the next step and purchasing the diapers.

The purchase, between phase 2 and 3, is upfront instead of spread out during the use phase like for disposables. Buying a collection of reusable diapers usually cost ca. 500 euro's upfront on average (Nappy's.nl, N.D.), while disposable diapers cost on average around 1000,- over the course of several years. This is backed-up by a survey done in the UK among 339 participants, that found the high upfront cost to be the most common discouraging factor (GFK NOP, 2013). Thus, even though overall reusable diaper can be cheaper, they still require a high ability, meaning many people will not make the purchase.



1 Orientation phase:

Orientation in most cases happens during pregnancy. In most cases someone, usually the mother, gets information from a friend or colleague. This is usually followed up with online research. This online research usually leads to the discovering of an overwhelming number of options and caveats. Interested families often do not know beforehand if washable diapers are manageable in their situation, or what diaper number/system/material will be suitable for them.

2 Try-out phase:

In many cases diaper shops provide cuscuses, personal consultations and rent out trial packages. Sometimes families buy a small number of diapers, or second-hand diapers. This phase is used to assess the feasibility, convince sceptical partners and determine the most suitable product.

3. Learning phase:

The family has fully committed to using washable diapers but is still fining a routine. Different diaper assemblies, washing frequencies and dresser set ups are tried out. Small mistakes during changing, like forgetting to tuck in a label or checking the elastic around the thighs, are still common and causes diapers leak from time to time.

4 Expert phase:

Over time a family settles down into a stable routine. Diaper rarely leak anymore and using washable diapers often becomes a source of pride. Both because it expresses the value of the family, but also because their system it is something that feels like something they created personally. These parents often become enthusiastic advocates for washable diaper, happy to talk about their experience and help others with questions they might have.

Figure 14: Phases in journey to the acquisition of diapers

In phase 3 people learn how to make washable diapers work for them. Besides the usual practice anyone learning to change diaper needs, a routine around washable diapers is more complex and more varied base on personal context and preferences (experimenting with number of diapers, frequency of washing, organisation of changing station). Families who just financially committed to washable diapers and start their learning process are both triggered and highly motivated, but also start out with a low ability due to their low skill level. Throughout the process the ability of most people will go up. The highest risk is this not happening fast enough since motivation will probably go down gradually.

passionate advocates and all too happy to promote washable diapers to other parents and show them off to family and friends. The flipside is that a lot of people who consider reusable diapers to not continue to use the product.

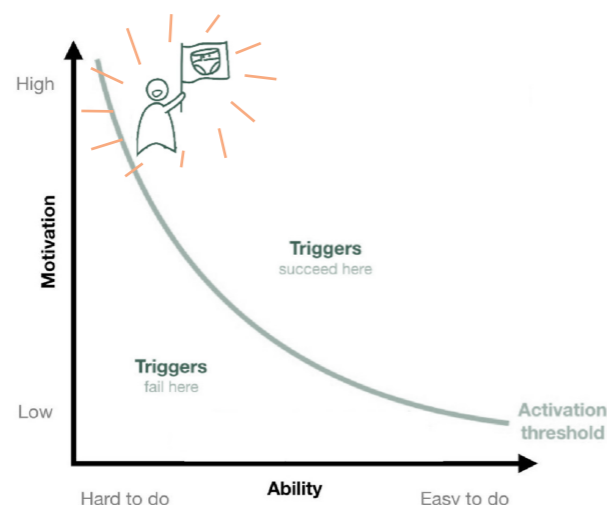


Figure 15: Fogg behaviour model applied to reusable diapers

All stages take substantial effort to get through and this effort is only 'rewarded' during the final stage. Therefore, reusable diapers require a high ability of the committed families to carry on through mistakes during the learning phase. Based on Fogg's behaviour model this high activation threshold results in a userbase with only very highly motivated users (see figure 15). This is reflected in the typical user. For them using this product often becomes a way of expressing their sustainable values and challenging the status quo of disposables. Most become

3.3.3. Conclusions and bottlenecks acquisition washable diapers

The acquisition journey for new users of diapers commonly has several bottlenecks with the potential to cause people to give up on diapers. Firstly, there is often no prompt to start investigating washable diapers, or even a complete unawareness their existence. Researching potential

washable diapers does often not provide enough clarity for people to determine beforehand if the product suits their needs. This uncertainty greatly lowers the estimated ability people have and lowers the chance of adoption. Potential users therefore would in many cases greatly benefit from more opportunities to try-out the diaper with a lower boundary and options besides buying a complete diaper set at once upfront. The process of learning how to use reusable diapers often requires time and effort before a working system is set up. In many cases reusable diapers would therefore benefit from it being easier and quicker to learn and set up a system and routine. This way it can generate more immediate positive experiences.

Bottlenecks:

Trigger and awareness to start orientating on diaper options is not always available

Trying out diapers often cost money and effort

High ability required to pay purchase cost upfront

Learning and setting up should be easier and quicker

3.4. Diaper use and perception

When consumers use a product, their perception is not only based on the physical characteristics of the product but also biased by preconceived ideas about product properties and is affected by the consumer's judgmental frame of reference. In the case of diapers, disposable diapers are generally that frame of reference. The 6 semi structured interviews were used to determine how users and ex-users perceive the diapers.

3.4.1. Subjective character of perception

During the interviews it became clear that people differentiated a lot in how they perceived diapers. The day-care employees who had discontinued the use of diapers after being dissatisfied, had a very negative perception. They perceived the product as backwards and crude, and overall, vastly inferior to disposable diapers. They had had bad experiences with leaking, bad smells and diaper rash and attributed this to the diaper and questioned if the diaper had any environmental benefits at all. Current users were very enthusiastic about the diapers, praising the product as superior to disposable diapers. While it is self-evident satisfied users have a more positive perception compared to

dissatisfied users, it is notable just how much their contradictory experiences were and how they disagreed about basic statements about the diapers. Current users stated that diapers did not leak more compared to disposable diapers and had advantages, like being better at containing faeces and smelling better. Where ex-users believed the diaper caused diaper rash and were concerned about delayed physical development, current users believed diaper reduced diaper rash and benefitted the physical development. To create a complete list of contradictory claims and experiences, statements made during the interviews about the same topic of mothers and dissatisfied users were all gathered and juxtaposed per topic (see table 1). These contradictory perceptions can be explained by two factors: confirmation bias and incorrect use.

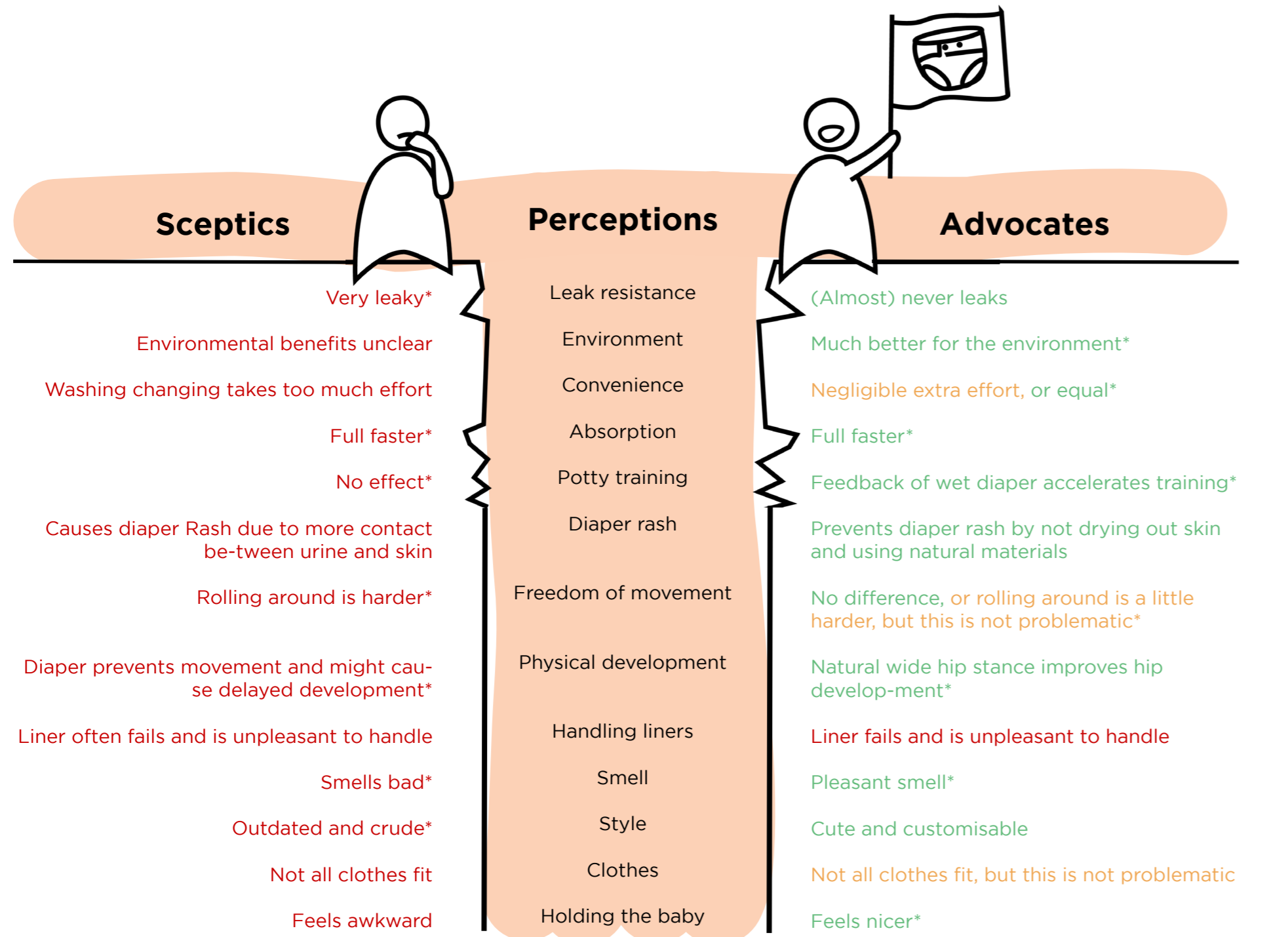


Table 1: The cliff between the perceptions of Sceptics and Advocates (*compared to disposable diapers)

3.4.2. Confirmation Bias

The first explanation for the contradictory perceptions between users and ex-users is confirmation bias. Confirmation bias is the tendency to search for, interpret, favour, and recall information in a way that confirms or supports one's prior beliefs or values (Nickerson, 1998). In the case of reusable diapers, one's perception of diapers is largely shaped by expectations. All users experience leaks (no type diaper is completely free of leakage), but users who expect diapers to be leak-proof, tended to write them off as a mistake they made themselves, while sceptical users tended to blame it on the design of the product, regardless of if they could have prevented the leakage.

This bias also extends to the positive characteristics of diaper. Many claims made by current users seem to come from websites like www.nappys.nl (the first hit when googling 'Wasbare luiers' on 19/01/2022). These websites say reusable diapers cost 1,5 to 2,5 times less, CO2, lessen diaper rash, improve hip development, and quicken potty training. Many claims of these are difficult to proof scientifically since research on babies is difficult and users/ex-users tend only have one case to draw conclusions from. This results in these claims generally being accepted by current users but

being disputed by ex-users.

3.4.3. Correct vs incorrect use

Another contrast between users and ex-users, is that in both cases, the ex-users had given up on washable diapers within a few months of very infrequent use. The overwhelming majority of the changes they performed were done with disposable diapers, with limited access to instruction on how to use reusable diapers. In interviews it became clear that 'treating reusable diapers as disposable diapers' lead to problems like not changing the diaper in time, not checking if the diaper was changed in the right way, and not having the right changing station setup.

This results into more cases of leakage, resulting into more work and frustration. Inexperienced Users often are unaware of what caused the leak and end up attributing it to the general quality of the product, ultimately leading into to a negative spiral of confirmation bias.

3.4.4. Conclusions: Product perceptions bottlenecks

Since the effectiveness and environmental impact of diapers depend highly on use, and standards on convenience and hygiene are personal and shaped by expectations, and research on babies is challenging, both sides are very

susceptible for confirmation bias, creating a rift in perception. Another cause for this rift is treating reusable diapers as if they were disposable diapers, which leads to problems like leaking.

The following statements are agreed on by both sceptics and advocates:

- Reusable diapers have a lower absorption capacity and need to be changed more often compared to disposables.
- Reusable diapers are vulnerable for incorrect use. They can leak due to very small mistakes.
- Liners sometimes fail to catch all feces and are generally unpleasant to handle. They are often seen as the weakest part of the diaper.

Bottlenecks:

- Big rift in perceptions
- Lower absorption capacity compared to disposable diapers
- Vulnerable for incorrect use compared to disposable diapers
- Liners sometimes fail

3.5. Clustering of problems

The bottlenecks and gains from each paragraph were collected (see table 2). Together all statements represent all insights found during the analysis phase. The different statements however all relate to different aspects of diaper use

and addressing them all in one design is not feasible. Therefore, different ways of clustering were tried out. It became apparent that some statements overlapped (e.g. 'Not intuitive, takes time to learn' and 'Low ability to learn use: needs quicken/lower learning curve') and

were merged into one statement. The full, original version can be found in appendix C. Eventually two main problem clusters could be identified: Unfamiliarity with diapers and the unreliability of diapers (see figure 16). All three problem clusters present design opportunities to improve the adaptation of diapers.

CHP. 2: THE WASHABLE DIAPER MARKET

Overwhelming number of product options and combinations

Not intuitive, takes time to learn

More colourful and varied look

Sustainability becomes more essential for consumers

Responsible consumers are more critical and feel more need for control

Trialability of washable diapers is low

Compatibility is low due to the norm set by disposables

Very minimal visibility washable diapers

CHP. 3: THE JOURNEY OF WASHABLE DIAPER USERS

Independent, credible sources often only focus on disposable diapers

Overwhelming period with lots of new information

Trigger/awareness to start orientating on diapers not available

Trying out diapers often cost money and effort

High ability required to pay purchase cost upfront

Learning and setting up should be easier and quicker

Big rift in perceptions

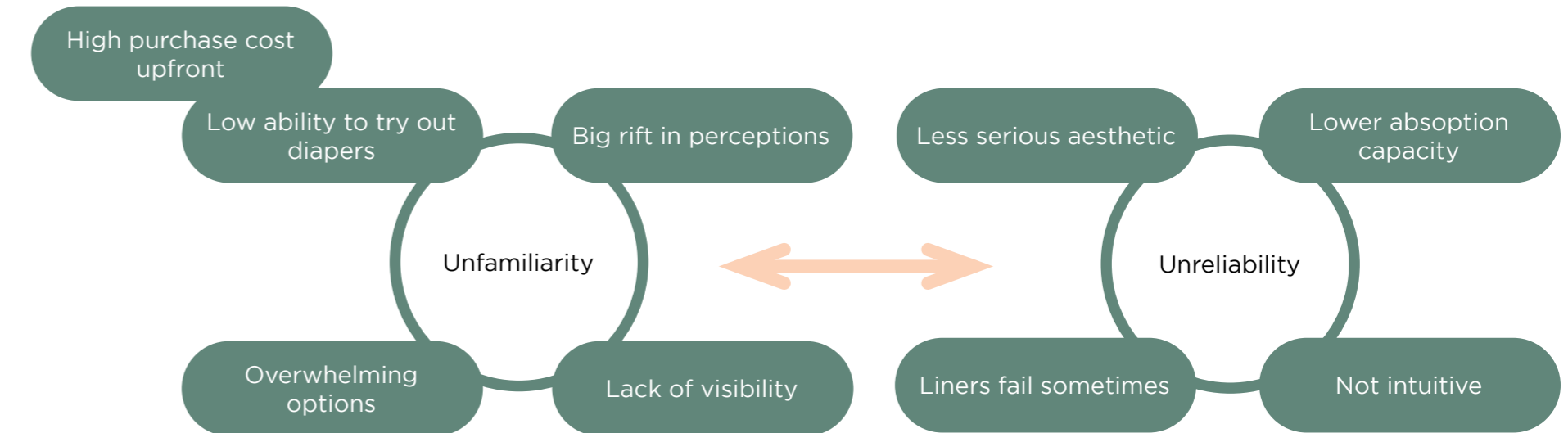
lower absorption capacity compared to disposable diapers

Vulnerable for incorrect use compared to disposable diapers

Linens sometimes fail

Table 2: List of bottlenecks identified in chapter 2 and 3

Figure 16: Problem clusters



3.5.1. Unfamiliarity

Many people are ignorant about the existence of reusable diapers or have an outdated image of the product. Reusable diapers can be bought mostly on specialty web shops and are not widely available yet. The fact that use of the product has not been normalised yet gives the product an air of 'sketchiness' and 'untrustworthiness'.

On the other hand, learning about reusable diapers is not easily accessible. Consumers who are interested in

reusable diapers have trouble figuring out exactly what they are getting into. They are overwhelmed by complex and contradictory information and many variations. Buying a collection of reusable diapers also comes with high upfront costs compared to disposables. New parents, who are already in a chaotic phase of their life, are not always in a place to do thorough research, making it hard to confidently invest money in money disposable diapers, while the safer, disposable option is extremely easy to access.

3.5.2. Unreliability

Washable diapers lack the intuitiveness of disposable diapers and have a lower absorption capacity. Their use overall is also more varied, and complex compared to disposable diapers. Therefore, reusable diapers are vulnerable for incorrect use. They can leak due to very small mistakes and liners sometimes fail to catch all feces. People have to put effort and time into learning about all the small caveats and mistakes along the way are almost inevitable.

The problem of unfamiliarity and unreliability intersect with each other. An unfamiliar product will be scrutinised harder for unreliability and distrusted more quickly. This leads people to be less willing to spend resources on getting to know a product, and a lack of support from partners, extended family, and day-cares.

3.5.3 conclusion and discussion: Why washable diapers are not being adopted more widely?

To answer the research question of the beginning of the research phase: The adoption of washable is held back by people being unfamiliar with the product, and the product being perceived as unreliable. While the goal was to include all relevant context and capture as much of all factors that hold back diapers, it must be acknowledged that the approach taken in this was most focused on adoption and all factors that influence potential users. Further research should look further into the details of user behaviour and map issues like, why diapers cost more time and effort. A further limitation of this research is the small sample group (particularly the small number of current diaper users) and the decision of include the perspective of day-care employees to voice the perspective of sceptical ex-

users. In further research I recommend approaching a larger, more diverse group of people, including inexperienced users, satisfied users and unsatisfied users. Furthermore, interviewing is inherently a limited tool since both interviewer and interviewee are influenced by their own biases. This is specifically problematic for the topic this research, since this research found a big rift between perceptions. I therefore recommend including more objective, observation based methods in future research.

With this information a problem statement can be formulated. However, before this is done, it must be ascertained that there is environmental value in stimulating adoption of reusable diapers in the Netherlands. Therefore, before a problem statement is formulated and a design vision is created for a service model in chapter 5, the environmental impact of washable diapers will be compared to disposables in chapter 4.

4 ANALYSES ENVIRONMENTAL IMPACT

The main reason why people choose to use reusable diapers over disposables is their environmental benefits. However, the impact of reusable diapers is hard to quantify and is greatly dependent on assumptions made about user behaviour like laundering habits. Geographical context matters as well since it greatly influences the end of life options for diapers and determines cultural expectations around potty training. To make an informed comparison between reusable diaper and disposables this chapter will assess the environmental impact of different diaper behaviour scenarios in the Dutch context.

4.1. Comparing Fast Track LCA's

To make this assessment fast track LCAs will be used. An LCA is a well-established tool for assessing the potential environmental impacts associated with a product or service. This is done by making an inventory of the energy and materials that are required across the value chain of the product, process or service, and calculates the corresponding cumulative potential environmental impacts. With this analysis we can highlight the effect of certain trade offs with in the Dutch context and flag the material and processes with

the highest impact along the value chain. One flaw of LCA's is that it focusses primarily on emissions and excludes other dimensions of sustainability and other social implications. These will therefore be addressed separately at the end of this chapter.

4.1.1. Method and assumptions

Many different LCA studies have looked at the difference between reusable diapers and disposable diapers. Some find disposable diapers advantageous (Lehrburger, Mullne, & Jones, 1991) (O'Brien, et al., 2009), others recommend the reusable diapers (Little, 1990) (Hoffmann, Morais and Teodoro, 2020). However, most of these studies, indicate that neither system is superior under all circumstances (Aumonier & Collins, 2005) (Aumonier, Collins, & Garrett, 2008); (Lehrburger et al., 1991; Vizcarra et al., 1994). Especially meta-analysis emphasizes the different outcomes with different contexts and user behaviour (Sau-Fun Ng, Li, & Chi-Leung Hui, 2013) (UNEP, 2021).

To be able to compare the impact of reusable and disposable diapers, a fast-track LCA was done that mapped different types of user behaviour in the Dutch context.

The most important characteristics of the Dutch context are:

- *Only a neglectable number (less than 5%) of all diapers are recycled (Rijkswaterstaat, 2021). Household waste is not landfilled, and it is (luckily) unlikely diapers will be littered. It is therefore assumed all disposable diapers are incinerated.*
- *In the Netherlands 19% of electricity is produced by wind or solar energy as per 2020. This percentage is increasing (Agora Energiewende and Ember, 2021)*
- *In the Netherlands 99% of households have a washing machine (tns NIPO, 2017). Most households use front load washing machines. Both washing by hand and top load washing machines are extremely rare. The energy usage of washing machines of European Union energy efficiency class A and D were estimated based on the new classes effectual since March 2021 (Commission Delegated Regulation (EU) 2019/2014, 2019). A list with Wthe exact assumptions can be found in appendix D.*
- *In the Netherlands children finish potty-training relatively late and use on average 5300 reusable diapers.*

Within the scope of this fast-track LCA are primary production and material processing the diaper during the production phase, the electricity of washing and drying and the emissions of wastewater treatment during the use phase, and the emissions from combustion during the end of life. All the scenario's represent extreme cases where behaviour is 100% consistent. In practice, all users will exhibit combinations of scenario's.

The following assumptions were made:

- One functional unit is one potty-trained child: either 3 years of using 5 disposable diapers per day, or 3 years of using washable diapers (Milieu Centraal, n.d.)
- A washable diaper lasts on average 2.5 years when line dried, or 2 years when tumble dried
- An average diaper stack consists of 24 diapers and 8 diaper covers
- 6 washable diapers are used per day, and 18 diapers are washed per wash
- A pre-wash is done before every wash

Other sources and assumptions can also be found in Appendix D.

The following was not considered:

- Recycling of disposable diaper or cloth diapers
- Impacts made during transport or retail
- The impacts of faeces and urine
- Extra product like wetbags, extra boosters and liners.

4.1.2. Hotspots

Like in previous LCA literature the baseline scenario of 100% reusable diapers results in a global warming potential between 550 and 600 kg CO2-eq (Aumonier, Collins, & Garrett, 2008) (see table 3). The main difference between reusable diapers and disposable diapers is that for of disposable diapers create most environmental impacts during production and disposal while the main impacts of reusable cloth diapers is created during washing. Especially laundry habits have an important influence on the environmental performance. While this fast-track LCA affirms neither product inherently has a lower global warming potential, it provides more insight in the effect of certain behavioural scenarios.

- The most common among current users (characterised by environmental consciousness) is using average washing machine on 60°C and line

drying. This scenario reduces the impact of diapers compared to disposables by more than 50%.

- Tumble dry-scenario's are on average roughly twice as impactful as their line dry equivalents. drying should only be done with very efficient machines and/or access to renewable energy.

- Washing on 40 or 60°C, as is recommended, has a significant impact

- Strategies that reduce the number of washes needed (like washing fuller loads) have the potential to significantly reduce impact.

4.1.3. Washing temperature

As the paragraph above established, the impact of diapers can be reduced significantly when washed at a lower temperature, but washing laundry at 30 or 40 degrees has potential risks.

Under normal circumstances the main task of laundering clothes is the removal of visible stains. However, for some products the washing procedure should also lead to a hygienically clean textile surface, which includes the reduction of microorganisms on the fabric to a level safe for use as well as addressing other adverse microbial effects, like unpleasant smells. (Bockmühl, Schages, & Rehberg, 2019) For diapers especially urgent is the

Global warming potential diaper use per child



Table 3: Global warming potential for several diaper use scenarios

reduction of enteric viruses (e.g norovirus and rotavirus) that are transferred via faecal matter and commonly occur among children. These viruses need to be made inactive since textiles might act as vectors (Bloomfield, Exner, Signorelli, Nath, & Scott, 2011). While studies suggest that laundering with detergent is effective against enveloped viruses, non-enveloped viruses (this includes norovirus and rotavirus) are only completely deactivated at temperatures above 60°C (Heinzel, Kyas, Weide, Breves, & Bockmühl, 2010) (Lemm, Merettig, Lucassen, & Bockmühl, 2014). The consumentenbond does not consider an Eco 40-60°C washing program to be a sufficient replacement of a 60°C degrees washing program to accomplish this (la Faille, 2021). Therefore, as long as there is risk of spreading non-enveloped viruses like norovirus and rotavirus, diapers should be washed at 60°C.

4.1.4. Future of washing

In the Future the energy mix in the Netherlands will likely contain more renewable energy. The aim of the Dutch Climate Act is a reduction of greenhouse gas emissions in the Netherlands to a level that is 95% lower in 2050 compared to 1990, which helps to implement the Paris Agreement to keep global warming below 1.5 degrees. To achieve this, it is essential

to expand the generation capacity of wind and solar energy in the Netherlands. In 2030 approximately 80% of the electricity should be generated from wind and solar energy in 2030 and electricity production should be almost completely from sustainable sources by 2050 (TNO, 2020). Based on a recent analysis by the planbureau voor de leefomgeving, the Netherlands is currently on track to reach the 2030 goal (PBL, 2021).

This would significantly reduce the impact of washable diapers in the future due to a steep reduction in the kg-CO2- eq per kWh, even without further technological innovations, behavioural interventions or changing business models (Sigüenza, Cucurachi, & Tukker, 2021). Even considering innovations in disposable diapers it is likely that future comparisons between reusable and washable diapers will fall even more in favour of washable diapers. It should be noted that this is not a licence to use an unlimited amount of energy, since a higher energy demand will make it more challenging to reach the climate goals. It is therefore still interesting to look at ways to make the use of washable diapers less energy demanding.

4.1.5. Beyond global warming

The impact of the production and disposal

of material for reusable is minimal, meaning strategies to limit this will have a small impact on the Global Warming Potential, but should still be done to limit other externalities, like child labour and worker exploitation within the clothing industry (True Price, 2021). Cotton and polyester require a lot of water and chemicals during production, potentially leading to water scarcity in its country of origin. Cotton and bamboo are also more likely to be produced in China or India, where safe labour conditions are hard to verify, child labour is still present and fair wages are not guaranteed, unlike disposable diapers, that are often produced in Europe with a highly automated process.

Washing diapers also demands a larger amount of water compared to disposable diapers resulting in more wastewater polluted with faeces and detergents. The main risk this creates, is that it will be harder to meet water demands during summer droughts in the Netherlands. Despite the lack of official numbers, it can be assumed recycling of the materials in disposable diapers remains rare. More than half of textiles in Europe are incinerated or landfilled. Bio-based fabrics like bamboo or hemp are biodegradable and need less chemicals in the production process (Van Doezem, 2009, p. 16).

