



From disposable to washable

A case study about the most important barriers for consumers to use washable baby diapers

Master Thesis European Governance

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Management summary

The world population is increasing pretty quick, while individual consumption levels rise as well (Raworth, 2017, p. 4-6). Today a lot of raw material is used to fulfil human needs and the economic system is linear: we take, make and waste. Currently, environmental pollution is excessive and waste production is massive, partly due to disposable and single-use products like baby diapers (Raworth, 2017, p. 31-46; NVRD and Rijkswaterstaat, 2015, p. 8-9). With this linear economic system the earth will be exhausted eventually. A regenerative alternative economic system in less waste is created is therefore needed: the circular economy (Ellen MacArthur Foundation, 2013 and Raworth, 2017, p. 221-239). Of course, the supply side of the market needs to adapt new business models to close the loop in the production chain. However, to stimulate development of this alternative economic system in the first place, more sustainable consumer behaviour is a key factor (Raworth, 2017 and Ceton and Van der Wal, 2006). Nevertheless, it is not easy for consumers to make more sustainable choices: disposable products have become the norm and sustainable alternatives can be hard to find, if a consumer even knows what the sustainable alternative is (Milieu Centraal, 2017). Therefore policy interventions are needed to remove the barriers that consumers experience to choose for a more sustainable and washable alternative instead of a disposable product (European Commission, 2012, p. 7).

The focus of this research is to find the barriers that hold consumers from using washable diapers. Based on this a policy advice is given on how to stimulate the use of the washable baby diaper and to reduce the amount of waste that is generated by disposable diapers. Disposable diapers and other incontinence materials waste are a substantial part of the residual waste production of households, about 5-8% in the Netherlands. Together all Dutch households produce 200 million kilograms of disposable diaper waste per year (Rijkswaterstaat, 2017, p. 14 and Rijkswaterstaat, 2016). For all European countries together this comes down to about 4.5 billion kilograms of disposable diaper waste each year (EACI, 2013). So far EU and the Dutch national government invested about 40 billion euros in recycling but it did not result in a solution for this waste problem yet. The recycling technique is very expensive and if it runs, like the RECALL project in Italy which costed 36 billion euros and has been fully funded by the EU, it is only possible to recover a couple of valuable materials like high-quality cellulose and speciality plastics (Eco-Innovation, 2018 and Smouter, 2015). Moreover, according to the ambitions and principles of a sustainable economy, prevention of waste should be the main aim while recycling is a second-best alternative. For example, the Sustainable Development Goals (SDGs), the EU action plan for a circular economy, initiatives to address single-use plastics and the Dutch government-wide program 'A circular economy in the Netherlands by 2050' all incorporate a regenerative economy in which less waste will be created. All these plans underline prevention and address consumer behaviour as a key factor to create a more sustainable economic system (UNSEC, 2017; European Commission, 2015; Ministry of Infrastructure and the Environment, 2015). Stimulating the use of the washable baby diapers would fit within these ambitions and help to reduce disposable diaper waste. However, what are the barriers that consumers experience to use washable diapers?

For this research hypotheses based on the more traditional neoclassical economic and the more modern behavioural economic approaches are analysed to review what the most important barriers are for consumers to use washable diapers. The neo-classical approach assumes man to be rational, fully aware of its preferences and has perfect information on all choices. Therefore, consumers are mainly driven by factors like price, information and the utility of the product in relation to the consumers' preferences. According to these theories consumers base their choices on their own preferences solely. The impact of the consumers' social environment is not taken into

account (Shepherd, 1996; Nelson, 1970; Stigler, 1957 and Fishburn, 1970). Contrarily, behavioural economists assume that human behaviour is rationally bounded and not based on perfect information or infinite time. To handle choices, heuristics – like rules of thumb- are developed but these can be biased. Besides, this approach includes the impact of the social environment on individual consumer choices (Thaler and Sunstein, 2008 and Green, Fry and Myerson, 1994). This approach states for example that consumers can be hyperbolic discounters: they undervalue long term savings compared to short term investments. Therefore it is likely that consumers are less interested in a more sustainable good with high purchase costs but with long term savings eventually because they discount on the savings over time (Green, Fry and Myerson, 1994). Besides, consumers are loss-averse and don't like do not think hard about daily choices like groceries or diapers. Overall, according to this theory, consumers prefer the easiest choice which is actually guided by the choice architecture, but the consumer is unaware of that. By making use of flaws in consumer behaviour like the biases and heuristics, consumer choices can be steered in the preferential direction. For example, through intervening in the choice architecture and turning of the default, consumer behaviour can get a soft, hardly noticed push in the preferred direction, which is also known as a nudge (Thaler and Sunstein, 2008, p. 4-6).