4.1.6. Conclusions: No control of impact

Since the effectiveness and environmental impact of diapers depend highly on use, certain requirements need to be met before there is an environmental benefit compared to disposable diapers (see figure 17). Currently there are little incentives or visibility on how diapers are treated. However, adopting washable diapers demands effort, and usually only attracts environmentally conscious users who have been through a thorough

research phase. People who get through and get to the final phase of the process are highly motivated to use the product in an environmentally conscious way. The rate of people who use their diapers in an unsustainable way, according to data from a survey done in during a trial in London (GFK NOP, 2013) is low.

Although in most cases there are environmental benefits for using reusable diapers, the uncertainty makes it more challenging for toddy/FDP to guarantee

and communicate the value of their company and product. Adoption could be promoted by making the benefits more evident and unswerving. It should also be acknowledged that when the ability needed to adopt and/or use of washable diaper is lowered, the motivation of users could be lower, resulting in less sustainable user behaviour. This should be anticipated for by focusing on education and lowering the effort needed for sustainable use.

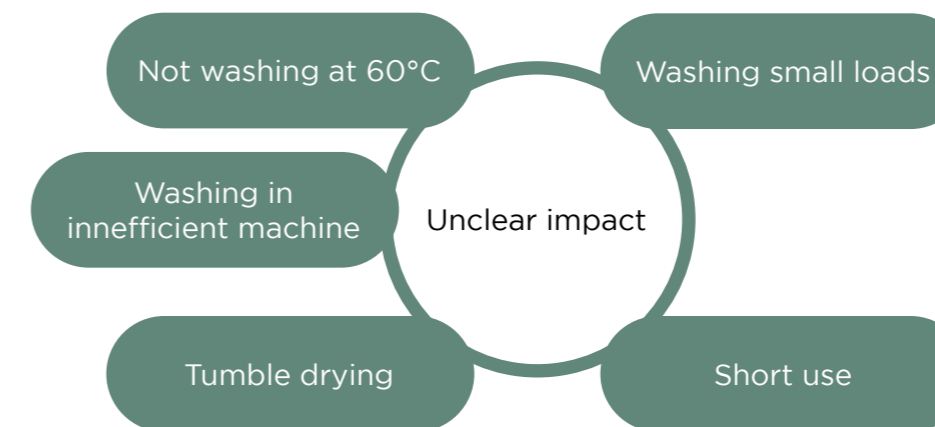


Figure 17: Problem cluster environmental impact

Bottlenecks:

During regular use the impact of reusable diapers is lower compared to disposable

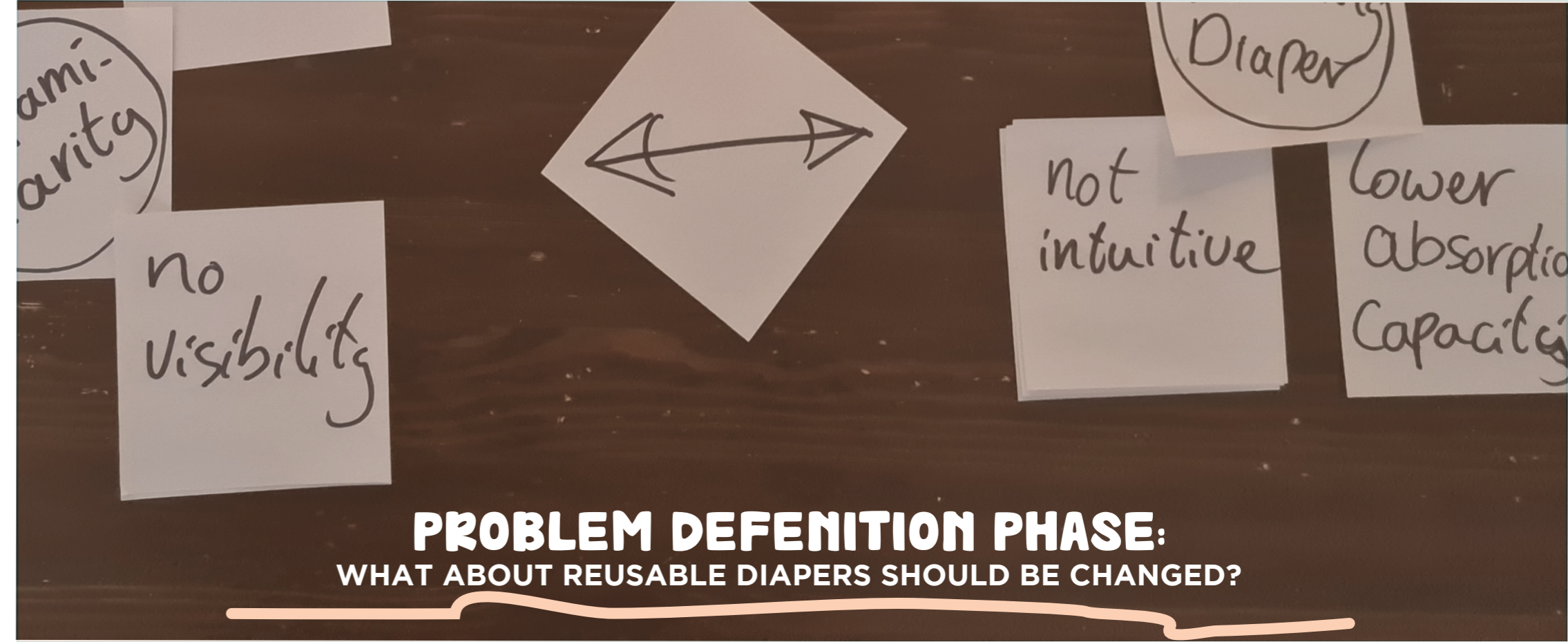
Tumble drying should be avoided

Washing should be done at 60°C, preferably in an energy efficient machine

Washing fuller loads significantly reduce impact.

The life-time of Diapers should be prolonged as long as possible the material should be recycled at the end of its.

Reusable diapers require more water



In the research phase of this project three aspects of the diapers were investigated for bottlenecks during adoption. The goal of the next phase is to formulate a problem statement and subsequent design vision based on these insights.

5 PROBLEM STATEMENT ADOPTION BOUNDARIES OF REUSABLE DIAPERS

In the research phase of this project the features, impact and acquisition of the diapers were investigated for bottlenecks in adoption (see figure 16). The goal of this chapter is to narrow down which problem should be prioritised. The goal of the next phase is to formulate a problem statement.

5.1 Problem prioritisation

Two problems were identified in chapter 3 and additional insights were gathered in chapter 4. These problems are connected and cannot be addressed in isolation from each other. However, this does not mean everything can be focused on at the same time. While a solution will always affect both issues, and all insights should eventually be addressed in future horizons, the choice was made for prioritizing either unfamiliarity or unreliability so that a sharper, specific design vision could be formulated. The choice was made based on three criteria: added value (aka potential to increase adoption), fit with Toddy's capabilities, and fit with service design.

Based on the first criteria, potential to increase adoption, the 'no control over impact' is not an interesting problem to

focus on, since, as concluded in chapter 3, generally the impact of Dutch reusable diapers is lower compared to disposables. Stimulating more sustainable user behavior, is an interesting path to pursue, but will have little direct influence on the adoption and therefore lays outside of the scope of this project. 'unfamiliarity' and 'unreliability' both do have potential to increase adoption.

Like mentioned in chapter 1, FDP is a non-profit foundation focused on researching sustainable diaper use, and Toddy is a consumer brand that intends to retail diapers in an innovative way. Neither of them has production capacities to manufacture a completely new diaper design. While suggesting a new, more intuitive embodiment design for the diaper that would prevent issues like incorrect use is interesting for the long run, a new way of distributing diapers is currently more relevant and actionable for this small, young company with limited resources. This fits better with 'unfamiliarity' than 'unreliability'

The same can be said about service design. A service design to make the diaper more reliable during use is interesting, a service

model is likely more suitable to intervene in how the product and information is presented during the acquisition journey, which fits better with 'unreliability'.

5.1.1. Conclusions

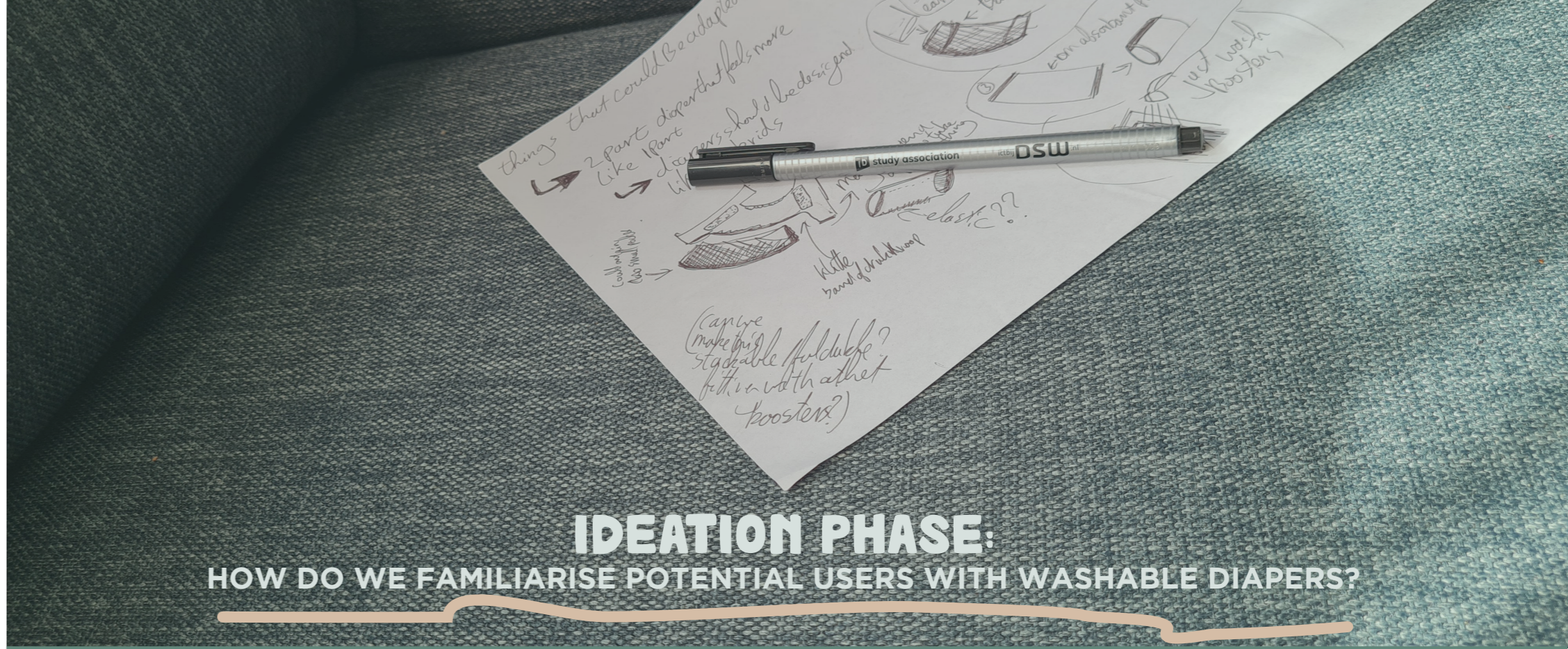
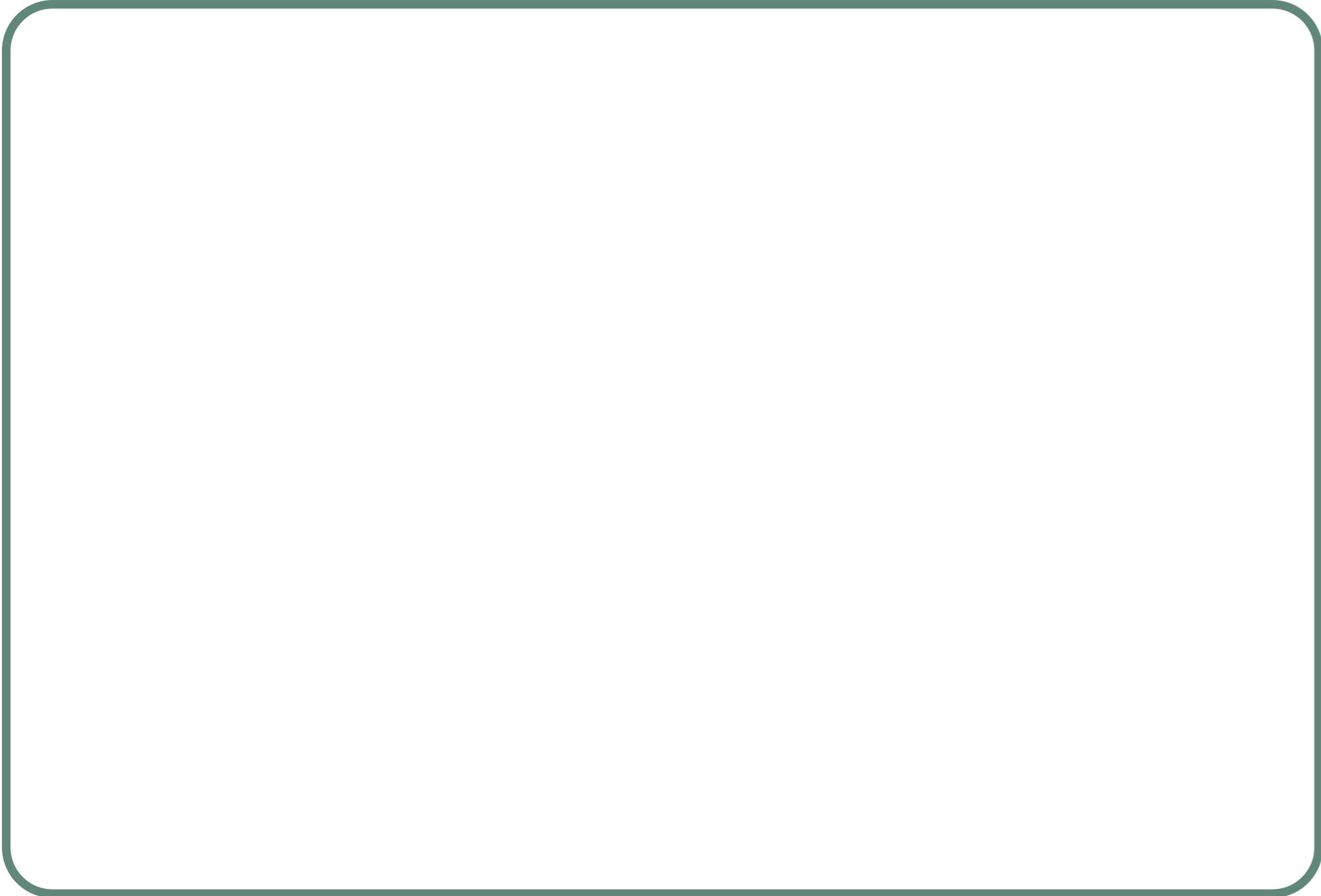
The main outcome of this research is that the usability of reusable diaper on its own is not flawless and has some drawbacks compared to disposable diapers. However, the focus should not be on 'fixing' the usage of the diaper, but instead on the awareness and perception of diapers in a service model design that interferes in the decision-making process of families who are expecting a child. This will benefit adoption, but also eventually raise the overall trust in the product.

5.2 Design vision: moving washable from fringe to credible

Reusable diapers are not for everyone, but many people want to put effort into making them work. However, currently there are many hurdles on the journey of acquisition, and it often takes too much time and research to build the necessary confidence in the product to spend 500 euros on it. At short-term I want

to make it easier for potential users to find, understand and try the product, so that more people get the chance to give reusable diapers a real shot.

If current diaper users could be described as 'dark green', this aim of this service is to capture the young and growing medium green target audience. These people do not mind spending some effort for a more environmentally conscious product but are either unaware of its existence or are doubtful about its workings.



IDEATION PHASE:

HOW DO WE FAMILIARISE POTENTIAL USERS WITH WASHABLE DIAPERS?

Converging on a design vision focused on familiarity means we can start ideating ways to solve this problem. In this phase several ideas are generated and evaluated. This process is structured by focussing on Rogers' theory of diffusion and

finding solution principles. These are used to eventually find concepts and select the most viable one to develop further in the design phase.



6 SYNTHESIS

Synthesis is the part of the design process where ideas are generated. In this case the goal of the design is to stimulate adoption by familiarising potential users with diapers. Rogers' theory of diffusion is used to structure an initial brainstorm that results in two overarching solution principals. Based on these principals, a brainstorm was done to generate concepts. The concepts with most potential were developed into a value proposition. Based on the best fit with the customer segment, the best value proposition was selected to be developed further.

6.1 Idea generation

The question of how to familiarize people is the question of how to get people to use something new. It is therefore not surprising Rogers' definition of diffusion ("the process by which an innovation is communicated through certain channels over time among the members of a social system") has some overlap with familiarising. While acknowledging that Rogers encompasses more, looking at the presence of Rogers' characteristics provides a list of different strategies to make it easier for people to familiarise themselves with a product or motivate them to do so.

6.1.1 Initial ideation

According to chapter 4, washable diapers mostly lacked trialability and compatibility. Ideating within these two areas has the most potential but should not be limited to them exclusively. All five characteristics hold room for improvement and could be fertile ground for explorative ideation. Therefore, all characteristics were put in a table with all actors in the decision-making process. This table was then used for an initial brainstorm. The aim of this phase is to explore different the range of options available. The outcome of this brainstorm can be found in Appendix E. The initial ideation brought forth many ideas to help reduce unfamiliarity of washable diapers. Two things stood out. Firstly, some relevant solutions fall outside of design. Many opportunities lay within the field of commerce (e.g., selling through different channels, like drugstores and baby (web)shops) or education (e.g. adding reusable diapers to the curriculum of maternity carers, obstetricians and pediatricians). These options should be explored further but fall outside the scope of this project. Secondly some ideas worked in similar ways. The ideas from this table were therefore clustered to extract the main solution principle behind them. These principles were used to define the direction for a second round

of more focused brainstorming. The two general solution principals are increasing visibility and lowering upfront boundaries (see table 4).

Increase visibility

Many people are completely unaware of the existence of reusable diapers. Others do not remember them at the right time. Additionally, the absence of reusable diapers in stores and conversations with professionals delegitimises them. Increasing visibility means making sure that diaper will be present in places where families will come across them, even without intentionally looking for them.

Examples: Using/offering diapers at day-cares, Workshops at parenting classes, Sending information packages to Consultation bureau & Obstetrician

Lower upfront boundaries

People interested in washable diapers often feel apprehensive, not knowing if they are suitable for their situation. Yet the expected upfront investment is substantial. Lowering upfront boundaries aims to make it easier to start small with less commitment and more flexibility. This reduce the feeling of risk families feel when they are considering washable diapers.

Example: Offer rental diapers, Pregnancy box with one free diaper/one free month of diapers, providing essential information clearly, selling small sets of diapers

Table 4: two solution principles

6.1.2. Initial Idea development and evaluation

After having extracted the two main solution principals, four ideas were generated that best embodied these two principals (see table 5). All ideas were explored further and evaluated. This was done based on the four sub-problems

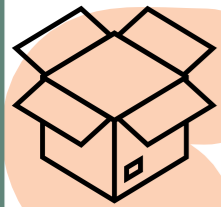
identified in chapter 4, the fit with user values from defined in chapter 2, the goal and capabilities of Toddy from chapter 1 and finally, the presence of the rogers characteristics (See table 6, for a full overview of the presence of each rogers characteristic see appendix F).

Based on the insights from evaluation of the ideas, it became clear that not all ideas are likely to contribute equally to adoption of washable diapers. The baby shower service could make the product more visible among friend groups of new, eco-conscious families, but fails to meaningfully reduce any of the boundaries or bottlenecks around acquiring diapers, besides shifting part of the cost to friends and family. Therefore, the idea was not developed further.

The flexible diaper access aims to make it possible for people to start with washable diapers without upfront knowledge by making it possible to constantly adjust one's diaper stack. This will lower some of the perceived risk of having to choose the 'right' kind of diaper upfront and allowing for a user to slowly grow their diaper stash over time. However, by increasing flexibility it might become more over whelming for people to find out what they want to use, and the flexibility of an access model could make it unclear what someone is signing up for beforehand. Therefore, the idea was also not developed further.

The circular pregnancy box benefits from using the well-known concept of a pregnancy box. While the product would not be free, it would be reduced in price

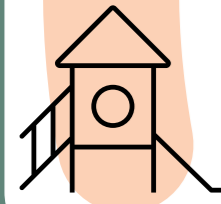
Increase visibility



Baby shower service:
A service that helps friends buy a family's preferred diapers as a baby shower gift



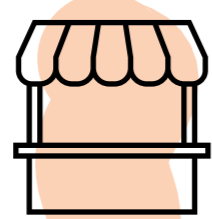
Visible use at day-care:
A roadmap for increasing the adaptation of washable diapers at day-cares



Circular pregnancy Box:
Offering diapers in a pregnancy box with reusable products that can only be used for the first 3-ish months, and is send back after that period

Table 5: Initial Ideas

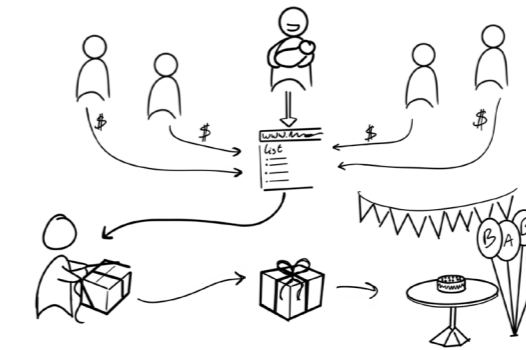
Lower upfront boundaries



Flexible diaper Access:
Flexible diaper-stack rental service with pick-up and drop-off at a local store

Table 6: Evaluation initial ideas

Baby shower service



A service that helps friends buy a family's preferred diapers as a baby shower gift. This service is an online tool that helps people select the most suitable type of diaper, and sends these preferences to a group of friends, who can pay together for the (part of) the diaper system and personalise and decorate it.

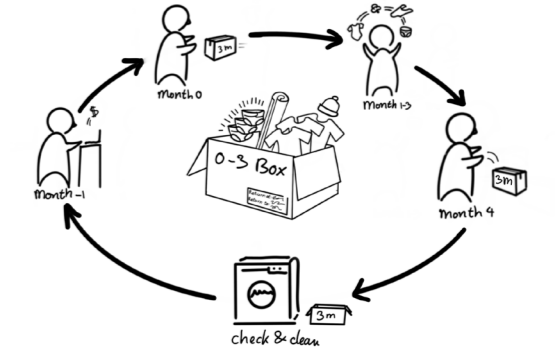
	--	-	+	++
Improves trialability				
Improves visibility				
Guides product choice				
Effective conveys information				
Fits values users				
Fit Toddy				
Presence Rogers characteristics				

Using the baby shower ritual to position diapers as a communal gift increases the compatibility with existing ways of acquiring baby products and exposes new people to the diapers, but is unlikely to convince people without intention of buying, because it does not add much additional value. Making the acquisition easier if also unlikely to reduce complexity in a relevant way.

Continue?

No

Circular pregnancy box



Offering diapers in a pregnancy box with reusable products that can only be used for the first 3-ish months, for a rental fee below purchase cost (and deposit). The box contains, simple to use, new-born sized diapers for people to try out for a while. After 3 months the box is send back, cleaned and checked and rented out again

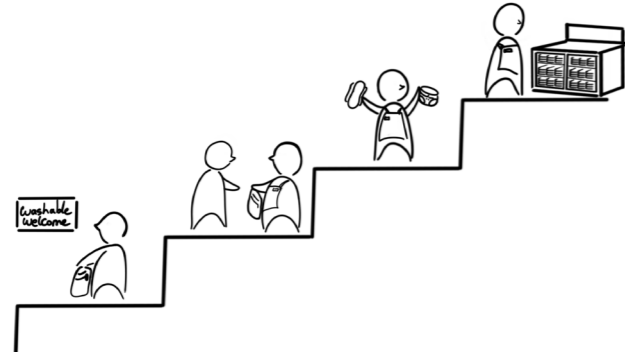
	--	-	+	++
Improves trialability				
Improves visibility				
Guides product choice				
Effective conveys information				
Fits values users				
Fit Toddy				
Presence Rogers characteristics				

Pregnancy boxes are a very familiar concept, and a good way to get people to try out new-born washable diapers in an indirect way. The added value is clear. The main concern is that the box might not fit with preexisting values, since many people are apprehensive about using second-hand products for babies. This part of the concept needs to be redesigned.

Yes, but redesigned

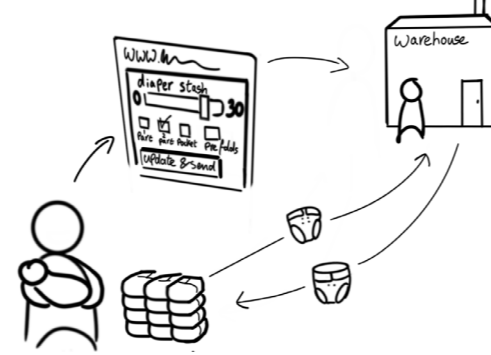
Table 6 cont.: Evaluation initial ideas

Visible use at day-care



A roadmap for increasing the adoption of washable diapers at day-cares, so that for every stage day, so that they act as example to their clients, and can set themselves apart from their own competition. The roadmap starts with only accepting diapers and ends with using 100% washable.

Flexible diaper Access



Flexible diaper-stack rental service allows people to pick-up and rent several types of diapers from a local store allows people to swap the type and number of diapers indefinitely until they are happy with their personal diaper stack. Drop-off would happen in a drop-off box at stores and payment via an app.

	--	-	+	++
Improves trialability				
Improves visibility				
Guides product choice				
Effective conveys information				
Fits values users				
Fit Toddy				
Presence Rogers characteristics				
Evaluation	Day-care workers are trusted authorities on who are an example to many families. If special attention is given to their communication to expecting families, it is also a way for the day-car to differentiate their service from their competition. Day-cares can also function as a platform to make diapers more triable for existing customer			
Continue?	Yes			

	--	-	+	++
Improves trialability				
Improves visibility				
Guides product choice				
Effective conveys information				
Fits values users				
Fit Toddy				
Presence Rogers characteristics				
Evaluation	This concept makes diapers available for people without upfront knowledge and is a good platform for providing information. However, the flexibility of the service might also make it complex for people and hard to commit to it upfront. It is also a very labor-intensive process to keep cleaning and transporting different types of diapers. This will likely result in higher overall cost for consumers			
Continue?	No			

and contain new-born sized washable diapers. These diapers can only be used for a brief period, and therefore it makes sense to reuse them. The same is true for many other baby products for new-borns. While this is a good moment for people to become familiar with diapers, the idea of buying/renting second-hand products for a baby is not attractive and the logistics of having to check and clean all products will quickly reduce financial benefits of reuse. There are benefits to this idea, but it needs to be redesigned to become a concept.

Visible use at day-cares is interesting because it would be a way of creating a lot of visibility for diapers to parents and make their use more mainstream. On top of this it would provide environmental benefits beyond families and create a new market for reusable diapers. While there are some questions around the value it would bring for day-cares and how this visibility can best be translated to adoption, visibility at day-cares was developed into a concept.

6.2 Concepts

For the concept phase Visible use at day-cares will be developed further and circular pregnancy box will be reworked into the baby gift box.

6.2.1. Concept 1: Visible use at day-care stage by stage

The aim of visible use at day cares is to introduce parents to reusable diapers via day-cares. A day-care's ability and motivation to adopting washable diapers varies widely per day-care, therefore this concept was envisioned as being a roadmap for day-cares that guides them to incorporate more washable diapers into their daily practices at any stage of openness to the product, and potentially transition to the next stage.

One of the main value drivers of this concept is it visibility of diaper use is both the key to stimulating adoption and the way day-care to differentiate itself from its competitors. It is possible for babies to go to day-cares from around 6 weeks old, but it is more common to start between the ages of 3 and 6 months. For both adoption and the value for day-cares it is important to make sure families are aware as early as possible. Therefore, there is an extra focus on making the use of reusable diapers visible to families before they start attending the day-care (e.g. their

website and a potential guided tour for potential attendees).

There are four stages (see figure 18 and 19), with the first one being 'inform and align'. This stage is for day-cares with low ability and motivation. The focus is to communicate a day-cares willingness to accept diapers brought by parents and providing a protocol for parents and employees to deal with diapers. This is done by providing a day-care with a package containing physical (posters and window stickers like in the wasbaar welkom campaign by zero waste Nederland (Het Luihuis, N.D.)) and digital material for on a day-cares website particularly focused on reaching new, potential day-care clients and clear, easy accessible guides for both employees and families.

The second phases, for day-cares with medium ability and motivation focusses on introducing partial or hybrid use. The focus should be on starting with day-care employees and families who are intrinsically motivated and slowly normalise the disposable diaper and optimise its use. To make sure this is visible for new potential attendees of the day-care, it should be reflected in by window stickers and posters, the website, but also in the changing station, since

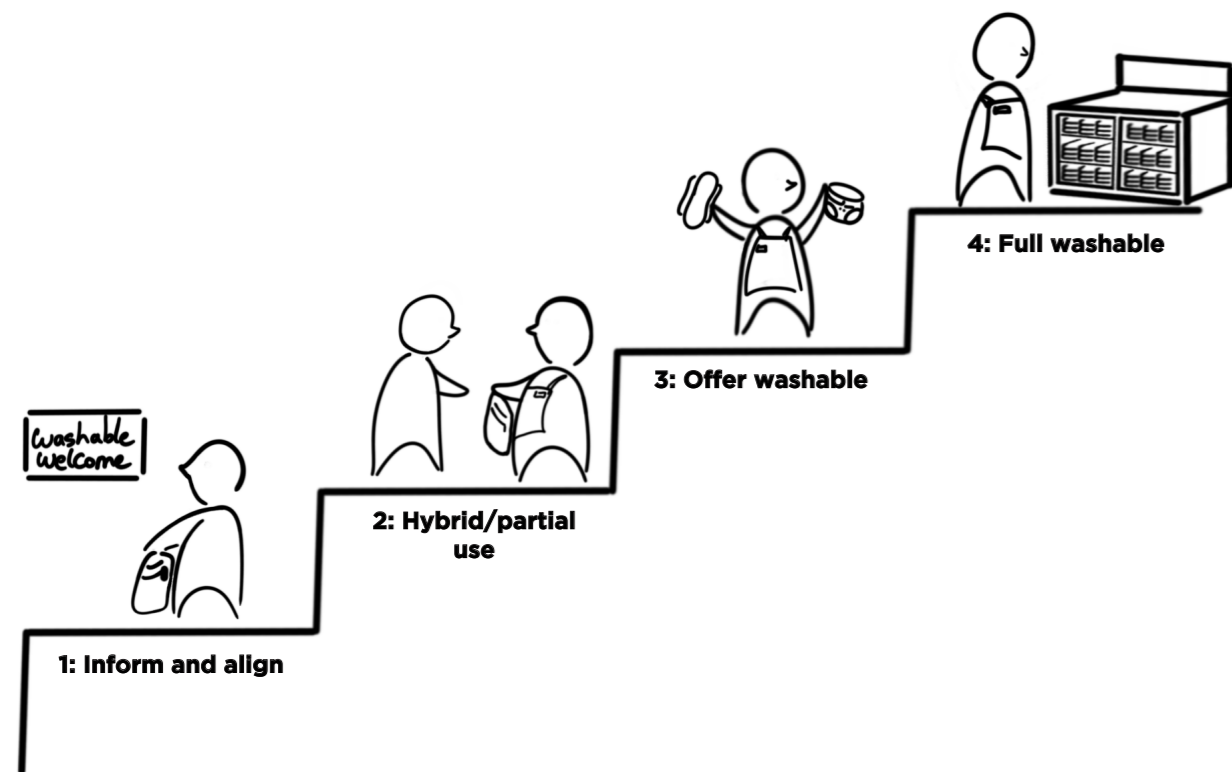


Figure 18: Visible use at day-care

this is usually visible during guided tours for new parents. Toddy will rent out the equipment (diapers, changing station, washing machine) and instructions necessary, but washing will be done at day-cares if possible.

The third phase focuses on starting to use day-cares as a pickup and drop off point for rental diaper packages. The purpose of this phase is providing families easy trialability without burdening the day-care employees. The purpose is for Toddy to handle all handling, checking, and cleaning, and for day-cares to receive a small number of diaper rental packages, displaying them and handing them out. Here, again, it is important that families are made aware of this option during their orientation and to make this information part of the onboarding process and potentially even a guided tour.

For the final phase, for day-cares with particularly high motivation and ability the focus is on maximising the use of washable diapers. For this todody, or a partner, will provide a full washing service where soiled diapers are collected and replaced daily.

Goal

Day-care orientation parents

Inform and align

Partial/hybrid use

Offer rental diapers

Full use



Window stickers & posters Website

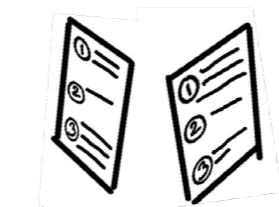


Optimised changing station



Intoduction folder Rental diaper display

Daily Day-care routine



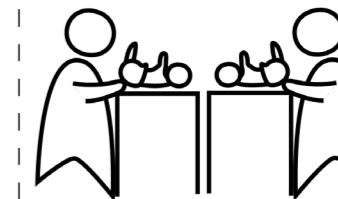
Protocol for parents and employees



Partial/hybrid use



Rental diapers available for parents



Full use

Backstage actions



Washing at daycare Training for employees



Handeling, checking and cleaning



Washing service

Figure 19: Visible use at day-care stage by stage

6.2.3. Concept 2: baby gift box step by step

The baby gift box ('Doorgeef Doos' in Dutch) is the continuation of the idea of the circular pregnancy box but focused on making the box a suitable gift to be passed on directly to a next person (see figure 20). The aim of the baby gift box is to introduce families to washable diapers right after the baby arrives by offering new-born sized diapers in a pregnancy box together with other baby products for a reduced price. All other products are also sustainable but only relevant for babies from the first three months but could potentially be reused. The baby gift box can be passed on as a gift to a friend later. Replacement products can

be bought online for products that got damaged or that people want to keep for themselves. For brands and retailers for smaller, local value driven companies, this is a way to be exposed to new users and increase trialability.

The value of this concept is that it is a fun way to explore some new sustainable items, either by buying the new box for once self, or by getting it as a present from family or friends. The idea is that presenting it as a pregnancy box puts the product in a familiar and easy to find product category and mixing the diapers with other products lowers the pressure for individual products to be a guaranteed success upfront (especially when bought

for a reduced price and with a plan for reuse in place). By making gift giving, and making checking, cleaning, and potential replacing the responsibility of the user, the logistics and cost of reuse are reduced, while the process becomes more personal and transparent.

Instead of different phases, this service exists out of one process with four steps. Firstly, one goes to the website. This website provides information about all the different items and the companies they originate from. Here you can create an account to order the box.

During the second step one uses the items, while receiving information and instructions via your account and being able to reach out to peers for tips and questions.

Thirdly the user repacks the box and prepares it to be given away themselves. Via their account they can buy replacement products to restock the box and also conveniently buy a full, universal sized diaper system and other potential follow up products.

Finally, the box is passed on as a baby shower or maternity gift. This person can be friend or family, or if there are no new babies around within the personal circle



Figure 20: Baby gift box

of the original user, toddy can match the user with someone.

6.3 Concept evaluation

To determine which one of the concepts should be chosen, a new table with herris profile was created. This time two elements are added: a simple PMI overview (plus-minus-interesting) and a value proposition fit analysis.

While PMI is meant as a simple way of judging an idea quickly instead of a definitive decisionmaking tool (Tassoul, 2006), it was included in the decisionmaking table 7 as an efficient way to highlight specific aspects about the concepts and prevent being too abstract.

Value proposition design value addresses the relationship between customer segments and value propositions by defining exactly what value is being created for whom. This can be used to check if in both concepts all main parties benefit from this solution. The complete value proposition canvasses can be found in appendix G and H, figure 21 and 22 are the abbreviated versions.

6.3.1. Evaluation day-care concept

The day-care concept presents a multifaceted approach to support day-cares in using washable diapers, something interesting for the manager and parents, since it allows the day-cares to differentiate themselves as eco-conscious. It can likely be done at a similar cost as disposable diapers, since the cost for disposable diaper and municipal waste management services will likely be reduced.

One of the most prominent problems that comes forward is the value fit for day-care employees. Introducing reusable diapers at day-cares will always come with some extra effort and complexity. In most cases day-care employees are trained in pedagogy and the primarily goal of their job is the physical, social, and mental wellbeing and development of the children they take care of. Spending more time on handling diapers for

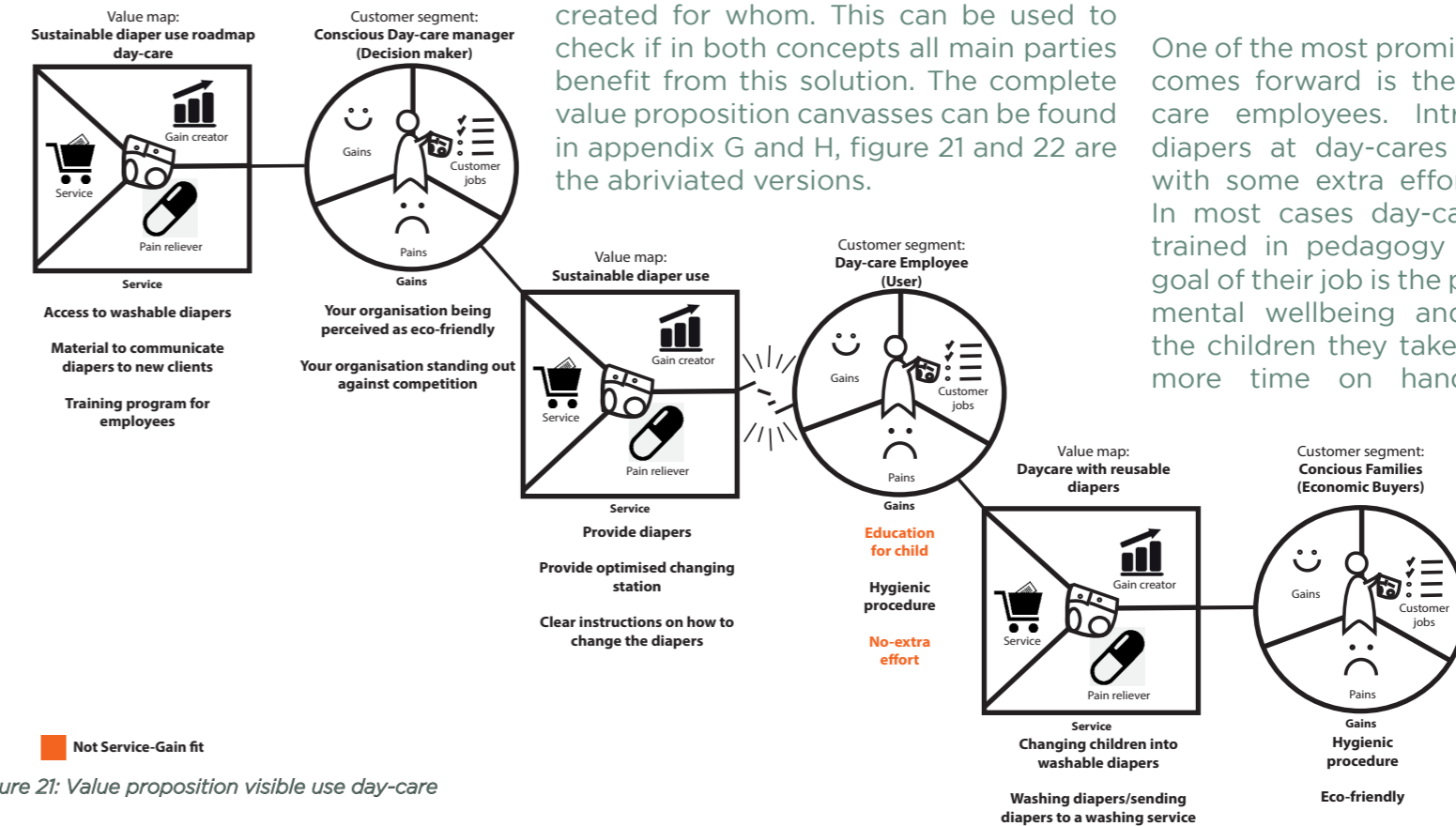


Figure 21: Value proposition visible use day-care

environmental benefits risks feeling like a concession of primary goals to focus on a tertiary concern.

The holisticness and multifacetedness of the concept also makes it fairly resource intensive, where a diverse range of smaller services are provided to different clients. This presents a boundry for a small,

young brand like toddy, who does not yet possess these resources.

6.3.2. Evaluation baby gift box

This concept brings conscious consumers and brands together and increases trialability for several 'ethical' products. The product itself also encourages reuse of products by enabling people to give away their product as a personal gift. The baby gift box is a product close to toddlers current potty-training box and diaper boxes (with disposable ecological diapers), that provides new value for both retailers of reusable diapers and other sustainable products and families

with toddy needing relatively few new resources to start providing this product. The main downside of this product is that this product does require an additional behaviour change from consumers. Communicating the intended purpose of this product will require effort and not all consumers will be open to giving away old diapers to a friend. It could be possible that people either do not know anyone, prefer to give something new or want to hang on to their stuff due to its sentimental value.

The second highest risk is the limited control toddy, and the provider of baby products have over the use of the product. People might gift incomplete boxes or hand down damaged products, potentially harming the reputation of the product providers involved.

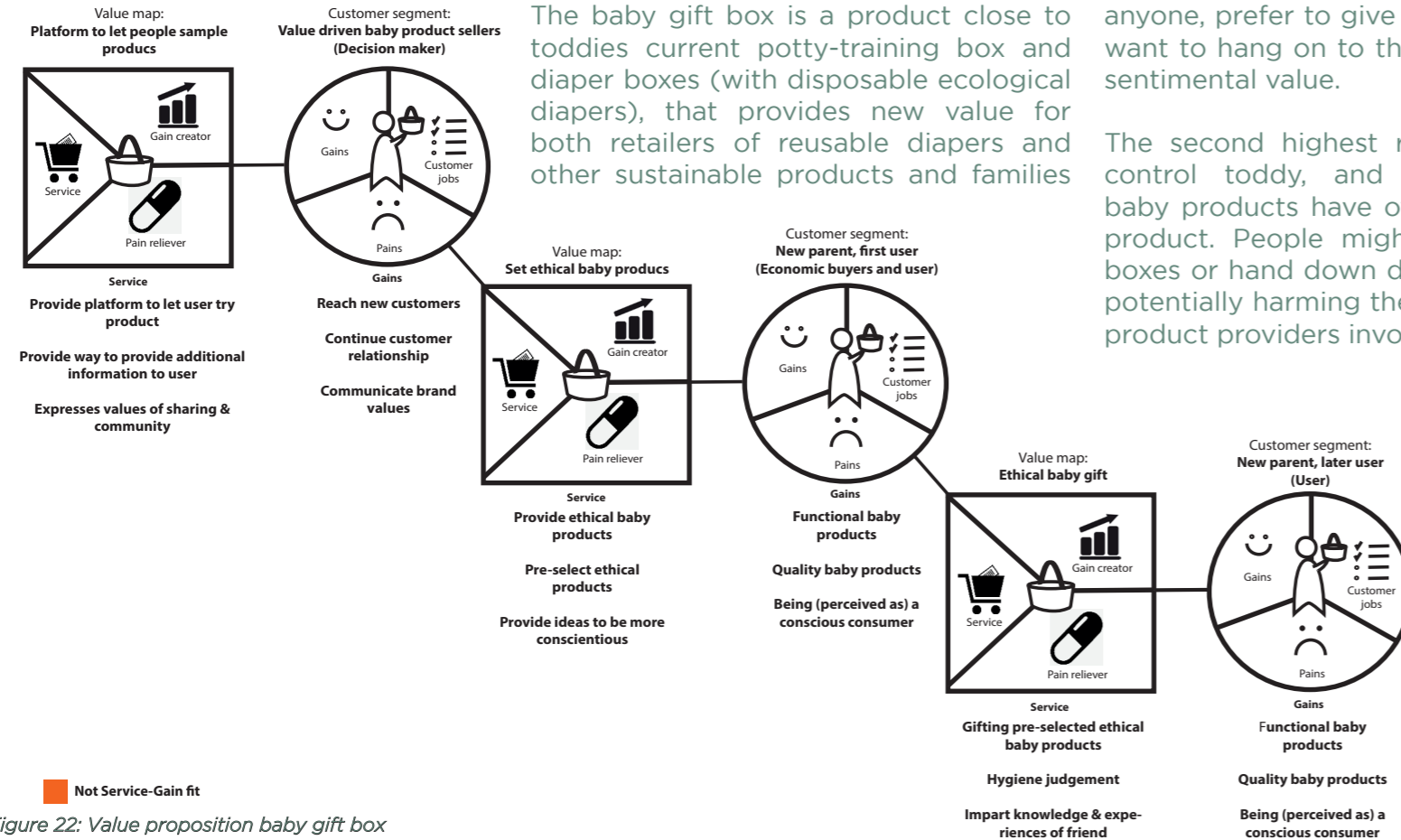


Figure 22: Value proposition baby gift box

	Visible use at day-care				Baby gift box			
	--	-	+	++	--	-	+	++
Improves trialability								
Improves visibility								
Guides product choice								
Effective conveys information								
Fits values users								
Fit Toddy								
Presence Rogers characteristics								
	+ Holistic solution for many day-cares + Directly lower diaper waste + Reduces cost of waste management for day-care - Puts extra work on shoulders day-care employees - Outside of Toddie's current field of expertise - Translation to adoption is uncertain - requires lot of resources				+ Fits well with Toddie's current portfolio and expertise + Solution fits other sustainable products as well + Stimulates reuse - Not much control over quality - User base likely small - Requires promotion - People might expect the product to be free			
Value proposition fit	Flawed				Good			
Evaluation	Day-care workers are trusted authorities on who are an example to many families. If special attention is given to their communication to expecting families, it is also a way for the day-care to differentiate their service from their competition. Day-cares can also function as a platform to make diapers more triable for existing customer				This concept brings conscious consumers and brands together and increases trialability for several 'ethical' products. The product itself also encourages reuse of products by making enabling people to later give away their product as a personal gift.			
Continue?	No				Yes			

Table 7: Evaluation concepts

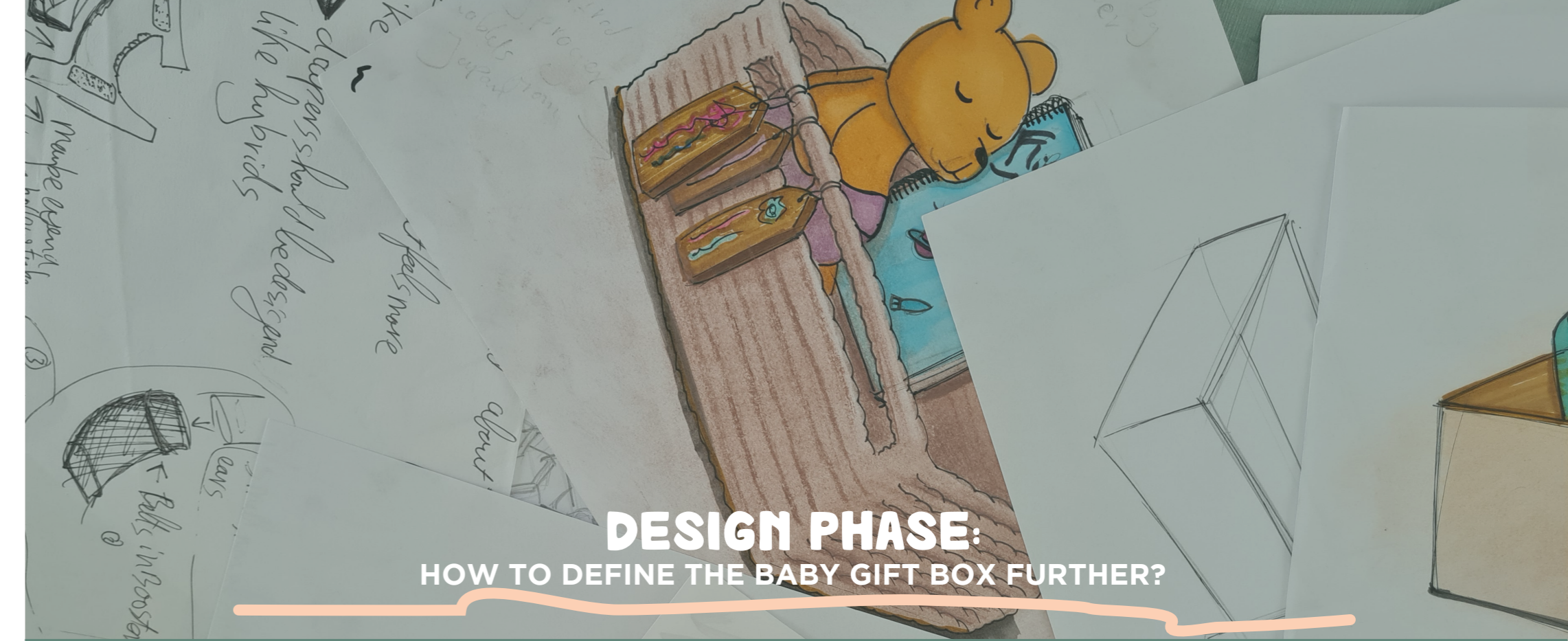
6.3.3. Choice final concept: baby gift box

The final choice was made to continue with the baby diaper box. This was done for the following three reasons:

While the product might increase familiarity among a more limited target audience compared to visible use at day-cares, the familiarity is created earlier and deeper is therefore probably more likely to result in continued use of washable diapers.

While the product might increase familiarity among a more limited target audience compared to visible use at day-cares, the gift box is more likely to target the intended audience. The target audience for diapers is the growing group of young medium green care takers who do not mind spending some extra effort to be more environmentally friendly. This group is likely attracted to a box that helps them find new ways to be more sustainable and are likely willing to adapt their behaviour.

The concept aligns well with the resources and expertise of Toddy and has a high feasibility.



DESIGN PHASE: HOW TO DEFINE THE BABY GIFT BOX FURTHER?

The goal of the design phase is to develop several ideas for how to develop the 'doorgeef doos' into a product and service model and select the most valuable one. To do so the concept

will be explained in first and the value drivers will be identified. After this the details will be designed and presented after which the outcome will be evaluated.

7 FINAL CONCEPT

So far the chosen concept is a gift box that introduces families to washable diapers right after the baby arrives by offering new-born sized diapers in a pregnancy box together with other baby products for a reduced price. All other products are also sustainable but only relevant for

babies from the first three months but could potentially be reused.

After the selection for the baby gift box the concept was still largely undefined. The first step in developing it further was to explain the customer journey in detail

and define the value drivers.

7.1. Customer journey

The aim of the baby gift box is to get people to eventually buy a washable diaper set from Toddy. Therefore, the

gift box is made to guide people through the acquisition process of diapers as described in chapter 3 and guide them to other todody products. The box focuses on familiarising people with washable diapers by creating awareness of the product during the orientation phase and creating practical experience during the try-out phase. This is also done by linking the gift box to existing products and services provided by Toddy (See figure 23).

7.1.1 Step 1: Buying

The goal of this step is to create awareness about the existence of washable diapers (see figure 24). This is done by offering the reusable diaper in a pregnancy gift box. In contrast to reusable diapers, in most cases users will already be looking for baby items and/or (free) pregnancy boxes, even if they do not know about the option of reusable diapers. During this process they might hear about the Toddy doorgeef doos from friends or family, advertisement online or other actors in the preparation phase (third trimester of pregnancy).

Firstly, one goes to the Toddy website. This website provides information about the concept of the box and the fact that this box is meant to be passed on after

use. All the different items are shown with additional information about the companies they originate from with their impact and mission. If the user decides they agree with the package discount, they can order a box by making an

account. This account gives them access to online forums and online instructions. Another likely scenario (not shown) is friends or family buying the box as a gift for a new family.

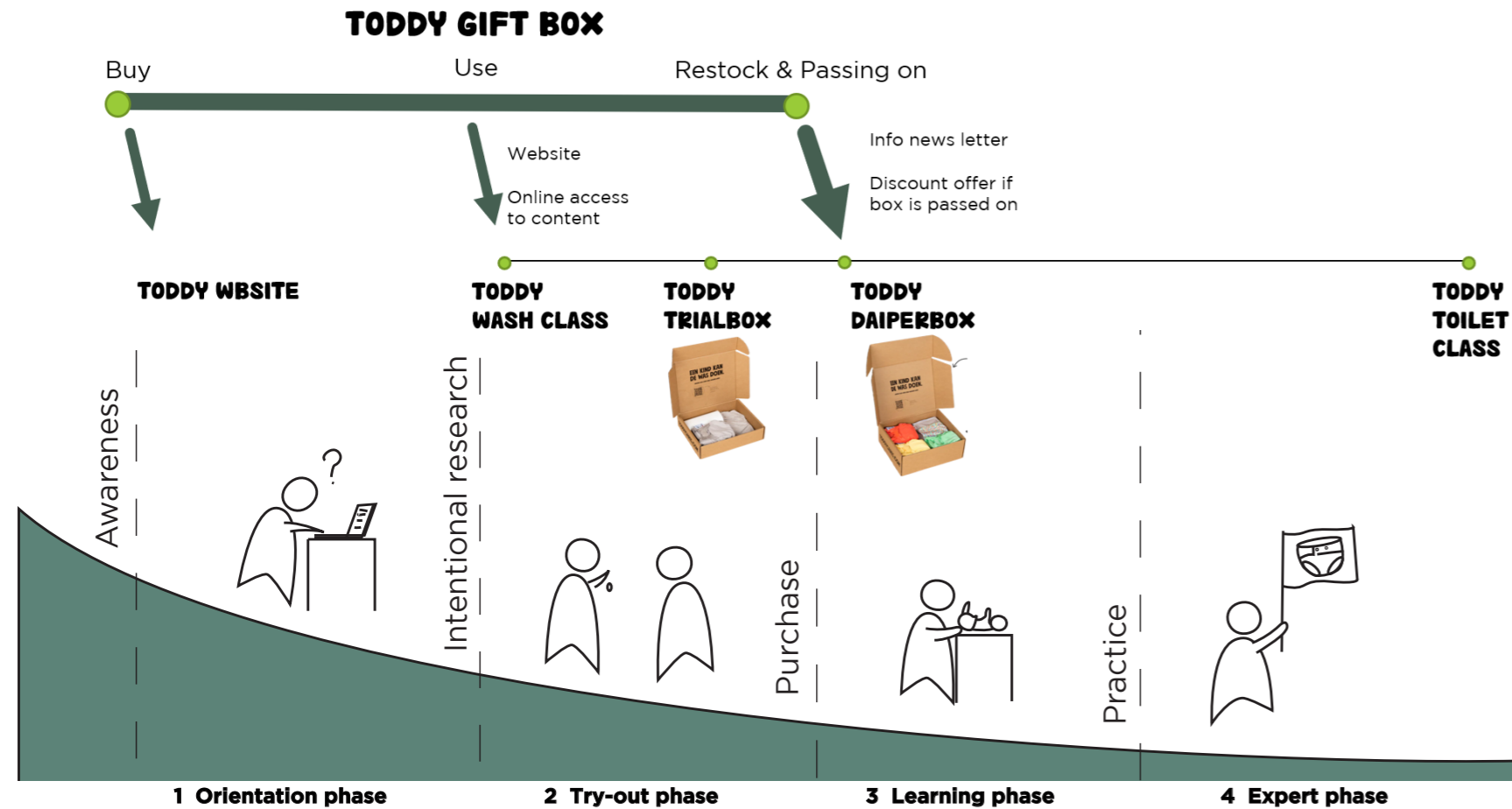


Figure 23: Toddy products within the journey to the acquisition of diapers

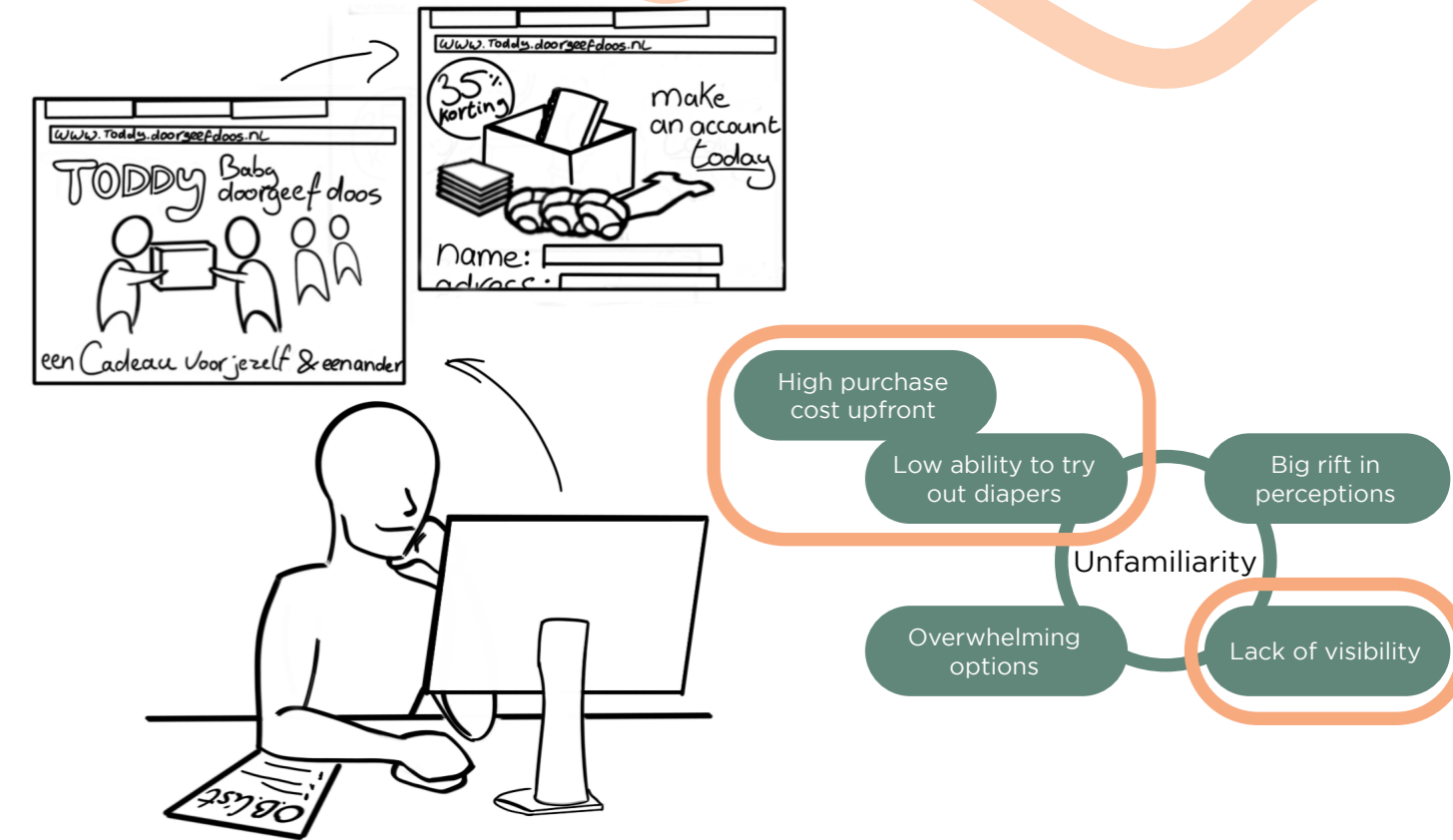


Figure 24: Customer journey Toddy baby gift box step 1

7.1.2 Step 2: Use

The goal of step two is to help users through the try-out phase by conveying how diapers work and allow people to experience if they are suitable for their family (see figure 25).

The box has a unique name (a reference to a famous spaceship) and contains items and a journal. The journal contains 1) an introduction about todody and the box, 2) information about the items, mission and instructions of the companies 3) a guestbook section users can personalise and leave messages for the next user (like

a vriendenboekje). With this information families can start trying products.

If the journal is not clear or engaging enough, it can refer them to the Toddy Wash class in the form of a series of online explainer videos and to the online forum where people can answer each other's questions and share their experiences.

During this a bi-weekly email newsletter will also provide extra sustainable parenting tips based on the age of their baby and remind them of the possibility to participate in the online community.

7.1.3 Step 3: Restock

The goal of step 3 is to direct users with positive experiences to buy universal sized washable diapers and other follow-up products (see figure 26). Additionally, the box is prepared for being given away.

After circa 3 months the user repacks the box and prepares it to give it away. Firstly, they determine the state of all products and what products should be replaced or the user wants to keep themselves. Via their account they can buy replacement products to restock the box. Additionally, users are asked to fill out some questions about their experiences and future plans. Based on this the app will provide them with personal suggestions for follow up products and users can conveniently buy a full, universal sized diaper system that meet their requirements (targeting this group with special offers is an option).

When the box is full the user can personalise the box by putting their own stickers and doodles on the box. The idea is that with the stickers users can easily build a unique spaceship, that represents their family, floating through space. Additionally, the insight of the lid can be signed.

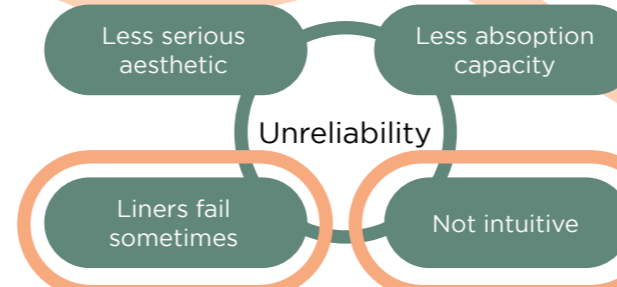
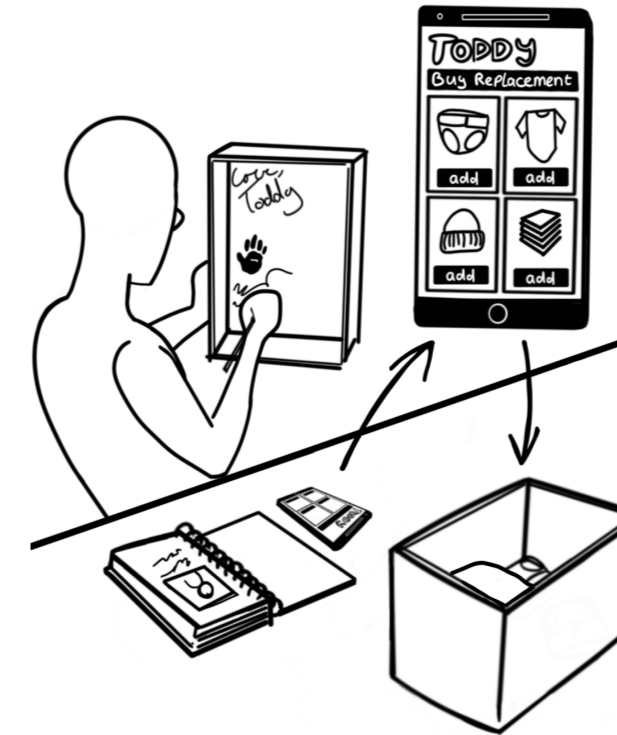


Figure 26: Customer journey Toddy baby gift box step 3

7.1.4 Step 4: Passing on

Finally, the goal of step 4 is to familiarise a new person with diapers, guide them into starting step 2 by themselves (see figure 27).

The box is passed on as a baby shower or maternity gift. This person can be a friend or family member (further in the future, todody can match the user with someone or if there are no new babies within the personal circle of the original user). This person also receives the journal that explains how to start their own step 2. The first page will explain the concept and instruct them to set up a new account. When this account is created and linked to the unique name of the received box, the box is officially transferred. The new user starts step two and personalises the box further.

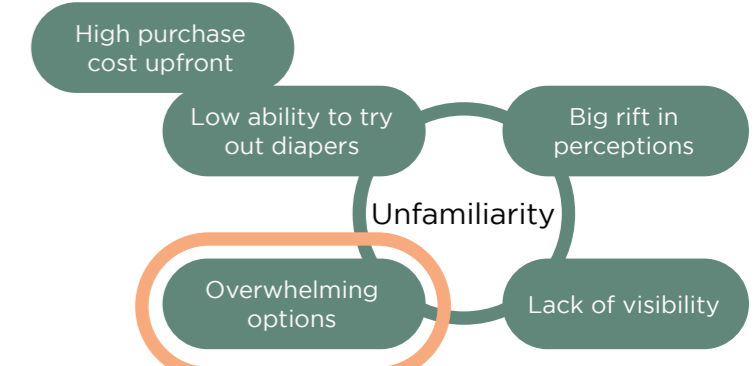


Figure 27: Customer journey Toddy baby gift box step 4

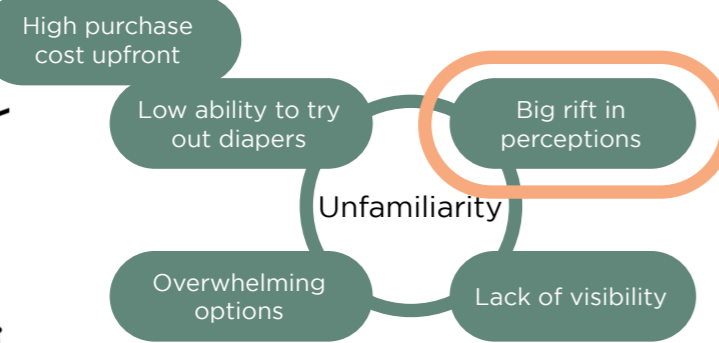
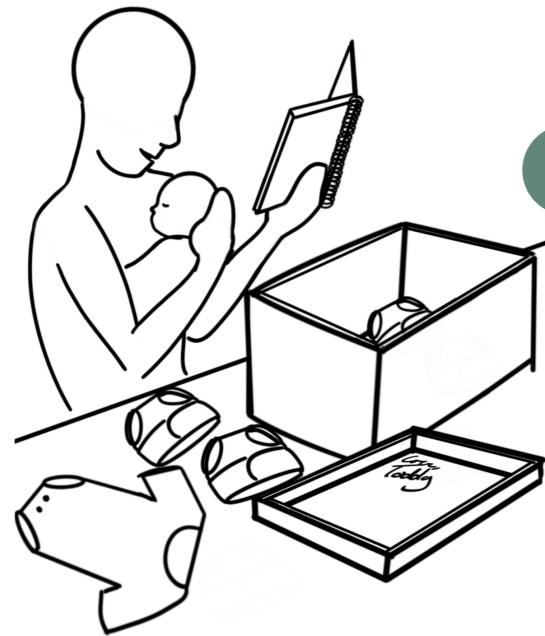


Figure 25: Customer journey Toddy baby gift box step 2

7.1.5 Risks and possible mitigations

There are potential pitfalls and uncertainties that need to be taken into account. For the first step, there the possibility that marketing the box as a not-free pregnancy box might cause confusion and frustration. To mitigate this the price should always be communicated early. One strategy is using the percentage of total discount people to communicate the fact that the box has a price in a clear but positive way.

During second step the main risks is that three diapers is not enough to build a routine. Currently three diapers was estimated to be the minimum number (and therefore the cheapest) of diapers needed, but this should be verified with user tests. It is also possible the first user mistakes the cardboard for a simple shipping box and destroys it or throws it away. To combat this a box design with a telescoping lid was chosen and I recommend to already write the first message on the box. Furthermore, to prevent people from not engaging with all products and the online community the box and online options should be kept limited and not overwhelming.

The risk of the third phase is the most important one: the possibility that users do not buy universal sized or other

follow up products. This should be monitored closely by collecting user data of purchases made per account. The questionnaire in step 3 should be used to gather information about why people choose not to continue. This information should be used to improve the user phase of the service, the advice on follow-up products given by the questionnaire and considered for possible future diaper designs. If people still do not buy enough follow up products the product has not fulfilled its main goal and should be discontinued.

Additionally, there is a risk of people passing on the box with broken/incomplete products. This can be partially prevented by adding a checklist or guideline to the journal to help people check and judge their products. It should also be investigated if it is possible or necessary for Toddy to compensate people who receive a broken/dirty product or send them a replacement.

The main risk of the final step is people not knowing a suitable person to gift the box to. The service can be expanded further to match users to new people. This is expanded on further in the roadmap of chapter 10.

7.2. Value drivers

The core concept behind the design is 'Circularity through community'. The baby gift box uses this concept to generate value in four ways: product selection based on trialability, increased reuse, a stronger community of peers, and a platform for value driven companies (see figure 28).

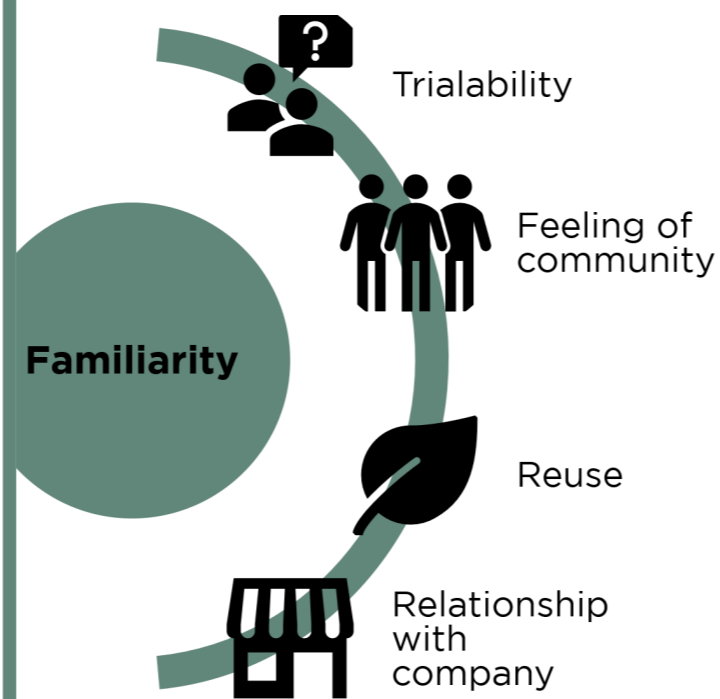


Figure 28: Value drivers of the Toddy gift box

7.2.1 Product selection for trialability: new-born sized diapers

As mentioned before, it can often be hard to select the right diaper right away without experience. One of the values of the gift box is the preselection of products for trialability. In the case of diapers: new-born sized diapers (see figure 29).

As mentioned before in chapter 1, most reusable diapers have one universal, adjustable size. The average birth weight in babies of European descent is 3.5 kilograms, with the normative range between 2.5 and 4.5 kilograms (Janssen & Thiessen, 2007). Most systems are



Figure 28: Value drivers of the Toddy gift box

only recommended for children between 6 and 15 kg (the Green Butt, N.D.). This means that on an average they are not an ideal solution for the first 3-4 months of a baby's life. During this time families have roughly three options: using disposables, using pre-folds (folding a diaper out of a piece of cloth with a diaper cover), or using reusable new-born sized diapers.

Using disposables is not ideal (besides environmental concerns) because once a habit is formed, it is harder to change it. Pre-folds are cheaper and more similar in use compared to disposables, but more time consuming to learn and more likely to leak. They also come with the stigma of folding your own diaper, which is often considered more old-fashioned and regressive compared to pre-shaped disposable diapers. New-born sized diapers are ideal for introducing someone to reusable diapering for three reasons. Firstly, they are used at a time when families are most receptive to learn something new, since they can establish a new diaper routine right when the baby arrives for until after potty training, without having to unlearn another one. Secondly, starting during this period has a higher chance of success, since the diaper is less complex (they lack resizing poppers) and liners are not required yet (since faeces is water dissolvable while babies do not eat solid

food). Thirdly it is possible reusable diapers are also more resistant to so called spray-diapers. These cases where runny faeces escapes from the diaper (also known sometimes as sputluiers, poo(p)nami's or poopsplions). A washable diaper has stronger elastics around the waist and the legs, so that the diaper closes more tightly. Cotton and bamboo fabric is also less smooth compared to disposable diapers, making it less likely for feces to escape compared to disposables (The green butt, 2019). Thus, introducing consumers to new-born sized washable diapers is likely an effective way to increase the trialability and create the experience necessary to potentially decide to transition to a more long-term solution of universal-sized washable diapers. Mixing the diapers with other products additionally lowers the pressure for individual products to be a guaranteed success upfront (especially when bought for a reduced price and with a plan for reuse in place).

7.2.2 Reuse and circularity

New-born sized diapers have one big drawback: they only fit for a few months on average but are priced similarly to universal sized diapers. This short functional lifespan makes them not only very cost ineffective, but also an environmentally inefficient way to use the material. The problem of the short

functional lifespan is not unique to newborn sized diapers. Babies grow faster than in any other life stage, and their size and physical needs change rapidly. Many baby products become obsolete within a short period of time, well before many products are outdated, damaged or broken.

Within the framework of the circular economy, this is a way of value being destroyed (see figure 30). The philosophy of the circular economy is to retain a product's added value for as long as possible and when a product is ready to start its downhill journey, it should be done as slowly as possible so that its useful resources can still be of service to other systems (Achterberg, Hinfelaar, & Bocken, 2016). About 100 years ago it was quite normal for a family to consist of 5 to 7 children. Retaining value of baby products by reusing them was easy and made sense. The average number of children in a Dutch family right now is 1.8 (gemiddelden, N.D.). Essentially, this makes the most common informal sharing platform for baby products (the household) a lot smaller.

While there are platforms for renting/leasing (<https://tinylibrary.nl/>, <https://www.babyproductenleasen.nl/>), they often rely on a process with a lot of

logistics, a labor intensive cleaning process and a high bar for quality control. The process is often fairly costly, time, and labor intensive and products will small, aesthetic damage can often already not be used anymore. Reselling baby products (<https://www.marktplaats.nl/>, <https://www.vinted.nl/>) on peer-to-peer platforms is a more common option, but comes with a higher risk and often an extra charge for consumers. Thus there is still space for extra additional solutions to promote reuse.

7.2.3 The value of peer-to-peer community

One of the ways to promote reuse, is by re-introducing the more informal ways of re-use. The concept of decentralising the reuse of products by letting users pass on products to peers themselves, has a straightforward value proposition: it vastly reduces the logistics and complexity of the process. By reducing the cost and effort involved the process will hopefully become more accessible and increase the rate at what products are reused. Additionally, to this, according

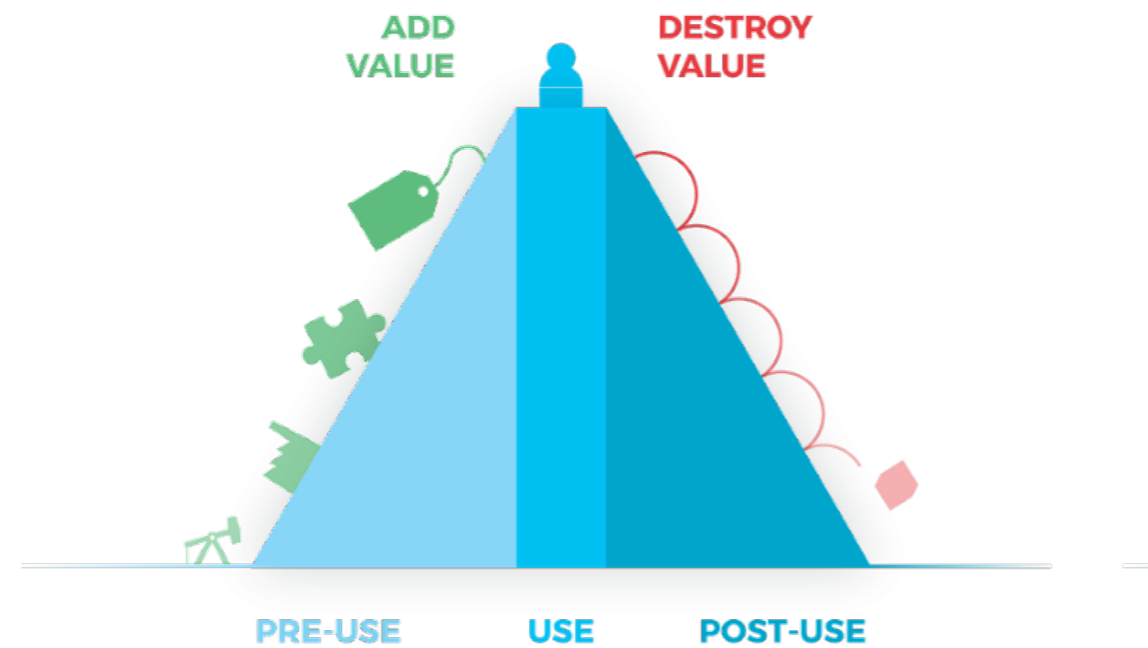


Figure 30: Value hill (Achterberg, Hinfelaar, & Bocken, 2016)

to the elements of value, customers perceive products that provide a sense of self-transcendence, heirloom, belonging or nostalgia as more valuable (Almquist, Senior, & Bloch, 2016)

However, beyond a purely economic and environmental gain, letting people pass on products also promotes sharing, collaboration and trust between citizens and empower citizens and communities (Martin, 2016). This is especially relevant for young families, entering a new phase of their life for whom strong communities and support systems are often crucial. The baby gift box aims to aide families with conscious consumers to support and uplift each other by, besides passing on the box, also provide opportunities to leave supportive messages and share advice and ideas.

7.2.4 Trust and transparency for value driven companies

As mentioned within the user profile, the importance worldwide of responsible consumerism is growing while young consumers are becoming more sceptical. The resulting desire for 'ethics checks' is understandable in the current constant exposure to marketing based on environmental benefits and progressive social causes (see chapter 2).

When consumers discover said greenwashing it reduces their loyalty, satisfaction, and the perceived benefits. In response many other companies try to show that they do not fall into this category and do not practice greenwashing. This results in a situation where both genuine and ingenuine messaging looks similar to each other. Distinguishing value driven (rather than profit driven) companies is often a challenging task for consumers, who often lack the information and/or understanding necessary for making these judgements (Braga, Martínez, Correa, Cox Moura-Leite, & Da Silva, 2019). Therefore, there are greater expectations for transparency and communication about social and sustainable goals. However, smaller, local businesses often lack the ability to reach people with a clear centralised message. Many products either get lost in large stores or centralised online platforms. Here the ability to communicate values and verify claims is limited to the appearance, packaging, price, and maybe a short description of the product. The other option is selling in a smaller, decentralised (web) store and risking obscurity and inaccessibility (Rivers, 2021).

The baby gift box aims to increase trust and transparency in two ways: firstly, the goal is for to act like an independent ethics

check and seal of approval from toddy. This way conscious consumers have access to set of products preselected by toddy, reducing the effort to find these products and increasing trust in the claims made by their producers. Secondly, it will act as a platform for companies to communicate their values and business practices to consumers, by providing the opportunity to attach extra material with the box (like, for example, information about their philosophy, impact of materials, or treatment of employees).

8 PRODUCT DESIGN

To further develop the concept into a detailed product, several ideas were created on how to design the details of the box. This includes the appearance and the user interaction with the box. To create several comparable designs, the four value drivers from chapter 7 were chosen as a baseline. These were extrapolated into several strategies and functions associated with these values.

8.1. Ideation design details

All four designs developed fulfil the same functions with different design elements (both physical and digital). Table 9 shows an example of the first design.

8.1.1 Option 1: Anthropomorphic box

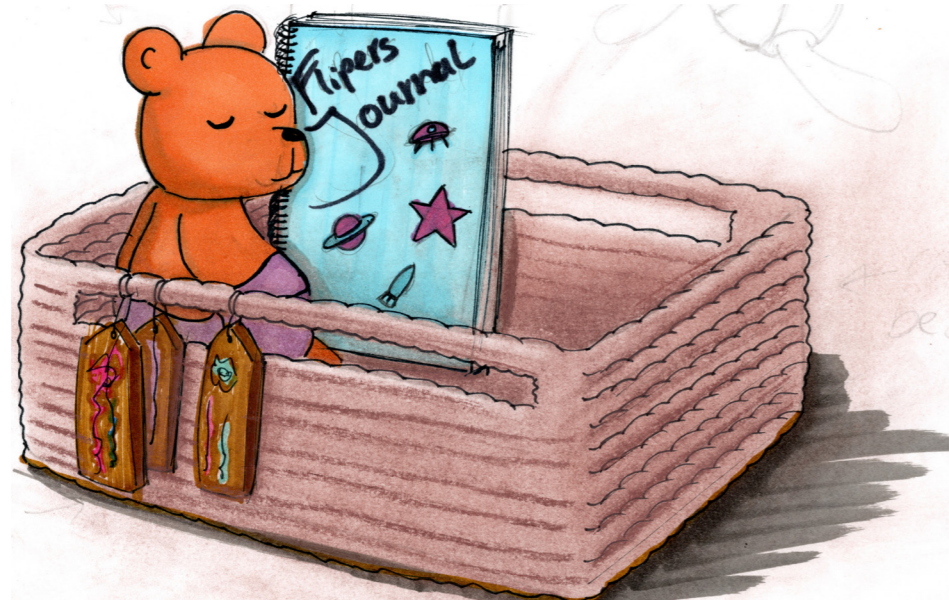
The first design (see figure 31) is based on the idea that people want to take care of something that they project human emotions onto. This way the value of community is emphasized. If users feel like the box needs to be taken care of, they are more likely to 'find a good home' after they have finished using the products. The idea is inspired by 'flip de logeerbeer', (see figure 32) and might also stimulate the user to write in the journal, by framing it as a journal kept by the bear.

To emphasise the idea of the teddy bear being a traveller looking for a home, the 'box' can be a Rutan basket (like the myth of Moses going down the Nile) with wooden tags inspired by Japanese

prayer tablets (Ema) because they are a traditional way for sending a personal wish together with other people in your community (See figure 33).

The drawbacks of this idea of the design

is that it is relatively costly (estimated 22,- see table 8) and hygiene concerns. A teddy bear used by several babies might pose a health hazard over time, or be perceived as such (this is something Flip de logeerbeer was often criticized for)



Upper row:
Figure 31: Drawing of the anthropomorphic box

Lower row, left to right:
Figure 32: Flip de logeerbeer (BNNVARA, 2018)

Figure 33: Japanese prayer tablets aka ema at the shinto Kasuga Shrine in Nara (Wikipedia, 2005)

Table 8: Estimated cost anthropomorphic box



	Cost Price (estimated)	Source
Teddy Bear	10,-	(Ikea, N.D.)
~5 Wooden plaques	2,-	(Amazon, N.D.)
Rutan basket	10,-	(Ikea, N.D.)
TOTAL Cost	22,-	

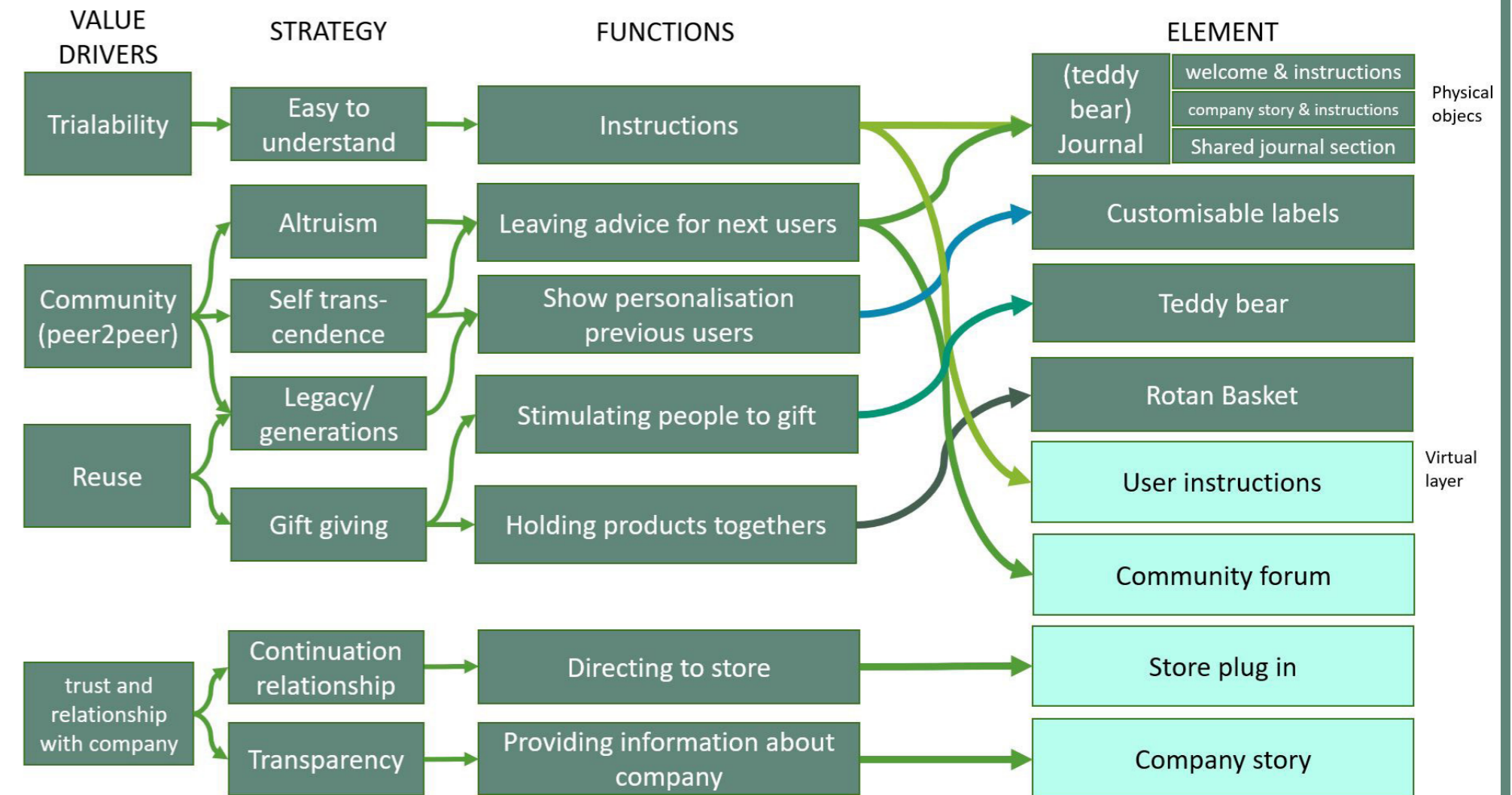
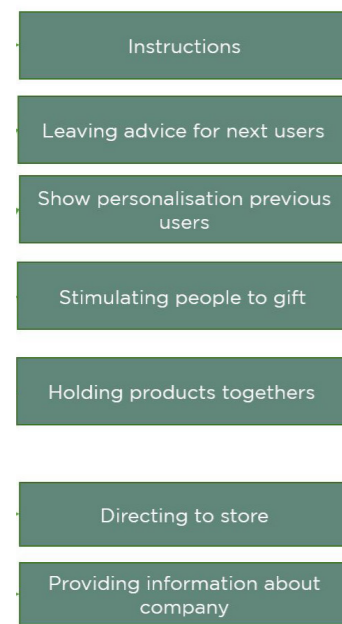


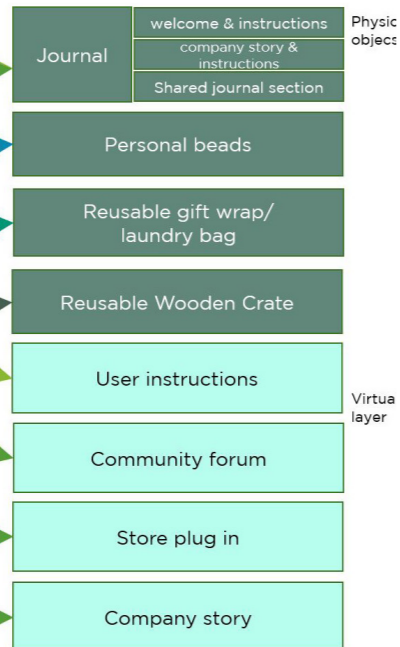
Table 9: Break-down functions The anthropomorphic box



FUNCTIONS



ELEMENT



Upper row:
Figure 34: Drawing washing bag box

Lower row, left to right:
Table 10: Abbreviated break-down functions The washing bag box

Table 11: Estimated cost washing bag box

8.1.2 Option 2A: Multi-functional box: washing bag

The idea of the multi-functional box (see figure 34) is to provide extra value to users by making the box multi-functional. This way the reuse aspect is emphasized because the box is a reused product and can also replace other products. In this case, the box is a used wooden food crate and the 'wrapping paper' is a linen bag that also functions as laundry bag. To personalise the bag, and add a sense of legacy to it, every user can add a beat to the pull string of the bag (see table 10 and 11).

The drawbacks of this design are the fact that combining a post bag/wrapping paper/laundry bag, and a fruit crate/gift box/laundry basket might be confusing to people, resulting in people not using the products as intended, throwing them away, or misuse them. Besides that, it is possible that a used fruit crate contains splinters that might injure users or end up within baby products and injure a baby.

	Cost Price (estimated)	Source
Used wooden fruit crate	5,-	(Decolis, n.d.)
Post/laundry bag	4,-	(bagmasters, N.D.)
Coloured beads	1,-	(Bol.com, N.D.)
TOTAL Cost	10,-	

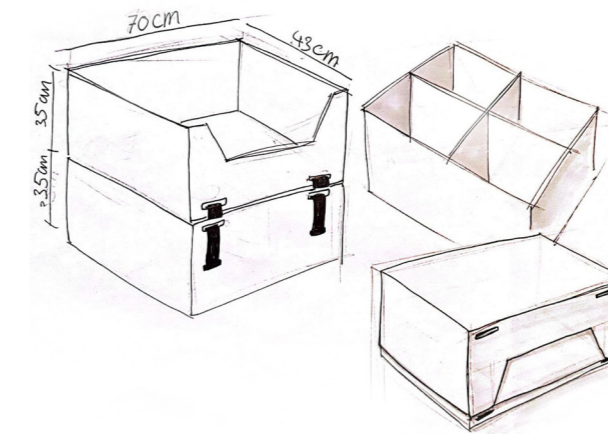
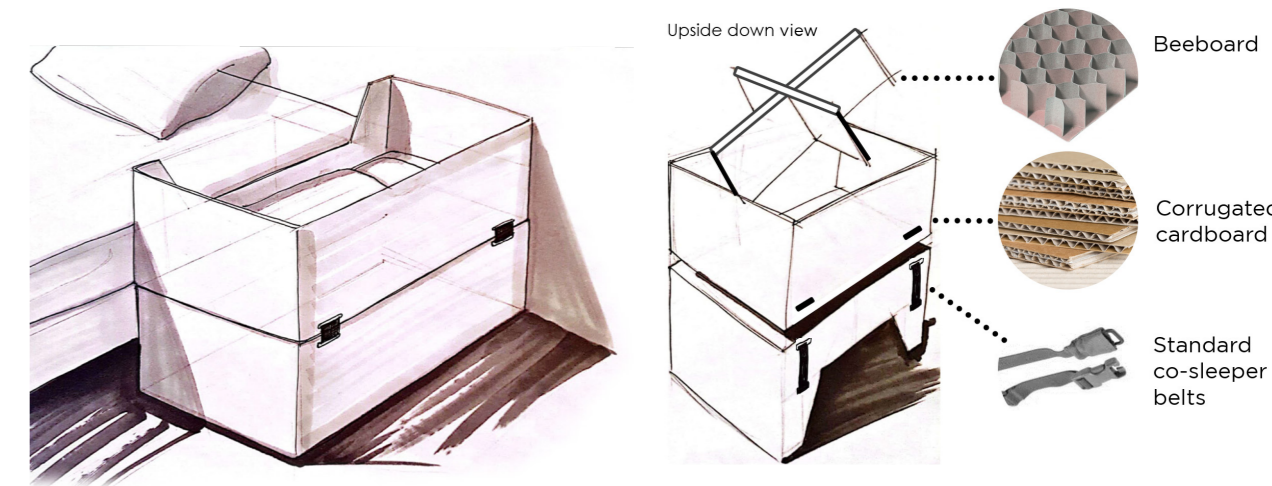
8.1.3 Option 2B: a multi-functional box: Co-sleeper

Another way to make the box more multi-functional is to make the box suitable to be used as a cradle and/or Co-sleeper. A co-sleeper is a baby products that can only functionally be used for few months, and is often a fairly valuable product (the cheapest co-sleeper march 2022 on prenatal is 149,- (Prenatal, 2022)). This function is often associated with baby-boxes from Finland, where the government issues a set of free baby items in a box that doubles as a crib. These boxes are popular and were also adopted in Scotland and exported internationally to be sold commercially. Out of the 29 free baby-box initiatives that have been done world wide, 20 doubled as a sleeping space for babies. One reason for their popularity is the fact that they are associated with lower child mortality (this link has never been scientifically proven, but is often assumed because it discourages parents to let babies sleep in bed with them, which has the risk to cause sudden Infant Death Syndrome (SIDS)).

The idea behind the cardboard co-sleeper is to place the lid and base on top of each other and attach them with a belt. Two pieces of honeycomb cardboard (Kraft paper shaped into hexagonal cells) in a cross underneath the box provide extra structure. This way the box is raised high enough to be connected to a standard

adult bed with the belts (see figure 35 - 37). While the weight this co-sleeper can hold is unknown, a similar product, kartent's papercrip made from honeycomb cardboard, can hold up to 70kg (see figure 38) and has been declared compliant

with EU legislation and NEN-certified. While the box is relatively expensive, this could be justified by the extra functionality added to the box. The cardboard look also fits well within Toddy's brand identity.



Upper row:
Figure 35: drawing co-sleeper

Figure 36: co-sleeper upside down view and materials

Lower row, left to right:
Figure 37: drawing co-sleeper

Figure 38: producer of the kartent's papercrip demonstrating its ability to carry weight

The drawback of this design is that, while being used widely in Finland and Scotland, a cardboard baby sleeper is not always perceived as safe. The effect of reuse on cardboard cribs, or wrongly assembling are also unknown. Currently EU safety standards for nursery furniture only exist for traditional cots cribs and bassinets and there is currently no specific standard for the use of a cardboard box as a sleeping place for an infant. In America the Consumer Product Safety Commission (CPSC) approved new standards to regulate several infant sleep products on July 2, 2021 banning baby sleeper products with a flat base due to the risk of them being put on an unstable surface (like a bed or a small chair) (US CPSC, 2021). While the cardboard co-sleeper would not be banned (because it is not a flat-sleeper) it does risk also effecting the perceived safety of the cardboard co-sleeper. Getting the product officially NEN-certified as a cradle/co-sleeper might be possible but will cost additional time and money (table 12 and 13).

	Cost Price (estimated)	Source
Corrugated cardboard box	10,-	(packlane.com, N.D.)
Honey comb support	10,-	(honingraatkarton, n.d.)
2 Belts	5,-	(Hockeydirect.nl, n.d.)
TOTAL Cost	25,-	

Table 12: Estimated cost co-sleeper

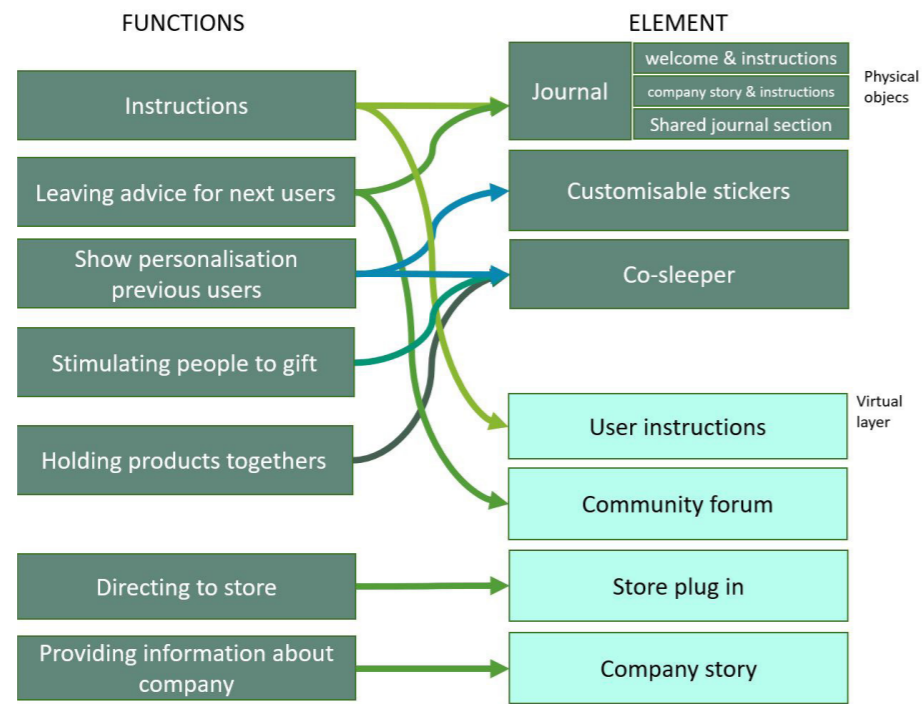


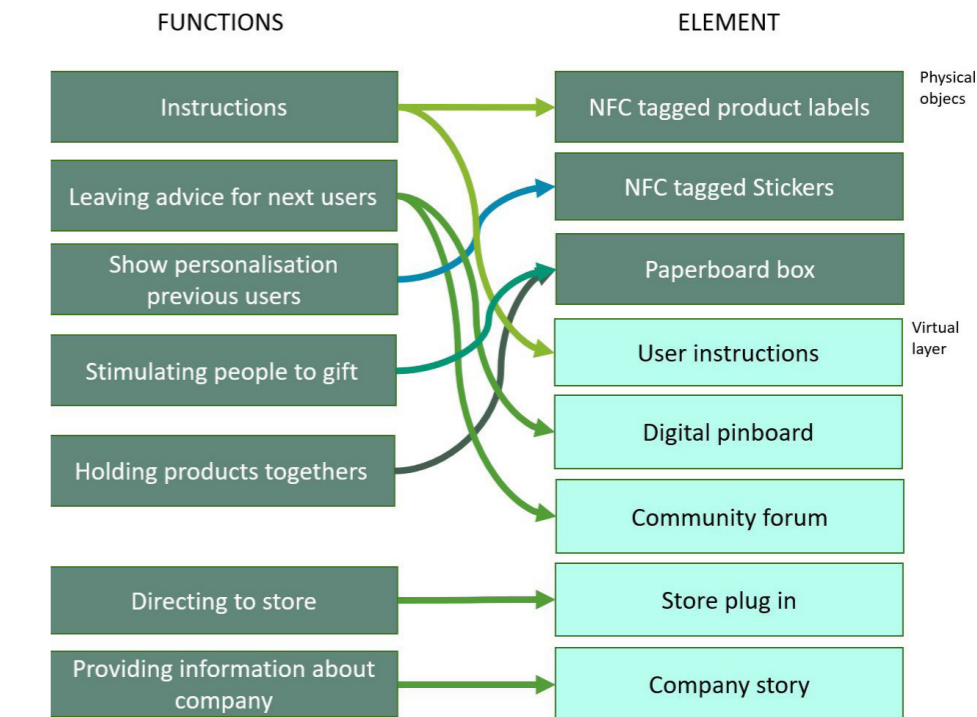
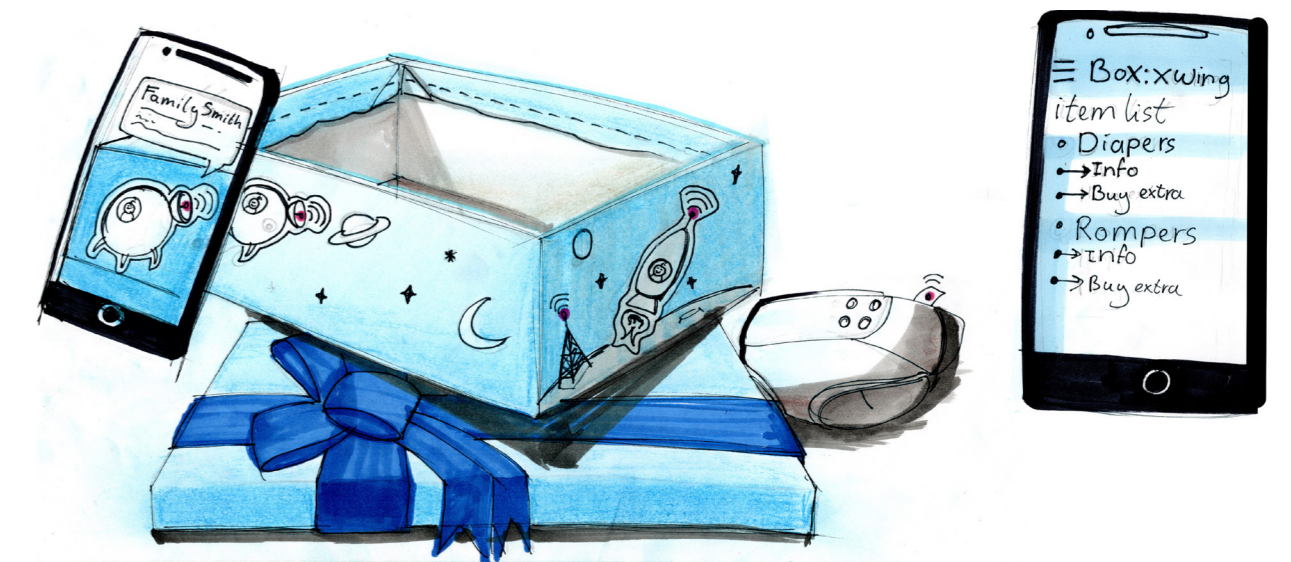
Table 13: Abbreviated break-down functions co-sleeper

8.1.4 Option 3: Digital box

This design aims to enhance the community by integrating the journal and online components (see figure 39). The box (made out of durable rigid paperboard) and products contain a NFC chip. By scanning these chips the user gets access to all information and instructions provided by the companies and an online pinboard for the chip they scanned. Here people can post pictures, tips or other messages for future users. It is also possible to stick a tagged spaceship sticker on the box that represents a family, and leave a message here. This way a digital layer of personalised messages is created around the box that grows with every user. This solution integrates the journal functionality into the virtual layer, and the online and offline parts of the design become more connected (table 14 and 15).

The drawback of this solution is that digital messages might feel less personal, and that not every user might be able to understand and/or scan NFC tags.

	Cost Price (estimated)	Source
Paperboard box	8,-	(IKEA, N.D.)
NFC tags products	3,-	(Amazon, N.D.)
NFC tagged stickers	4,-	(Stickerbeat, N.D.)W (Amazon, N.D.)
TOTAL Cost	15,-	



Upper row: Figure 39: drawing Digital box

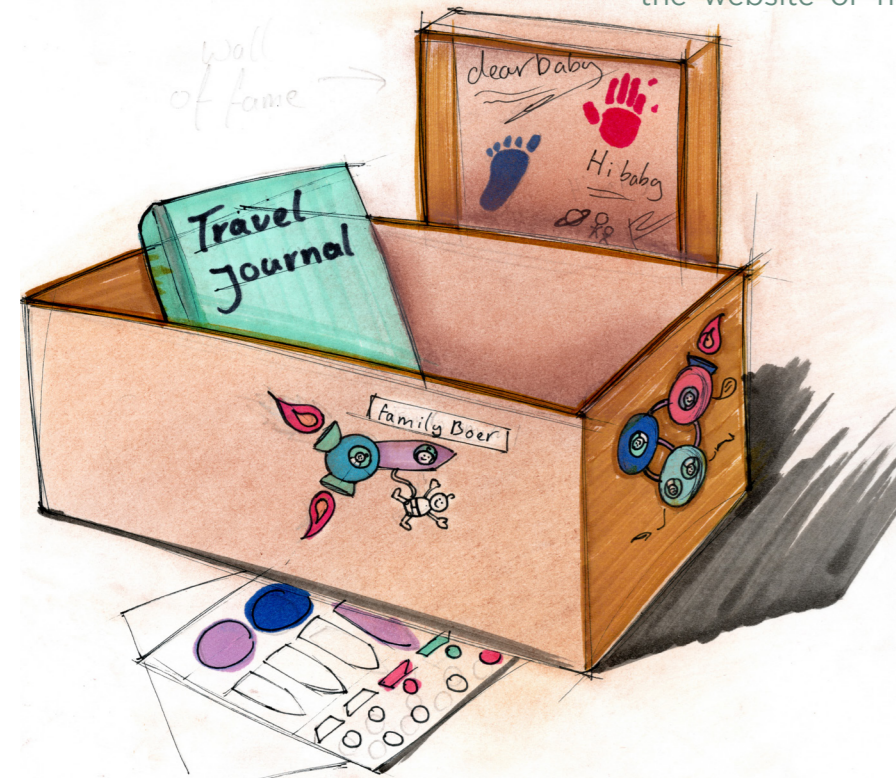
Lower row, left to right: Table 14: Estimated cost Digital box

Table 15: Abbreviated break-down functions Digital box

Upper row:
Table 15: Estimated cost Customisable box
Lower row, left to right:
Figure 39: drawing Digital box

Table 16: Abbreviated break-down functions Customisable box

	Cost Price (estimated)	Source
Corrugated cardboard box	5,-	(packlane.com, N.D.)
Extra sticker sheets,-	3,-	(Sticker-beat, N.D.)
TOTAL Cost	8,-	

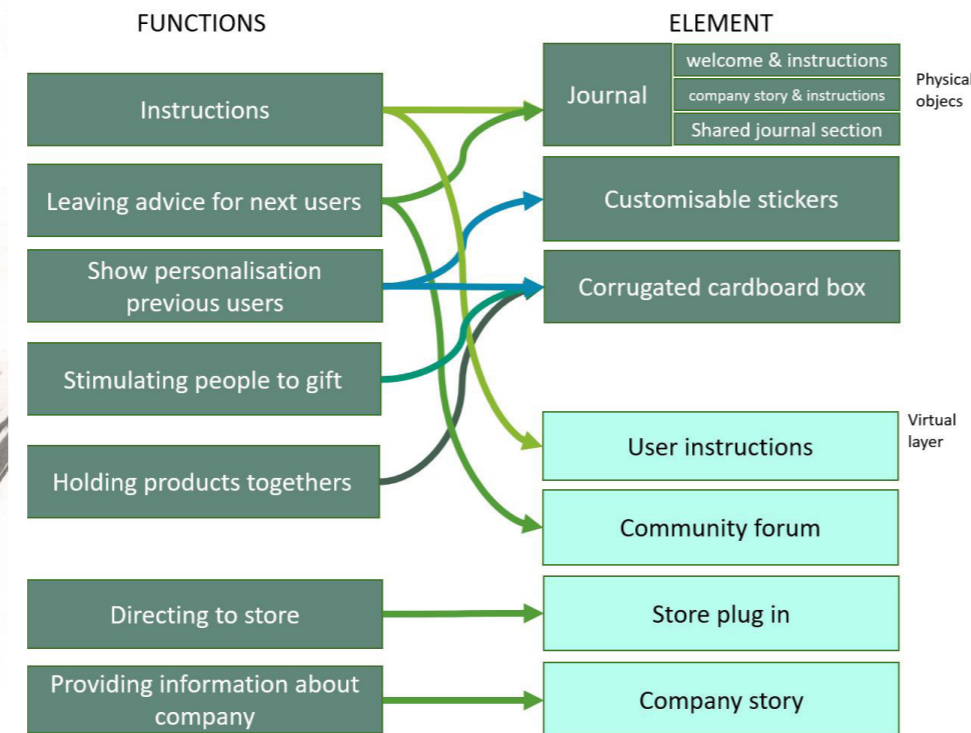


8.1.5 Option 4: Customisable box

The idea behind the final design is to conceptualise the box as a blank slate that people can decorate and personalise themselves like a guestbook (see figure 39 and table 15). This is stimulated by providing stickers that can be combined to look like a personal spaceship with the user's family in it. With every family that uses the box a new spacecraft is added. The inside of the box lid can also be signed. Pictures can be uploaded with the online account and the most fun and creative box can be featured on the website or newsletter. This way the

box always visually shows it belonged to several people, reminding users of the shared responsibility of taking care and passing on the box. The simple cardboard box also fits well within todody brand identity, the design can be implemented quickly and is relatively cost effective (see table 16).

The drawback is that (especially the first user) might not yet feel a sense of community and shared responsibility. The plain cardboard might also be confused with a standard shipping box and be thrown away by the user.



8.2 Design detail selection

Like the concepts in chapter 6, all options were compared with a Harris profile containing the value drivers of the product (see table 16). This was supplemented with a simple PMI overview and the estimated cost price. Based on this, the decision was made to select design 4: the customisable box, but to incorporate the co-sleeper within the future horizon on the roadmap. The customisable box is the cheapest, least complicated design, and therefore functions in a way as the minimal viable product. This way the product is lean and can be sold on short notice. Once the core principle of the box has been validated (or not) FDP can start to expand research and develop a more risky box design (the co-sleeper) for the future.

The final design of the baby gift box is presented in figure 40 and 41. Here it is visualised how the box could potentially be presented to customers on the Toddy website, and how it fits within their current product portfolio.

Table 16: Evaluation design details

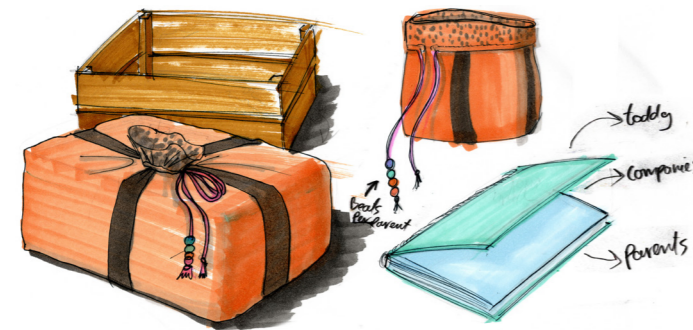
		--	-	+	++
Trialability					
Reuse					
Peer-to-peer community					
Trust & relationship company					
PMI		+ People are more likely to take good care of the box - Might not be perceived as unhygienic - Might be perceived as overtly Jewish/Christian			
Estimated price		23,-			
Evaluation		The bear is a valuable tool to tell stories and create a emotional and caring connection with the box. However, the hygiene concerns and relatively expensive cost price make the design less than optimal.			
Continue?		No			

Anthropomorphic box



Table 16: Evaluation design details continued

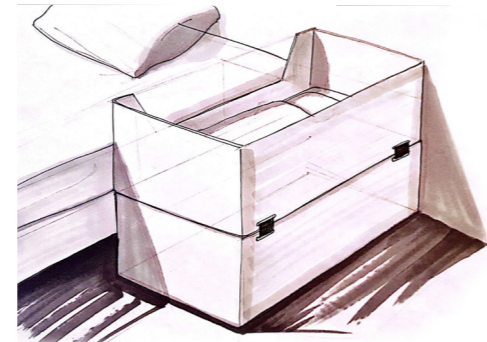
Multifunctional: laundry basket



	--	-	+	++
--	----	---	---	----

Trialability				
Reuse				
Peer-to-peer community				
Trust & relationship company				
PMI	+ Very sustainable story - Functionality as laundry basket is questionable - Might be confusing to some - Risk of splinters			
Estimated price	10,-			
Evaluation	The box feels like a maternity gift one might find on Pinterest, but might just be a bit confusing and inconvenient to use			
Continue?	No			

Multifunctional: co-sleeper

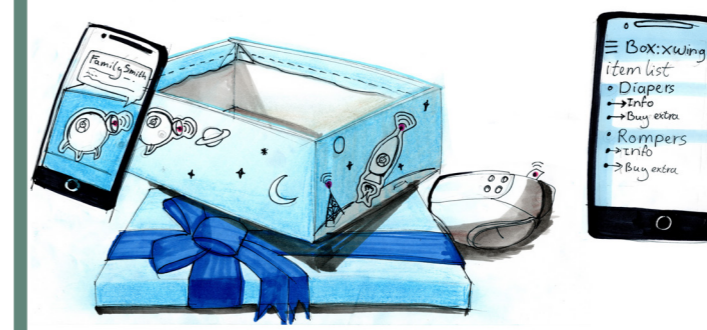


	--	-	+	++
--	----	---	---	----

Trialability				
Reuse				
Peer-to-peer community				
Trust & relationship company				
PMI	+ Adds a very valuable functionality to the box + fits well with Toddy's brand identity - Feasibility is unknown - Might not be perceived as safe - Might not be perceived as reusable			
Estimated price	25,-			
Evaluation	By adding a very valuable functionality to the box, the financial 'risk' of buying a product is reduced dramatically. This design does however need a lot of further research before it can be guaranteed to be a safe product.			
Continue?	Potentially in the future			

Table 16: Evaluation design details continued

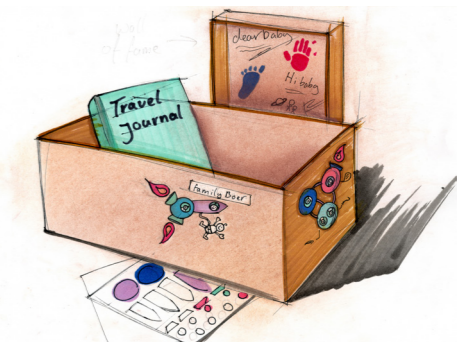
Digital box



	--	-	+	++
--	----	---	---	----

Trialability				
Reuse				
Peer-to-peer community				
Trust & relationship company				
PMI	+ Integrates online and offline parts of the box + Provides interesting data for Toddy & companies - Online parts of the mix might not feel as personal - NFC chips might not be usable for everyone			
Estimated price	15,-			
Evaluation	While there is a large benefit to integrating the online and offline aspects, the appeal might be too niche, and it might make the user interaction of the box less intuitive.			
Continue?	No			

Anthropomorphic box



	--	-	+	++
--	----	---	---	----

Trialability				
Reuse				
Peer-to-peer community				
Trust & relationship company				
PMI	+ Fits within Toddy's brand identity + Lean to implement - First person starts with blank canvas - Might be confused with standard shipping box i Has the potential to also be a sleeping box			
Estimated price	8,-			
Evaluation	This simple, lean idea has a high feasibility, is easy to understand and easy to communicate. The fact that it allows the maximum amount of agency is also expresses the philosophy behind the box. The fact that it allows for complete decoration makes people extra likely to show off the box online and offline.			
Continue?	Yes			

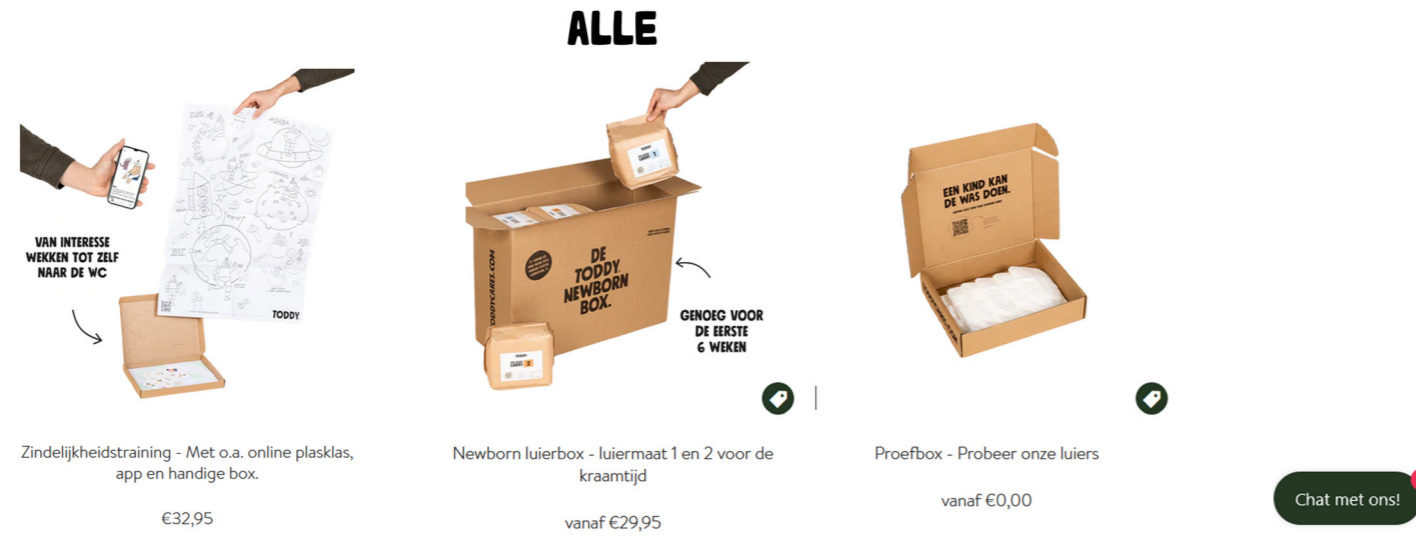


Figure 40: Presentation Toddy baby box on Toddys homepage
 Translation: NEW: Baby gift box - Box with reusable baby items that can later be passed on as a gift., 149,95 euro. INCLUDES WASHABLE DIAPERS, 190,- OF PRODUCTS



Hoeveelheid

MAAK ACCOUNT

Wil jij ook nieuwe milieuvriendelijke producten uitproberen en vind jij het zonde als ze maar kort gebruikt worden?

De Toddy doorgeef doos bevat herbruikbare producten (o.a. wasbare luiers) voor baby's van 0 tot 3 maanden die je inspireren de verzorging van een kind milieuvriendelijker te maken. Alle producten zijn speciaal geselecteerd omdat ze ethisch en milieuvriendelijk geproduceerd zijn. Omdat ieder product herbruikbaar en van hoge kwaliteit is kan de doos na gebruik een leuk cadeau voor zijn voor vrienden/familie die ook een nieuw kindje krijgen.

- De doos bevat:
- Journal waar je je ervaringen in kan schrijven voor de volgende gebruiker
 - 3 Wasbare luiers van Popolini, Newborn [\[Meer over Popolini's missie\]](#)
 - Zijde wollen romper van Red Orca [\[Meer over Red Orca's missie\]](#)

Figure 41: Presentation Toddy baby box on Toddys homepage
 Translation: Baby gift box - Box with reusable baby items that can later be passed on as a gift., 149,95 euro.

Do you also want to try new environmentally friendly products and do you think it is a shame if they are only used for a short time?

The Toddy pass-on box contains reusable products (including washable diapers) for babies from 0 to 3 months that inspire you to make the care of a child more environmentally friendly. All products are specially selected because they are ethically and environmentally friendly produced. Because every product is reusable and of high quality, the box can be a nice gift after use for friends / family who also have a new baby.

- The box contains:
- Journal where you can write your experiences for the next user
 - 3 Washable Diapers from Popolini, Newborn [\[More about Popolini's mission\]](#)
 - Silk wool romper from Red Orca [\[More about Red Orca's mission\]](#)

9 SERVICE MODEL

The aim of this chapter is to develop the service model around the baby gift box. This is done by identifying the most crucial actors within the service model first and making a breakdown of the business model. This is then used to create a service model blueprint.

9.1 Actors within the service model

The most important actors within the service model around the baby gift box are value driven companies, Toddy and the families who use the products (figure 42). In this paragraph, the role and benefits for

these three actors will be expanded on.

9.1.1. Value driven companies

The main purpose of the value driven companies is to provide products for within the box. Naturally, these companies should align with the values of Toddy (sustainable, child friendly). These companies provide their product for approximately their cost price, and provide information about the items, their mission and instructions for using the products for the website and journal. In return, the product will be featured on the todody website and added to the box.

In return, their item is easier to find, and comes with the added verification of being judged in line with the value of todody. Additionally, the product will be easier to try out and the box users can easily be targeted for follow up products. While the companies will not gain profit for providing the product, and information (and might even slightly undercut their own market), being part of the Toddy gift box will likely increase the brand awareness, increase follow up sales and improve the relationship with their customers. Therefore, it may still be a valuable deal for value driven companies.

9.1.2. Toddy

Toddy acts as the platform that connects value driven companies to customers. Firstly, they are responsible for finding value driven companies to partner with and verifying their claims about the sustainability or ethics of their business practices. Furthermore, they assemble, sell and send the box and maintain the online components of the service (forums and newsletter).

Besides encouraging sustainable user behaviour, this is a way for todody to provide a way to gain consumer information in feedback that can potentially be sold or used for the development for further products. The finances will be expanded on more in chapter 9.2.

9.1.3. Customers

The first consumer makes an account, buys the box and uses the products within. They are responsible for checking the content and passing on the box to the next person. The next consumers only have to make an account, use the products and pass them on again.

The first customer benefits from a package deal and easy access to a set of more sustainable products, verified by Toddy, access to an online community and a gift

to give away later. The later customers receive the same benefits, but in the form of a unique personal gift.

Additional to these three main actors there are also several minor actors (like postal service and online website hosts). These will be less influential in shaping the experience of the box, but not less essential.

9.2 Business model baby gift box

Trying to define an exact, definitive product mix for the box is not productive, nor relevant. Instead the general requirements of the items in the box will be defined, after which a hypothetical example list will be created for illustrative purposes and to provide inspiration. After this this hypothetical box will be used to test the financial viability of the baby gift box.

9.2.1 Product requirements

The purpose of the box is to increase trialability, promote reuse, encourage peer to peer community and create a long-lasting relationship between a company and consumer. The following products should be always present, to ensure the basic functionality.

Standard products:

- New-born sized diapers
- Box
- Journal

The additional products need to meet the following requirements:

- Intended to be used only for the first 1-3- months of a child's life
- Can be reused after 1-3- months
- Benefits from increased trialability
- Company benefits from a prolonged relationship (e.g., bigger sizes)
- Produced by value driven companies that align with Toddy

A few examples of these products are: high quality silk wool clothes, reusable baby wipes, reusable nursing compress's, mattresses and bedding, certain toys, baby carriers/wraps, baby baths, cradles and co-sleepers.

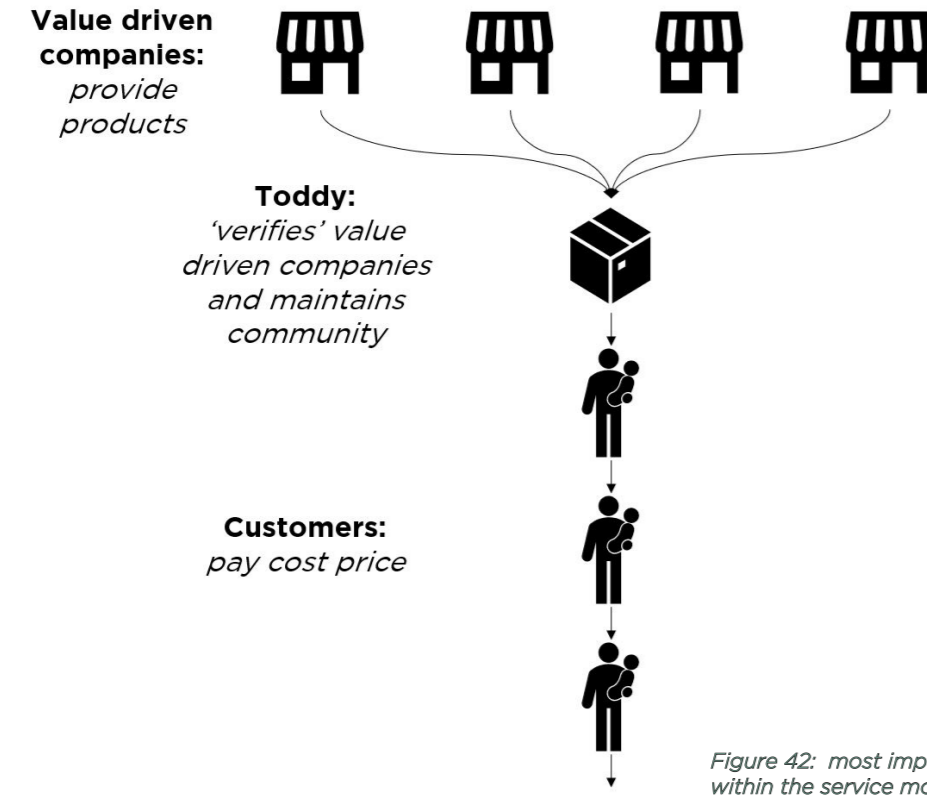


Figure 42: most important actors within the service model

9.2.2 Business model

To determine the business model the different circular business options should be considered. There are five circular business model archetypes that support the circular economy (Bakker, den Hollander, Van Hinte, & Zijlstra, 2014) (see figure 43). The biggest distinction that can be made between these are the one that the first two are based on user ownership and the latest two on ownership by a provider who gives access to users (The Gap Exploiter Model is not exclusive to one type of ownership but less relevant for baby diapers).

During ownership the user receives full rights over the products (Coase, 1960; Demsetz, 1967) and can therefore not only use the object, but also modify it, permit or prohibit usage by others, and lease or sell the object to others. In contrast, an access transaction exchanges money for consumption time, while the ownership always stays with the provider (Chen, 2009; Durgee and O'Connor, 1995). The main advantages of this is that it is easier to spread out payments over time and to retrieve the product(s). Additionally, it is possible to ask for an deposit to

encourage users cautious use and not keeping the product after they are done using it.

The difference between ownership and access influences functional, monetary, experiential and symbolic perceptions (Boksberger and Melsen, 2011; Richins, 1994; Smith and Colgate, 2007). These four categories are divided into 19 sub-categories visible in table 19 (Baumeister & Wangenheim).

Since the time of use is relatively short (3 months) but the gift box is of significant value, the choice was made to compare the two most promising options: ownership and lease with a onetime upfront payment and a deposit (this would encourage people to pass on the box). See figure 44 for two examples with hypothetical prices.

Monetary perceptions are expected to be influenced most drastically. Where for the ownership model most costs are paid by the first user, a lease contract is able to more effectively spread the cost of the box, because some of financial risk is also carried by the receiver. This makes the initial boundary for the first purchase lower. Functionally people might perceive it as riskier to personalise the box in a lease construction out if fear it might not

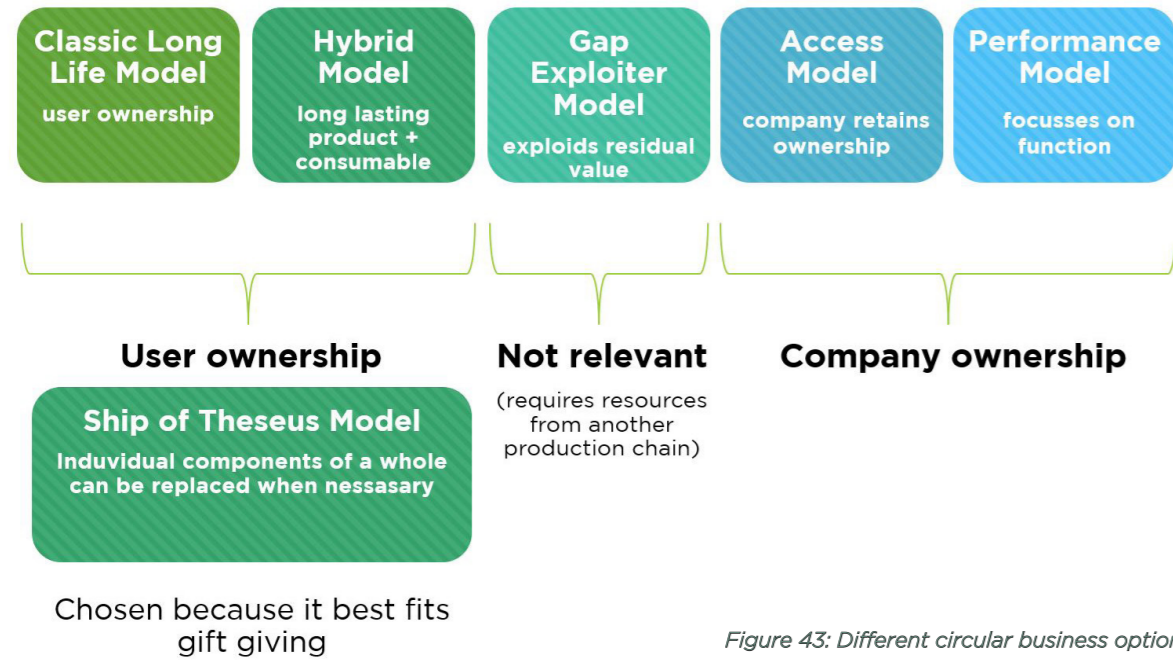


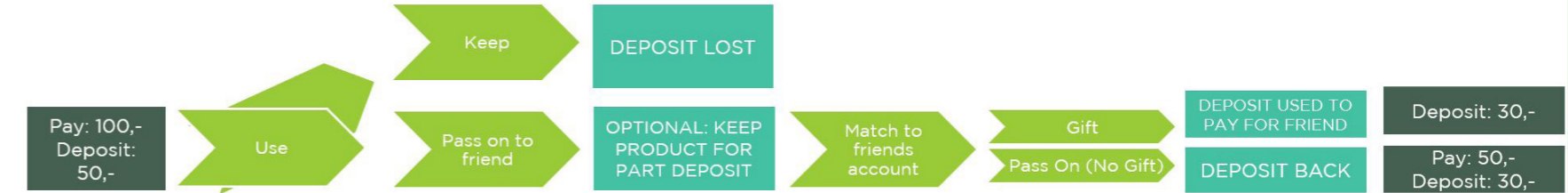
Figure 43: Different circular business options

Hypothetical Ownership model

Figure 44: two hypothetical ownership options



Hypothetical Lease model



be allowed and might cost them their deposit. However, it might also motivate them to treat the products more carefully and feel more pressure to give the box to another person instead of keeping it after use.

While the functional and experiential perceptions are also expected to be affected, the most crucially difference in perception will likely be symbolic. While giving a gift, it is unusual for that gift to be tied to a contract or payment. Even when the payment is a deposit, it

still goes against the symbolic meaning of a gift, which is something that should be a favour free of requirements for the receiver.

Therefore, even though leasing likely comes with certain advantages (the product would be cheaper for the first buyer, a deposit might make feel more pressured to not keep the box, etc.) it was chosen to go for a traditional ownership model because it is likely the agency it provides to users fits better with personalisation and the symbolic

value of gift giving. The circular business model associated with this product combines features of the classic long life model and the hybrid model, where all products (including the box) can be repurchased when necessary. This creates a ship-of-Theseus like combination where the lifetime off all individual products is maximised.

9.2.3 Pricing Strategy

A pricing strategy is the way in which the price of a product relates to its competition. In this case it is not immediately obvious

Table 19: Differences between ownership and access influences functional, monetary, experiential and symbolic perceptions

		Ownership	Lease (1 time payment + deposit)
Monetary perceptions	Total costs	Higher for first user, lower for later user	Equally shared
	Costs predictability	Predictable, besides refill products	Depends on deposit
Functional perceptions	Transaction effort	Easy	Some effort
	Pre- and post-usage effort	nd	nd
	Maintenance effort	nd	nd
	Storage effort	nd	nd
	Use limitations	More ability to personalise	Less ability to personalise
	Inflexibility	nd	nd
	Risk of failure	nd	nd
	Risk of non-availability	nd	nd
Experiential perceptions	Absence of costs	Refill might be perceived as separate purchase	All costs feel incurring
	Environmental friendliness	nd	nd
	Need for careful handling	No possibility to lose deposit	Possibility to lose deposit
	Fun while using	nd	nd
Symbolic perceptions	Being part of a community	Digital platform feel separate	Digital platform feels more integral
	Signalling one's personality	More options to personify	Less options to personify
	Personal attachment	Greater feeling of responsibility and autonomy	Lesser feeling of responsibility and autonomy WW
	Impressing others	Gift with no attachments	Gift that another person has to pay for

who the direct competition of the toddy gift box is. Desk research was done to select representative products from two product categories and map their price: Finnish style baby box bundles and maternity gifts (see appendix I). Free baby boxes are also in a similar product category as the Toddy baby gift box, but since they are free, are unlikely to actively impact the potential market for the gift box.

When the product is bought by a new parent, the closest product categories are free baby boxes and the relatively expensive and large Finnish Baby Box-style Bundles. It is likely that for parents these products are seen as necessities and but a small part of the many necessary

expenses made to accommodate a new baby. The main concern of parents is probably that they contain substantial value and a relatively high discount compared to the shelf price of the separate products. The price is usually between 200 and 450 euros.

If the initial purchase is not made by the parents, but by their friends or family the product competes mainly with maternity gifts (specifically gift sets with baby products). These gift sets are available in a wide variety of prices, usually from 20,- up to 80,-, but with outliers costing up to 125,- euro. The desired cost for a maternity gift likely depends, among other things, on the relationship with the new family, with grandparents and very

close friends being most likely to spend more on a maternity gift.

The pricing strategy chosen needed to accommodate for gift giving, as well as a family buying the box for themselves. It was decided on a discount pricing compared to Finnish Baby Box-style Bundles, but simultaneously allow the product to function as a premium priced gift. This gift is unlikely to be suitable for colleagues or acquaintances, but targets grand parents and friends who want to buy communal gifts. The chosen price is therefore ca. 150 euro (see image 44).

To estimate the cost price of the products a profit margin of 39,5% (the average profit margin on baby clothes in the Netherlands (Tighe, 2022)) and 21%

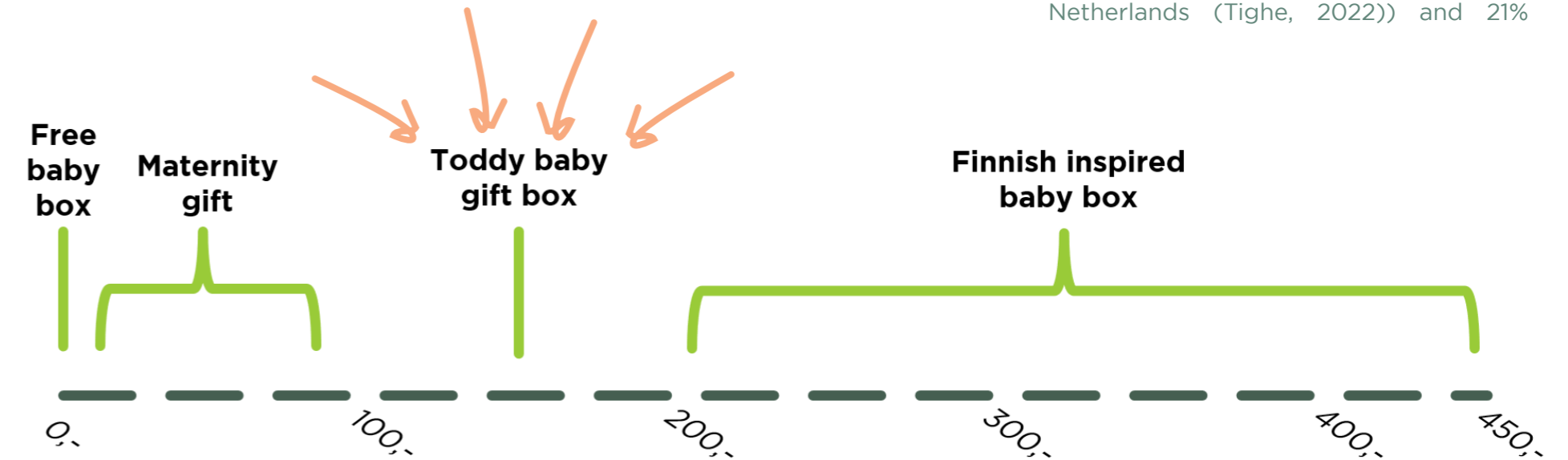


Figure 44: Prices of competition and the Toddy baby gift box.

VAT is assumed (see table 20 and figure 45). Financially the goal of the box is to roughly breakeven but this is not a necessity for the box to be cost effective. The income generated by new customers is expected to cover part of the costs for salary, website and advertising, but its main value is generated by attracting new

customers. Currently Toddy is willing to spend between 30 to 50 euro on acquiring a new customer. While the effectiveness of the box in terms of converting new customers to washable diapers is not known, this is how the box is expected to be cost effective.

Hypothetical Cost Price	Estimated Retail Price	Estimated Cost	Sources
(39.5 % profit margin & 21% VAT) (Tighe, 2022)			
3 diapers	60	30	
2 silk wool onsies	40	20	
1 sleeping bag	25	12.5	
1 hat	10	5	
Washable wipes	15	7.5	
Rattle	10	5	
Baby sling/carrier	30	15	
Box	-	8	
Journal	-	15	
Worth products	At least 190,-		
Buying Price		118,-	
Sales Price exc. VAT		124,97-	
Sales Price Customer		150,-	

Table 20: Cost+ analysis of the Toddy gift box



Figure 45: Example products from the Toddy gift box

9.3 Service model blueprint

To show the underlying process that facilitates the baby gift box, a service blueprint was made (see figure 46, and larger version in appendix J).

A service blueprint is a diagram that visualizes how different steps of a service are tied to touchpoints of a customer journey. In this

section all sections in the blueprint will be briefly explained (see figure 47).

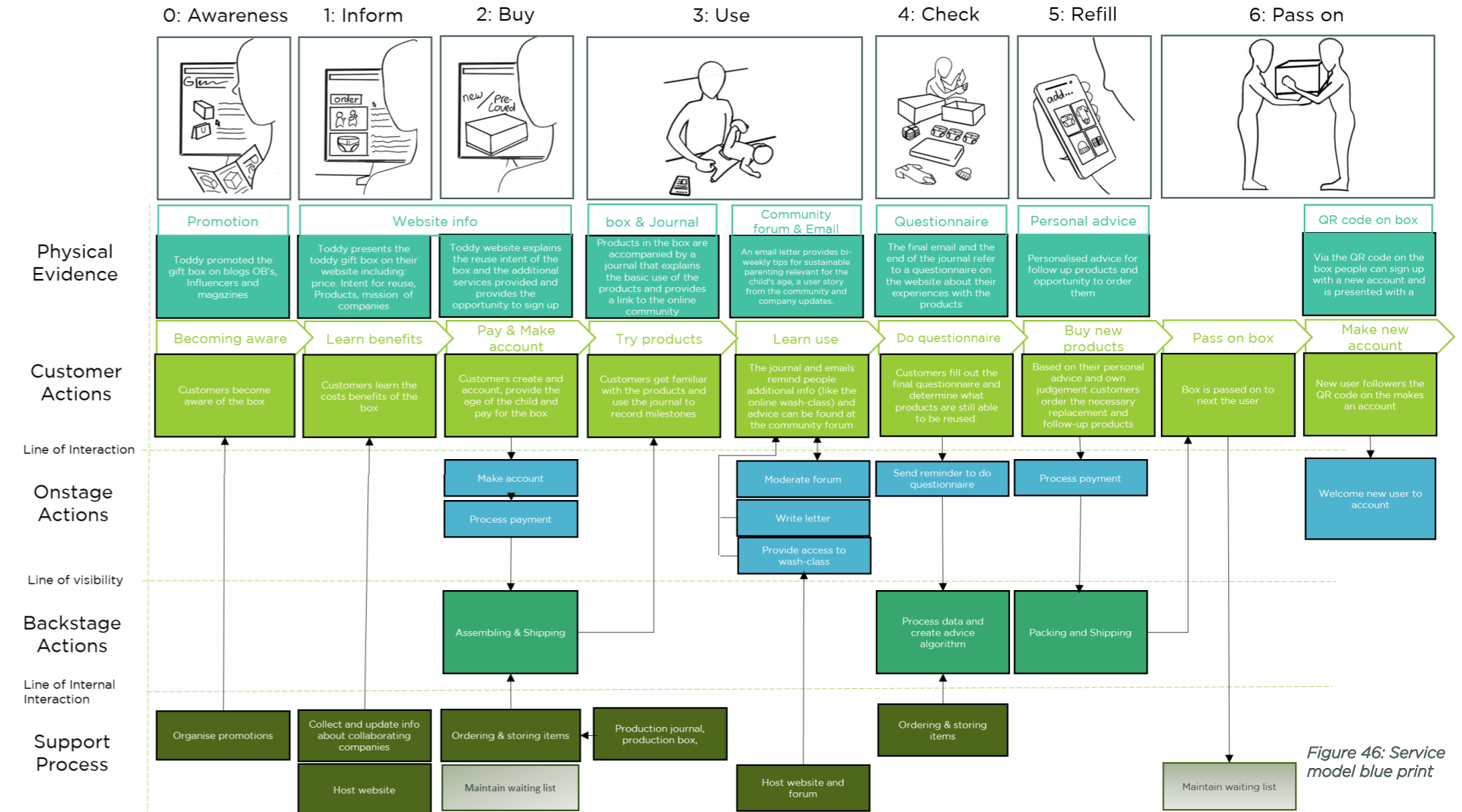


Figure 46: Service model blueprint

9.3.1 Step 0: Awareness

Before the service can be provided, new or expecting parents need to be made aware of the existence of the baby gift box. Families are generally told to sign up for free pregnancy boxes (as see in chapter 3). By targeting the places where people generally go for advice and information about pregnancy boxes with advertisement, Toddy can make people aware that the pregnancy gift box (doorgeef doos), is a similar, but a paid for and reusable variation. These places are for example blogs, OB's, influencers, magazines etc. Additionally, websites, books and social media campaigns that specialise in sustainable upbringing can also be targeted.

9.3.2 Step 1: Information

The purpose of the first step is to inform customers of the purpose and value of the service. Emphasis should be on the fact that this box is meant to be passed on to another person. Secondly, the site should feature the products present in the box and provide users the possibility to read about the individual brands present in the box. Every brand present gets its own page to present their goals and values and Toddy will be responsible for collecting, checking and updating that information.

9.3.3 Step 2: Sale

The purpose of the sales step is to process the payment and to have customers sign up via an account. This account will be

linked to a specific family and box. Users will provide the (expected) birthday of the baby. This is also where people will be able to acquire a used box or sign up for a waiting list in the future.

Toddy will be responsible for ordering, storing assembling and sending the box.

9.3.4 Step 3: Use

During use, Toddy provides the journal and access to the online community. Like the website, the journal contains pages reserved for the collaborating companies to design. Besides this, a community email newsletter, containing information that corresponds with the child's age will need to be written and automatically send. The standard age-corresponding segments

can be supplemented with news from todody, blog entries from participating parents, or feature stories written by the companies. Finally, Toddy's website will give access to community forums for users. These are monitored by Toddy.

9.3.5 Step 4: Check

After three months, Toddy can send a reminder to the user to give the box away. This can be done by mailing a questionnaire (and including a link to it in the journal) about the experience with the products. Here users are asked what products can be reused and what users would like to

replace. At this moment users likely have enough experience to be able to tell if reusable diapers suit their life-style and know what features they are looking for in a follow-up diaper system. Similar questions can be asked about all other follow-up products. This questionnaire will give users advice by using the data from the questionnaire to generate a personal a list of products they can buy as the prepare to give the box away.

9.3.6 Step 5: Refill

When people are planning on giving their box to the next person, they have

the opportunity to buy replacement and follow-up products. These can be ordered via the user's account.

9.3.7 Step 6: Pass on

Toddy does not interfere in the gifting, so that it can be a personal and spontaneous moment. The journal, and the inside of the box contain the url to make a new account. When making an account the new user will be shown a brief explainer video or presentation that welcomes them and explains the concept of the box.

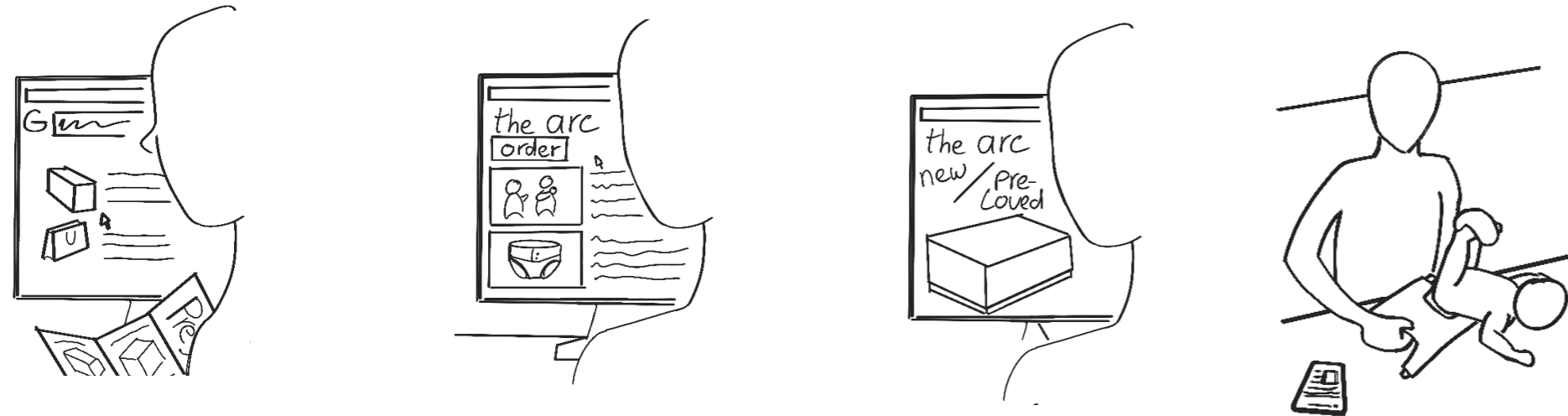


Figure 47: Service model Steps

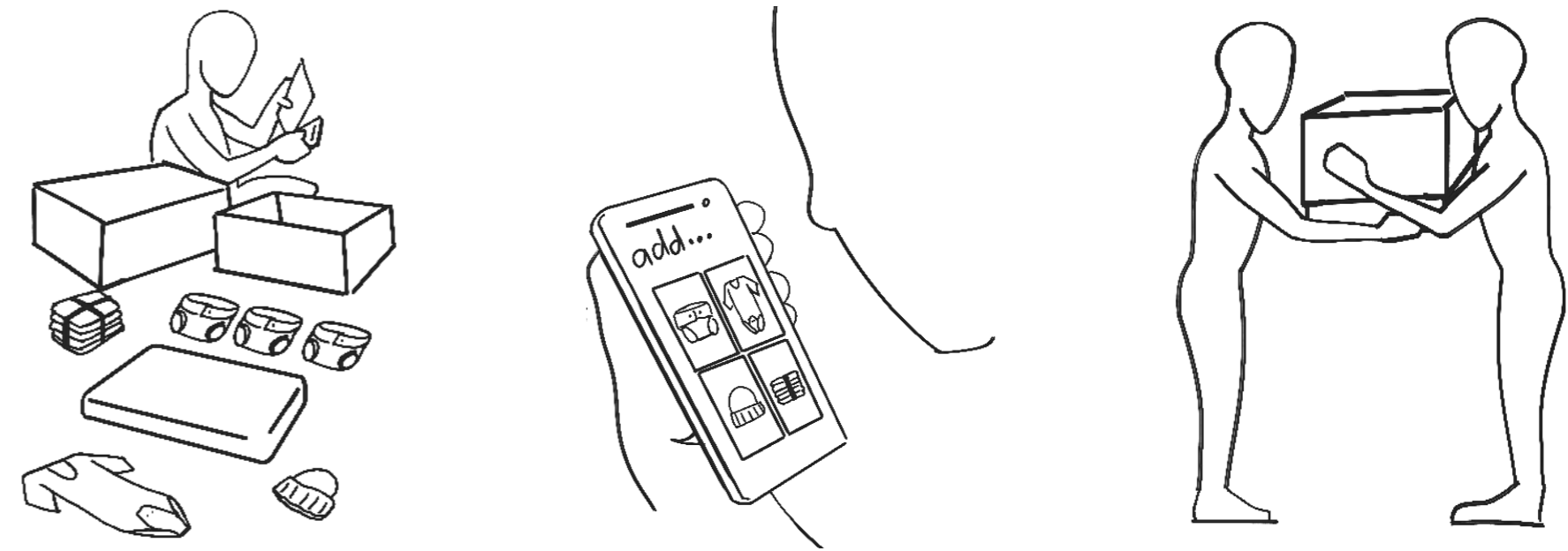


Figure 47: Service model Steps continued

10 ROADMAP

I conclude the design with a roadmap to provide a high-level overview of how the service could be implemented and developed further over time (see figure 48). The goal of this roadmap is not to provide a strict timetable and set of essential goals, but more to tie all research done within this report together, and group topics for potential future research in order of priority.

10.1 Horizons

The roadmap has been divided in three horizons: a pilot phase, an operational phase and a growth phase.

10.1.1 Horizon 1: Pilot Phase

The goal of the pilot phase is to get the service up and running. This means that the most essential elements get priority. These elements are selling the box and the fact that it should contain diapers. When the most stripped-down version of the box is launched for testing, other elements can slowly be implemented over time. At the end of year one, it is expected that the full design of the service blueprint from the previous chapter (with the subscription for refill products, email updates and an online community space) is fully set up and running stable.

10.1.2 Horizon 2: Operational Phase

The priority for the second year is to use the data gathered during the pilot phase and improve two elements: the number of people passing on their box, and the number of people continuing to use reusable diapers.

For the first goal, the service can be expanded to match users who do not have direct friends or family with small babies to people who would like to buy a used box. This way the box can be resold on the toddy platform, making it possible for users to earn back some of the investment in the box, and providing boxes for a more accessible price for new users. During this year Toddy can test how to best organise this process and how much oversight this requires.

For the second goal, it would be beneficial to create a service specifically to follow up the baby gift box for users who would like to continue using washable diapers, (like a washable diaper rental service). Additionally Toddy should tackle the other problem people face while adopting diapers according to chapter 3: reliability. The first step could be to start to develop liners that are more convenient and pleasant to use and diapers with more intuitive closing mechanisms.

During this time it should also be tested to see if the design of the co-sleeper box is feasible and valuable enough to replace or be combined with the customisable box.

10.1.3 Horizon 3: Growth Phase

During the growth phase the service should mostly focus on retaining the value of the box products. A potential solution for piloting is seeing if people are willing to send back (partial) boxes if they are uninterested in gifting or reselling the products. These products could be resold second hand by toddy. Furthermore, it should be researched if the reliability of reusable diapers could be improved further by introducing new booster material with higher absorption capacity.

Beyond this, once the baby gift box has been fully implemented, I recommend focusing on other potentially projects, like introducing diapers at day-cares and introducing a circular box with products suitable for potty training.

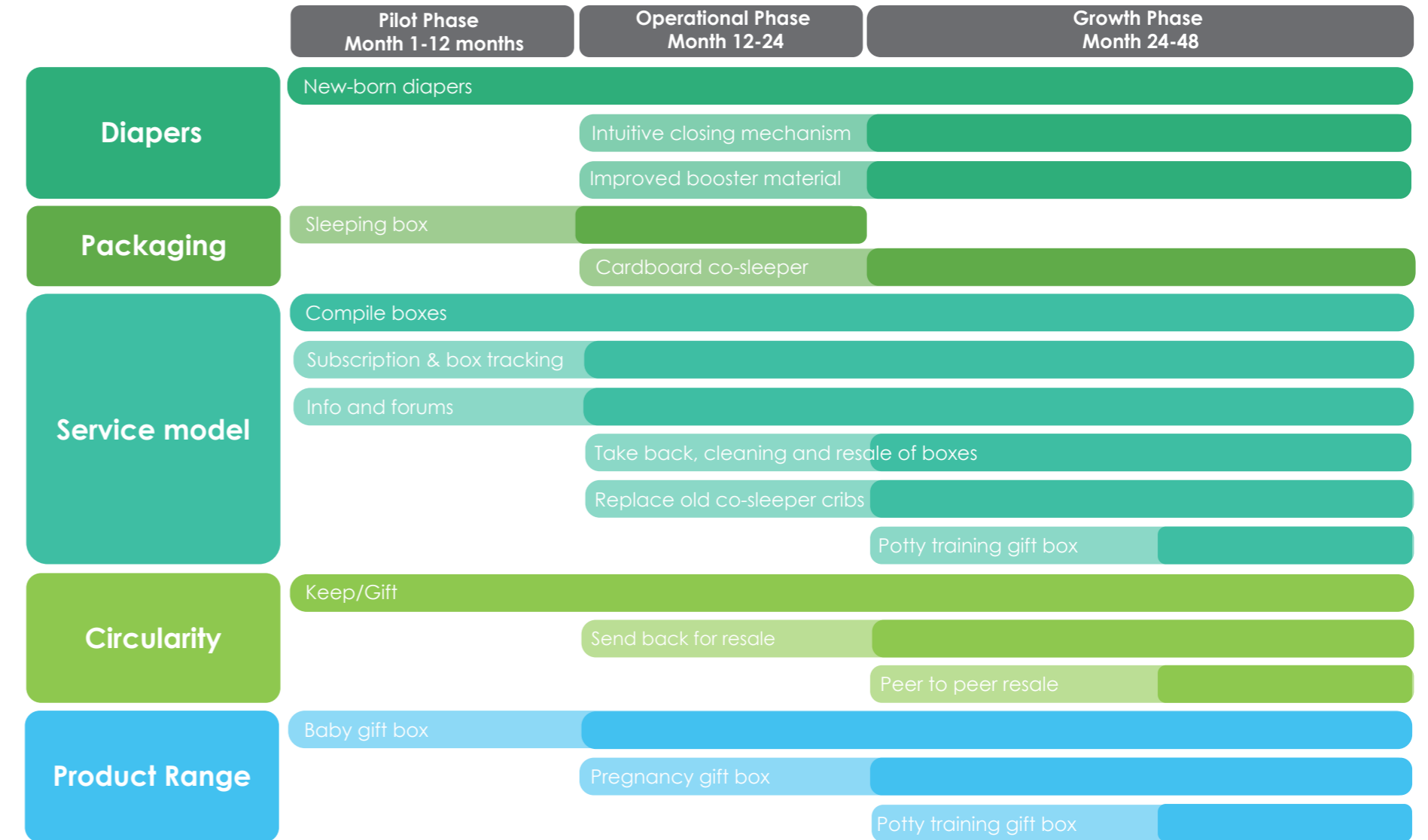


Figure 48: Toddy roadmap

11 CONCLUSIONS

This chapter summarises the answer to the final research question and discusses the validity of the results.

11.1 Answer to Research Question

Disposable diapers require a large amount of new material and put a large pressure on Dutch waste disposal services. To move to a more circular future it would be beneficial if more families used reusable diapers instead.

The goal of this project was to design a service model for Toddy to increase the acceptance and adoption of reusable diapers. To reach this goal the process started out with the research question: Why are washable diapers not being adopted more widely? After gathering existing information and a series of in-dept interviews, it was concluded that there is a specific pattern to the way users typically adopt diapers and that perceptions about diapers differ widely between people. This information was used to isolate two main reasons why washable diapers are not being adopted more widely: Unfamiliarity and unreliability. It was decided that this project, Toddy's resources and my personal skills and ambitions were most

in line with focusing on unfamiliarity.

Several ideas were generated and developed into concepts. The final design that was chosen was the Toddy gift box (Toddy doorgeef doos in Dutch), a product service combination that introduces families to washable diapers right after the baby arrives by offering new-born sized diapers in a pregnancy box together with other reusable baby products for a reduced price. This box gives access to information on how to use the diapers and can be passed on to a friend or family member in the future.

11.2 Discussion

This project has contributed to mapping the adoption process and largest bottlenecks for the adoption of reusable diapers. These insights can be used for further research and development of solutions for sustainable diapering and strategic decisions for Toddy's future.

Additionally, this project has found an interesting potential benefit into taking a community approach to circular design. Throughout human history informal gifting and sharing have played a huge role in meeting everyone's needs while reducing the waste of valuable resources.

The framework of the circular economy still prioritizes continued economic growth (Hervé, 2015) and does not consider more radical ways to reduce consumption. I hope the outcome of this project shows how enabling people to share and strengthen their community has the potential to add value to a product and encourages a more equitable society while still potentially providing an economical return of investment for the provider.

11.3 Limitations and Recommendations

This research was subject to time and resource limitations. First of all, researching topics like intimate hygiene and childcare is very emotionally loaded and, like the research concluded, especially prone to subjective perceptions and confirmation bias. With only one designer and a small research sample, additional research to confirm and elaborate on the findings in this research would be valuable. Additionally, like mentioned in chapter 6 a more interdisciplinary approach, that also considers solutions outside of product and service design (like education) could reap interesting solutions.

11.3.1 Feasibility

The feasibility of creating a box with reusable baby items is very high since it does not require any process that Toddy is not already doing. The additional services provided are new for Toddy but requires mostly already developed processes and technology.

It is recommended that in the future it is researched if the further horizons of the product service can practically be provided. Especially elements like giving the box extra functionality (as a sleeper box or co-sleeper) or expanding the service to allow the box to be resold to strangers would need further development and validation.

11.3.2 Desirability

Testing the desirability with users and potential partner companies of the product service fell outside of the scope of this project. While market research in chapter 2 indicates that the product should align with the desires of young responsible consumers, it would be advisable to confirm this.

It is recommended to scout for interested and relevant company partners and develop a pitch with realistic content inside. This can be used for both

qualitative and quantitative research with consumers.

11.3.3 Viability

The viability of the product service is the most uncertain aspect of the box. The product service costs Toddy money and it is currently unknown how effective the product service is into converting people to adopt reusable diapers or other reusable baby products. This will be the main element that influences the potential environmental benefit of this product and its financial viability for Toddy. It is therefore advised that Toddy keeps the financial risk of the product service in mind and gradually expends and tests the product, starting with a in a pilot, as described in the roadmap in chapter 10.

Toxboe, A. (2019). *Making the Fogg Behavior Model actionable*. Opgehaald van *UI patterns*: <https://ui-patterns.com/blog/making-the-fogg-behavior-model-actionable>

True Price. (2021). *Workshop Verduurzaming Luier industrie*. True Price.org.

UNEP. (2021). *Single-use nappies and their alternatives: Recommendations from Life Cycle Assessments*. United Nations Environment Programme.

US CPSC. (2021). *Safety Standard for Infant Sleep Products*. Opgehaald van [cpsc.gov](https://www.cpsc.gov/s3fs-public/FinalRuleSafetyStandardforInfantSleepProducts.pdf): <https://www.cpsc.gov/s3fs-public/FinalRuleSafetyStandardforInfantSleepProducts.pdf>

Vermandel, A. (2017). *Je kind zindelijk krijgen, dat doe je zo*. Leuven: Acco.

Wikipedia. (2005). *Ema at Kasuga Shrine Shinto shrine in Nara*. Opgehaald van *Wikipedia*: <https://commons.wikimedia.org/wiki/File:KasugaEma0398>.

Appendix A: Interview notes of interviews with daycares

	Day-care 1
General characteristics	5 days a week, 7:30- 18:30, age: 0-4 (0-2 and 2-4 group, spit recently) 8-10 children, 1-3 employees per group.
Number of changes per day	4 set moments per day, before bed, after bed, before eating
Current situation	2 children used reusable diapers for a while but ended up refusing to change them. Accept reusable diapers but will change them into disposable pampers.
Main Complaints	<ol style="list-style-type: none"> 1) they are full faster 2) Extra work due to ‘accidents’ 3) Diaper Rash (due to urine) 4) Freedom of movement, this dampers the development of children 5) Changing is more unhygienic (gloves are used consistently) <ol style="list-style-type: none"> a. Outer diapers gets wet at the groin b. Smells bad 6) Two employee respects the effort for the environment, the other thinks is no use since the diapers have to be washed anyway. 7) Outdated and crude 8) Clothes fit more tightly 9) It feels less nice to hold the baby due to thicker diaper <p>Employees were not aware reusable diapers helped children become potty trained.</p>
Diaper: disposable	
Diaper: all-in-one	
Diaper: all-in-two	
System 1	<p>Seems not realistic, would only do this if forced to.</p> <p>Concerns:</p> <ul style="list-style-type: none"> • What to do with diapers of children who are not eating solid food? BAD USE. • It needs to be out of reach for children • The smell of pee (and pre-solid food poop)
System 2	<p>‘This would fix the smell problem’</p> <p>Concerns:</p> <ul style="list-style-type: none"> • Washing, folding and putting it in a closet would be a lot of work. <ul style="list-style-type: none"> ◦ Using wash nets would be the best solution but it would more work during a changing moment
System 3	<p>Most popular one!</p> <p>This one is the fastest because you would not have to assemble your own diapers. Cost is not really a concern of employees.</p> <p>Concerns:</p> <ul style="list-style-type: none"> • Space to store diapers • It would take additional space if you have to store both pampers and reusable diapers
Notes	<ul style="list-style-type: none"> • Disposable diapers are thrown away in diaper trashcan that automatically puts diapers in bags. This still smells a bit. • Cost of diapers is calculated in price.
Notable quotes	<p>‘[Reusable diapers] Really hold back the development of children. They are a big clump at the butts of children’</p> <p>‘I find [disposable diapers] part of our current welfare. Reusable diapers is like going back to before the war.’</p> <p>‘I feel obliged to at least try the reusable diapers, because they spend a lot of money on the diapers and seem very dedicated’</p> <p>Manager day-care: ‘We are open for sustainability, but it needs to remain practical’</p>

	Day- care 2
General characteristics	2 x 10 babies (age 0-1), 2 x 12 (1-2), 2 x 16 (2-3),
Number of diaper changes per day	4-ish diapers on set times, sometimes extra in between, Significantly more than parents do at home.
Current situation	2 children use washable diapers (1 all in one, 1 two-part system) diapers are generally accepted and not experienced as a huge burden. It is appreciated that you have a little bit more time with the child. One of the day-care workers also raised her own children before pampers and was quite matter of fact about diapers.
Main Complaints	<ul style="list-style-type: none"> • One of the diapers leaks, about 1 time per day • Taking out bamboo liners is a hassle. Especially when the child is older and pees and poops more • One of the children has very smelly diapers, the others does not • Very thick package between legs, concerned about development and unable to let child sitting up. • It can be hard to judge if the diaper should already be changed. Sometimes the diaper gets changed unnecessarily, sometimes it's too late. • Small details (like tightness of the diapers) are not often communicated to everyone at the same time
Diaper: disposable	
Diaper: all-in-one	
Diaper: all-in-two	
System 1	<ul style="list-style-type: none"> • Bag should be in separate room for smell, • there is not really any room for a lot of diapers in the room right now
System 2	<ul style="list-style-type: none"> • washing would be okay • but no space for drying lots of diapers • pre-folding diapers is too much work
System 3	<ul style="list-style-type: none"> • Looks expensive (but practical)
Notes	
Notable quotes	
	[If you are changing a diaper, and it takes a few seconds longer, you also have a little bit more bonding time] [My eldest child is 40, he also wore washable diapers]

	Childcare 3
General characteristics	16 children in one group
Number of diaper changes per day	Every 1.5 at point at highpoint
Current situation	Tried washable diapers for 6 months but ended up refusing them after being very unsatisfied. Tried changing boosters and changing more frequently (every 1,5 hour putting diapers on more tightly) but did not work. Even convinced parents to switch (partly) to disposable diapers.
Main Complaints	<ul style="list-style-type: none"> • Leaking happened very fast, <ul style="list-style-type: none"> ○ they were changing diapers all the time ○ Hygiene ○ Smell of diapers and bag • It took time to instruct all employees • Not convinced of impact on the environment • Diaper rash seems more frequent
Diaper: disposable	
Diaper: all-in-one	
Diaper: all-in-two	
System 1	
System 2	
System 3	
Notes	
Notable quotes	'We tried it for about 6 months, but at some point, you got to choose for your team, and we unanimous decided to stop [using washable diapers].

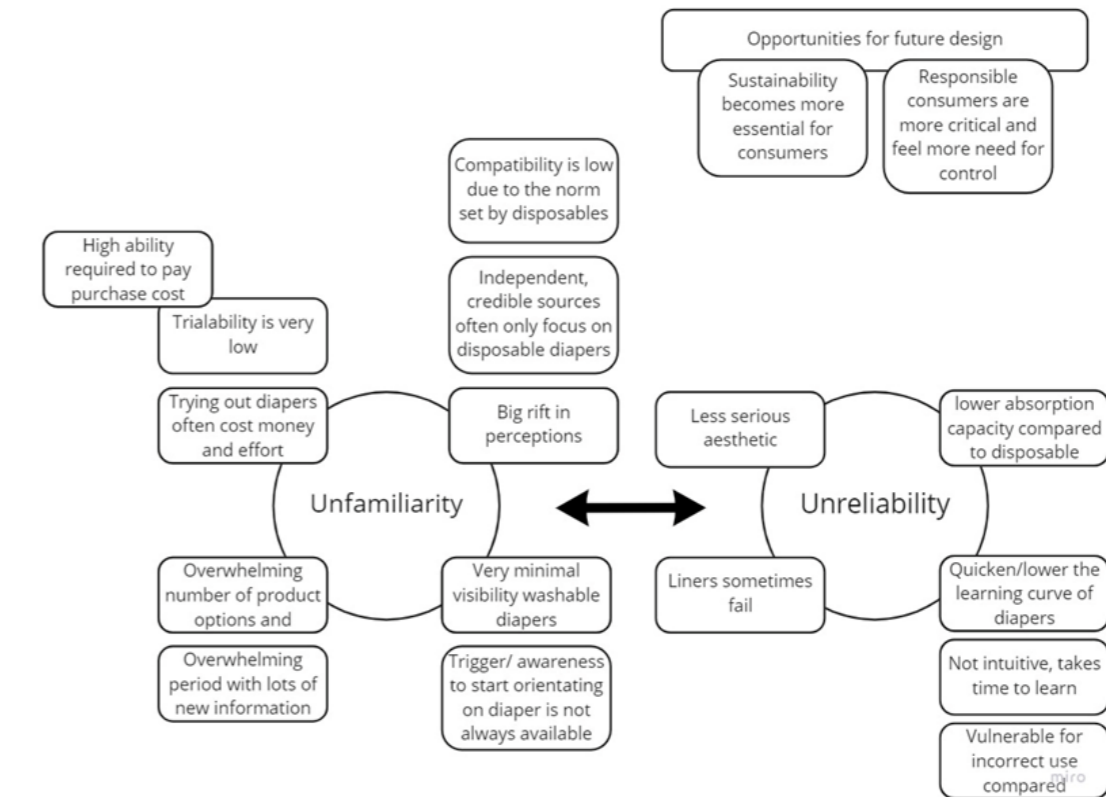
Appendix B: Interview notes of interviews with parents

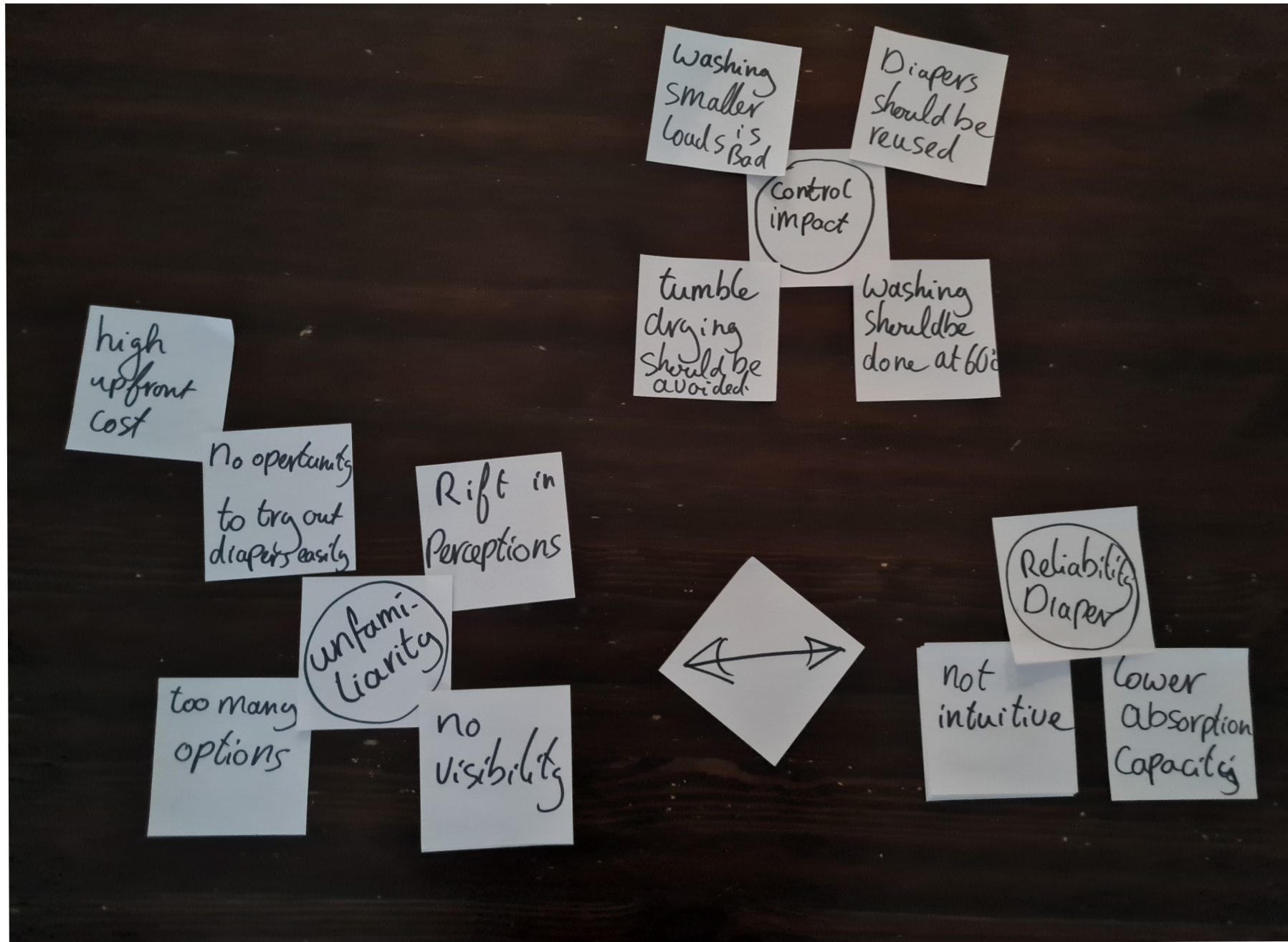
	Parent 1
General characteristics	First time Mother of one daughter (6 months old), Uses a 2 part-diaper system with bamboo liners and extra inserts during night-time.
Number of diaper changes per day	5 (different moments)
Current situation	Two-part system. Owned around 20 small sized diapers, washed 15 per time, now owns 17 diapers and washes 12/13. (2/3 times a week). Washes with pre-wash (Rinsing and centrifuging) 'to get poop out of the diapers' + 'baby wash' (4 rinses). Uses powdered soap. Air drying (less wear). Leaks happen only very occasionally at night (when label diaper is not tucked in).
Actors and stakeholders	<ul style="list-style-type: none"> • Web shop: Send trial package at 8st week • Diapering College: Lend out diapers and showed their system • Boyfriend: Was sceptical at first, due to extra work. Changes about 40% of diapers • Other parents give mostly sceptical reactions • Family: went along with it after extensive instructions. Two prepped diapers + one outer diapers. • Day-care (one day per week): informed during take-in, added instructions to wet bag. Day-care mentor was elderly and used cotton diapers back in the day.
Main Complaints	<ul style="list-style-type: none"> - The diapers are very thick - Freedom of movement (notices different behaviour in her child) but believes it's better for the stance of the hips - They are slightly more dirty - They are more work
Diaper: disposable	
Diaper: all-in-one	
Diaper: all-in-two	
System 1	If parents only use it during day-care, parents will have to wash very inefficient washes. Slight preference for this system because it gives her most control
System 2	You would have to send the children home in disposable diapers Some people might fall over sharing diapers.
System 3	Would be convenient to parents.
	Some people might fall over sharing diapers. She dislikes the idea of not having her own diaper system. Her system is something very personal. Is it still sustainable? Child only goes to the child-care one day per week.
Notes	It took a while to arrange and assemble a suitable dresser (space for diapers and hygienic products) and a washing routine, but she is very enthusiastic about it now. Gives the easiest closing diapers covers to babysitters
Notable quotes	'Leaks only happen very occasionally at night when I forget to tuck in the label at the back. That is my own mistake. Besides that, it never leaks' 'It took a while to assemble a suitable dresser with space for diapers and reusable wipes. Kind of like a sub-way sandwich counter' 'I think reusable diapers smell BETTER than disposable diapers'

	Parent 2
General characteristics	Third child, 8 th months old (eat solid food) Uses diapers parttime, partner and day-care do not use them, <ul style="list-style-type: none"> • Washed every third day <ul style="list-style-type: none"> ○ Short 30/40 degrees program (no prewash on wash machine) ○ Full 60 degrees program, sometimes towels are added ○ Line drying
Number of diaper changes per day	4 out of 6 diapers are reusable diapers.
Current situation	Third child was first child to wear washable diapers. Used them from the first weeks after birth (8 months). Currently very satisfied
Actors and stakeholders	<ul style="list-style-type: none"> • Partner: Hates reusable diapers, <ul style="list-style-type: none"> ○ calls girlfriend a 'linkse gekkie' for using them. ○ Girlfriend thinks it is ignorance but has not been able to convince him • Babysitter & Day-care: Decided beforehand not to even suggest it <ul style="list-style-type: none"> ○ Did not want to burden them with reusable diapers ○ Wants to do things their own way ○ Discouraged by stories online • Online workshop: Online presentation that gives information to parents who are considering buying
Main Complaints	<ul style="list-style-type: none"> • Poop diapers seemed intimidating at first <ul style="list-style-type: none"> ○ When poop is only half-solid, it spreads everywhere ○ When the liner is wet it is dirty to remove ○ When liner is folded around the booster it stays in place better but is harder to remove in one movement • Takes a bit longer to change <ul style="list-style-type: none"> ○ Takes about 30 sec longer • It can be harder to see if the diaper needs to be changed. • Rolling is slightly harder for small children. • It feels equally expensive (lots of extra products, like wet bags) • It seems easy to go for the wrong system upfront, and fail to build up routine
Diaper: disposable	
Diaper: all-in-one	<ul style="list-style-type: none"> • Seemed most practical at first • turned out to be more leaky <ul style="list-style-type: none"> ○ does not always absorb enough ○ Adding boosters makes the fit less tight
Diaper: all-in-two	<ul style="list-style-type: none"> • Leaks way less <ul style="list-style-type: none"> ○ easy to add boosters ○ Equally leak-free as disposable diapers, specifically when the babies are young
System 1	Own choice of diapers and own system for parents
System 2	Not everything has to be brought all the time, <ul style="list-style-type: none"> • BUT parents might do half washes at home • People don't know if the diapers will be washed and treated well <ul style="list-style-type: none"> ○ Right temperature, detergent, RPM, not tumble drying
System 3	<ul style="list-style-type: none"> • If diapers were labelled, they would be hard to resell <ul style="list-style-type: none"> ○ Diapers might get lost • One shared diaper pool would have the highest chance of success. <ul style="list-style-type: none"> ○ Diaper might not be the right for everyone. ○ Would not work when child comes 1 or 2a week
Notes	On Instagram: luierhuis. Lots of info and might be interested in collaborating.
Notable quotes	'After moving we started using a kliko container instead of an underground container. I had two children who were using disposable filled half the kliko.' 'Reusable diapers aren't really more work than disposable diapers. The time you lose washing, you win back because you don't have to buy or order diapers.'

	Parent 3
General characteristics	Second child, 2 years old
Number of diaper changes per day	4 washable diapers, 2-3 disposable diapers
Current situation	<p>Heard about it via friends. Started with (self-made) washable wipes, transitioned to washable diaper pants and diapers when second child was born. Friends and neighbors</p> <p>Two-part system Washes about 8 diapers per time (+ over diapers, wipes & cotton pads), sometimes combined with towels or bedsheets 60 degree wash, sometimes 40</p>
Actors and stakeholders	<ul style="list-style-type: none"> Day-care: never asked, feels cumbersome to ask them to use her system <ul style="list-style-type: none"> In general day-care uses their own material (sleeping bags) You can't ask them to wash poop diapers when necessary A 2 year old moves more and poops and pees more Disposable diapers are used for Babysitters and days out Husband: only uses disposable diapers (but does take diapers off) <ul style="list-style-type: none"> Too much work for a busy man Poop is unpleasant
Main Complaints	<p>It took a while to find the right system and learn how to avoid leaks (finding the right over pants for example). Dealing with poop is still hard.</p> <ul style="list-style-type: none"> Poop seems to always get next to disposable liner Washable liner works better but takes more time <ul style="list-style-type: none"> Since liners and stores them in a bucket with detergent in the bathroom Diapers still smell a little bit of ammonia after washing They do leak more
Diaper: disposable	When first child was potty training, many diapers were thrown away without being peed. It felt like waste to throw them away.
Diaper: all-in-one	HATES POPERS. Hard to find the right fit. Velcro is much preferred.
Diaper: all-in-two	Really important to use one with proper double edges that don't leak
System 1	<ul style="list-style-type: none"> Pretty disgusting to receive dirty diapers back from day-care
System 2	<p>Most likely to use</p> <ul style="list-style-type: none"> Concerned about use of tumble dryer <ul style="list-style-type: none"> It would damage the waterproof outer layer Other should not wash the (expensive personal belongings of other and risk ruining them) Would be more okay if day-care provides diapers <ul style="list-style-type: none"> If they are washed well
System 3	<p>Least likely to use</p> <ul style="list-style-type: none"> Would be very expensive, she'd rather buy them It only works go to the day-care every day, its dirty to just have diapers with poop waiting around for days. <ul style="list-style-type: none"> You would have to wash at home No extra value, washing isn't that much of a problem. You do laundry anyway
Notes	
Notable quotes	

Appendix C: Initial problem cluster





Appendix D: Assumption's in fast track LCA's

Washing machines temp (C)	Unknown machine central (kWh per load)	washing milieu (kWh per load)	Source	Electricity use D rated washing machine (kWh per load)		Electricity use A rated washing machine (kWh per load)	
Pre-wash	-	-	-	0.25	(Öko-Institut, 2005)	0.25	(Öko-Institut, 2005)
40/60 Eco	0.954		(milieu centraal, N.D.)	0.745	(Commission Delegated Regulation (EU) 2019/2014, 2019)	0.52	(Commission Delegated Regulation (EU) 2019/2014, 2019)
40	0.909		(milieu centraal, N.D.)	0.708	-	0.494	-
60	1.182		(milieu centraal, N.D.)	0.924	-	0.645	-
90	2.182		(milieu centraal, N.D.)	1.706	-	1.191	-

Dryer machine	Heat pump dryer label A+ (kWh)	Source	Heat pump dryer A+++ (kWh)	
	1.45	(Milieu Centraal, N.D.)	0.80	(Milieu Centraal, N.D.)

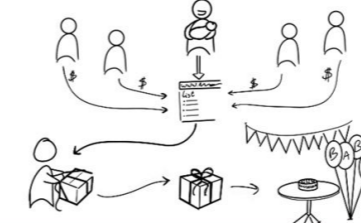
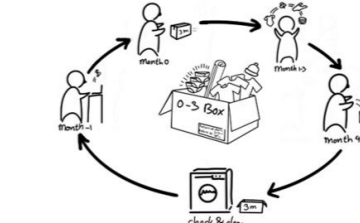
Energy recovery incineration		Source
Total waste incinerated in NL (kg)	7.6E+09	(Hernieuwbare energie uit afvalverbranding, 2020)
Total energy recovered by waste incineration in NL (kWh)	4.643E+09	(Hernieuwbare energie uit afvalverbranding, 2020)
Gray energy (Kg CO2-eq/kWh)	0.556	(CE Delft, 2020)
CO2 recovered per Kg waste incinerated	0.3396428	-

greenhouse gas emissions of wastewater treatment plants (Snip, 2009)	Bridle Beenyup WWTP [kg CO2e/m3]	BSM2 WWTP [kg CO2e/m3]	Literature (Bani Shahabadi et al., 2009)	Avr.
Biotreatment	0.1	0.3	0.2	0.2
Sludge digestion + biotreatment	1.9	1.5	1.8	1.7
Sludge disposal	0.2	0.1	0.0	0.1
Chemicals	0.0	0.0	0.2	0.1
Power	0.4	0.4	0.5	0.4
Biogas used	-0.3	-0.2	-0.1	-0.2
TOTAL [kg CO2e/L]:	0.0022	0.0020	0.0026	0.0023

Appendix E: Brainstorm

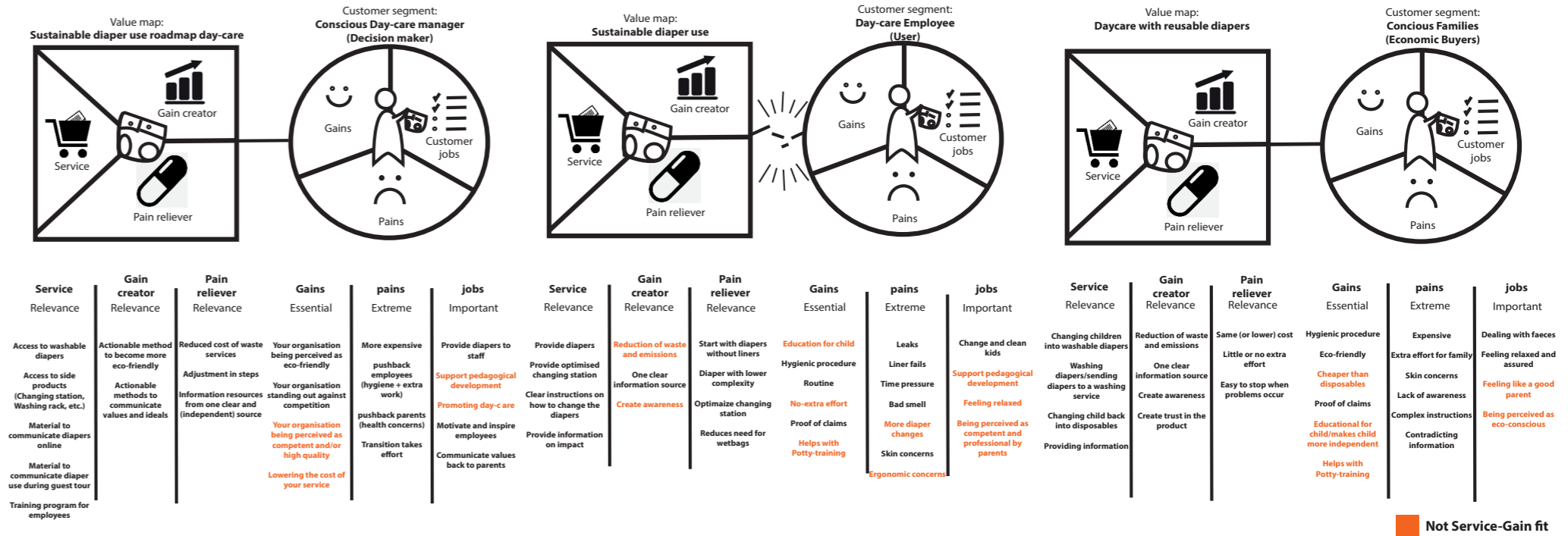
	Relative advantage	Compatibility	Complexity	Trialability	Observed effects
Day-care	Provide sustainable washing, reuse & recycle 'singing' training diapers Diapers to enhance attachment	Advertise acceptance reusable diaper Offer washing service Use them at day-care Special wet bags	Make liners more fitting	Offer rental diapers	Use them visibly to parents Use reusables Show diapers off during guided tour
Pregnancy box				One free diaper/one free month of diapers	
Drug/Baby store		Offering the diapers		Have a stand where people can touch & try	
Parenting Classes	Guest speaker/workshop at parenting classes				
Maternity care			Explain workings of reusables	Use soft & cute reusable new-born diapers	
Partner	'I love papa' diapers Diaper changing bonding ritual				Wash bag that equals one saved bag of trash
Online information			ONE video guide with all essential info Downloadable PDF/ mail brochure	Sell ½ or ¼ sets of diapers instead of full sets	
Friends & Family		Reusable diaper baby shower gift			'Bjorn borg' fashion (weir diapers more visibly) 'Bjorn burg' fashion, Window and bumper stickers
Consultation bureau & Obstetrician	Send information packages tell how it affects skin, 'singing' training diapers	Adding reusable diapers to education program	Provide ONE leaflet with essential info		Showing how many bags of trash are saved per diaper

Appendix F: Presence Rogers characteristics in concepts

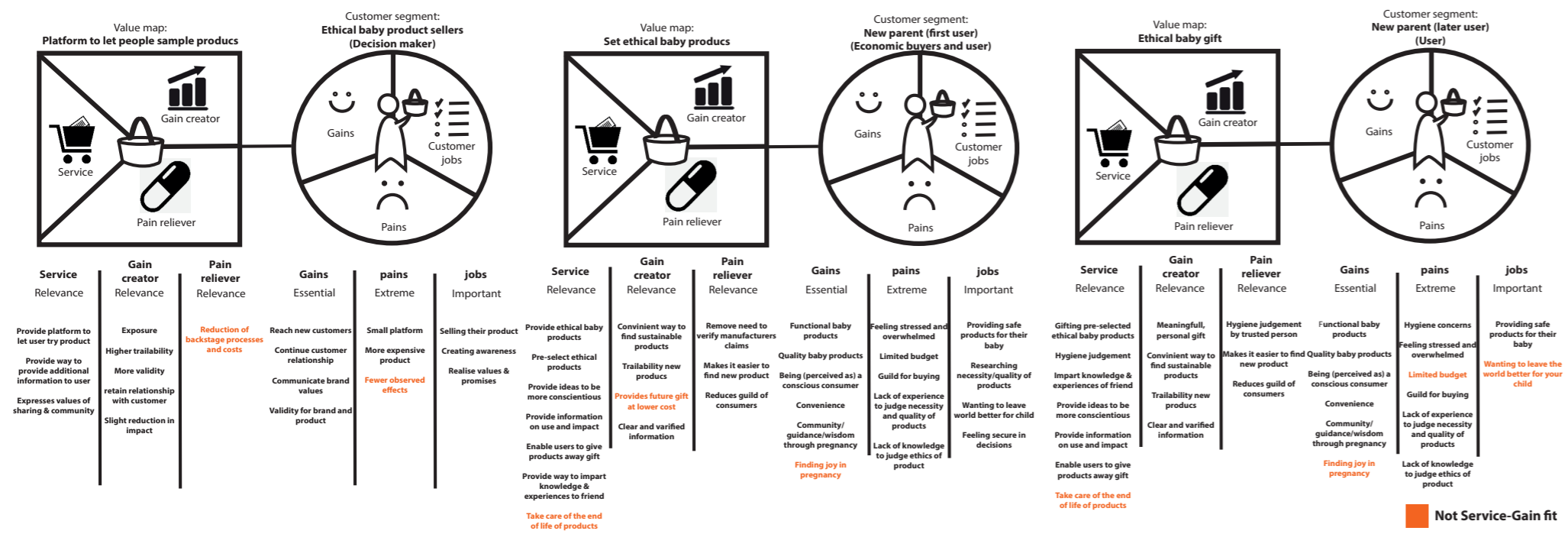
	Baby shower service	Circular pregnancy box
	A service that helps friends buy a family's preferred diapers as a baby shower gift. This service is an online tool that helps people select the most suitable type of diaper, and sends these preferences to a group of friends, who can (partially) pay together for the gift an personalise and decorate it.	Offering diapers in a pregnancy box with reusable products that can only be used for the first 3-ish months, for a rental fee below purchase cost (and deposit). The box contains, simple to use, new-born sized diaper for people to try out for a while. After 3 months the box is sent back, cleaned and checked and rented out again.
		
Relative advantage More value/less cost	1	4
Compatibility Fit with existing values and structures	4	4
Complexity Easy to understand	2	3
Trialability Easy to try out for families	1	4
Observability Awareness benefits	3	1
Total score	11	16

Appendix G: Value fit visible use at day-care

	Visible use at day-care	Flexible diaper Access
	A roadmap for increasing the adoption of washable diapers at day-cares, so that for every stage day, so that they act as example to their clients, and can set themselves apart from their own competition. The roadmap starts with only accepting diapers and ends with using 100% washable.	Flexible diaper-stack rental service allows people to pick-up and rent several types of diapers from a local store allows people to swap the type and number of diapers indefinitely until they are happy with their personal diaper stack. Drop-off would happen in a drop-off box at stores and payment via an app.
Relative advantage More value/less cost	2	1
Compatibility (x2) Fit with existing values and structures	5	2
Complexity (x2) Easy to understand	3	1
Trialability (x2) Easy to try out for families	3	5
Observability Awareness benefits	4	1
Total score	17	11



Appendix H: Value fit baby gift box



Baby box	Price (Euro)	Source	Maternity gift	Price (Euro)	Source	Finnish Baby Box-style Bundles	Price (Euro)	Source
BabyBox	0	https://www.oudersvannu.nl/zwangerbox/aanvragen/affiliate-4-you/?a-wc=12477_1652038071_463f65e9a9948f3cdabe1d-c8554f185c	Kraamcadeau koffer groot	89,95	https://www.kraam-cadeau.nl/kraamcadeau-koffer-groot-roze-of-blauw	Finbin. Baby Box Bundle: The Finland Original	426.64	https://www.finnbin.com/products/newborn-essentials-baby-box-bassiniet
Blijde doos	0	https://deblijedoos.nl/?utm_source=aw&utm_medium=partner&utm_campaign=374473&aw-c=12475_1652038097_1f-47f5597d9de-035aaaf664a41b1d8a8	Babygeschenkset - Kraamcadeau NH	49,99	https://www.bol.com/nl/nl/p/kraamcadeau-jongen-kraamkado-jongen-geboortecadeau-koetsiekoetsie-babysneaker-kraamkado-baby-kan-ook-rechtstreeks-woorden-verstuurd/9300000043825013/?bitgh=ht5yAHR4n-JWYicwDgBxOlq_2_38.41.ProductImage	Reima Baby Box	199.95	https://www.reima.com/int/Baby-clothing/Wool-and-fleece-for-babies/Reima-Baby-Box/p/999950-WNTR
Etos babydoos	0	https://www.etos.nl/extra/etos-baby/	Giftbox met naam en Pinguin Slofjes	20,95	https://www.kraam-cadeau.nl/giftbox-met-naam-pinguin-slofjes	Little un Maternity Box	397.80	https://www.littleun.co.uk/product-page/maternity-box
Kruidvat Blijde baby tas	0	https://www.kruidvat.nl/babywelkomtas	Baby Shower Gift Box	121,35	https://www.etsy.com/nl/listing/1052461084/baby-gift-box-pasgeboren-gift-box-baby?gpla=1&gao=1&utm_source=google&utm_medium=cpc&utm_campaign=shopping_nl_du_nl_bath_and_beauty-baby_and_child_care&utm_custom1=k_Cj0KcQjwIN2TBhCOARIsAGVHqC7Q8tJqYlKdtbv_FysqFOHTI9Rb_CycM75UI3tP0YMWGRT29-eRb8aAuIMEALw_wcB_k_utm_content=go_13699944162_124955763580_530541836333_pla-316236639725_c_1052461084nlnl_473546419&utm_custom2=13699944162&gclid=Cj0KcQjwIN2TBhCOARIsAGVHqC7Q8tJqYlKdtbv_FysqFOHTI9Rb_CycM75UI3tP0YMWGRT29-eRb8aAuIMEALw_wcB			
Baby Dump Cadeaupakket	0	https://www.baby-dump.nl/gratis-cadeaupakket/aanvragen/	Kraampakket Boy	45,95	https://www.geboortegift.nl/product/kraampakket-boy/			
Hoogvliet Babypakket	0	https://www.hoogvliet.com/baby	Hip&Mama box Zwangerschapsbox XL	59,99	https://www.greetz.nl/cadeaus/detail/hip-mama-box---zwangerschapsbox-xl/1142814303			
Plus Kiekieboebox	0	https://www.babydozen.net/gratis/plus-babydoos.html	NoPlasticPlease Kraambox	59,00	https://www.noplasticplease.nl/product/4052929/noplasticplease-kraambox?gclid=Cj0KcQjwIN2TBhCOARIsAGVHqC4v9uuJctwAOYvwwdKnle7e06RuusbYeIvUzyzw5sCLHuGaTL48z7MaAvC-ZEALw_wcB			

Appendix J: Service model blueprint