The data of this research is based on a general online survey with 360 respondents, all Dutch parents with young children. Additionally, this research makes use of survey data collected among 69 *Mazzelkontjes*¹ participants. The *Mazzelkontjes* pilots were organised by municipalities and the Dutch NGO Milieu Centraal to stimulate the use of the washable diapers by financial support and practical help. Within these pilots a select group of parents could try the washable diapers for a two months to see if it would work for them (Milieu Centraal, 2017). Quantitative and qualitative analysis of the survey data showed the that most important barriers for consumers to choose for washable diapers instead of disposable diapers are 1. the high purchase costs, 2. the complex information, 3. the practical downsides of the washable diaper and 4. the fact that the disposable diaper is the default option which is the easiest to get. Many disposable consumers are simply unfamiliar with the alternative option. Furthermore, this analysis showed that both neo-classical and behavioural economic insights are useful approaches for explaining the barriers that consumers experience with washable diapers. According to this research it cannot be stated that neo-classical economic theory is outdated by the more modern behavioural economic approach. The insights of both approaches complement each other and combining the instruments is therefore effective.

The most important policy recommendation of this research is that prevention is better than cure. This phrase has a double meaning. In the first place, prevention should be the main goal of waste management while recycling is a second-best alternative. Secondly, it is best to let consumers use washable diapers as early as possible. Once used to disposable, it is harder to use washable diapers instead. To address the barriers that consumers experience to try washable diapers interventions can be done on EU, national and local levels of government. The EU has a facilitating role as it comes to legislation on waste management. On this level stimulating legislation for prevention of waste can be enforced like for example the commission proposal for single-use plastics. Besides, funding can support member states to invest more in the stimulation of washable alternatives instead of recycling solely. Furthermore, EU funds like the Horizon 2020 programme but also national funds could be used for product innovation research which might help to improve the practical downsides of the washable diaper. On national level an information campaign on washable alternatives for disposable products in general, like diapers, sanitary products but also cutlery, is

¹ Dutch word for 'lucky bottoms'

recommended. This contributes to setting a new norm: washable instead of disposable diapers and helps to reduce residual household waste. Besides, further research should be done to review whether a lower VAT rate for washable products or other instruments like a higher tax on disposable diapers for compensating for the environmental costs if they might help to stimulate the use of washable diapers. Furthermore, local governments can stimulate the use of the washable diaper for example through providing information, organising social events for parents to share knowledge on washable diapers and give a free test washable diaper as a present for parents when they register their new born child at the municipality.

The focus of this research is on the demand side of the market: the consumers. However, also the actors on the supply side of the market have an important impact on consumer behaviour. The market power of the disposable diaper producers should not be underestimated. For example, producers of disposable diapers like Proctor & Gamble and Kimberly-Clark invest already a lot in disposable diaper recycling to sustain the market position of the disposable diaper. In contrary, the washable diaper sector is relatively small and not well organised at the moment. There is high competition between the different resellers on small details but not on price (NVRD and Rijkswaterstaat, 2015, p. 10-11). Better cooperation within this sector is crucial for acquiring a better market position for the washable diaper. Furthermore, the ambitions of a more sustainable economy and stimulation of sustainable consumer behaviour cannot be realised by each level of government separately but are interdependent on each other. It is therefore highly recommended to align the policies and cooperate as much as possible.

Chapter 1: Introduction

The world population is increasing pretty quick, while individual consumption levels rise as well (Raworth, 2017, p. 4-6). Today a lot of raw material is used to fulfil human needs and the economic system is linear: we take, make and waste. Currently, environmental pollution is excessive and waste production is massive, partly due to disposable and single-use products like baby diapers (Raworth, 2017; p. 31-46; NVRD and Rijkswaterstaat, 2015, p. 8-9). With this linear economic system the earth will be exhausted eventually. A regenerative alternative economic system in less waste is created is therefore needed: the circular economy (Ellen MacArthur Foundation, 2013 and Raworth, 2017, p. 221-239). Of course, the supply side of the market needs to adapt new business models to close the loop in the production chain. However, to stimulate development of this alternative economic system in the first place, more sustainable consumer behaviour is a key factor (Raworth, 2017 and Ceton and Van der Wal, 2006). Nevertheless, it is not easy for consumers to make more sustainable choices: disposable products have become the norm and sustainable alternatives can be hard to find, if a consumer even knows what the sustainable alternative is (Milieu Centraal, 2017). Therefore policy interventions are needed to remove the barriers that consumers experience to choose for a more sustainable and washable alternative instead of a disposable product (European Commission, 2012, p. 7).

The focus of this research is how to stimulate the use of the washable baby diaper to reduce the amount of waste that is generated by disposable diapers. Disposable diapers and other incontinence materials are a significant problematic waste stream. It adds up to about 5-8% of the residual waste from households (Rijkswaterstaat, 2017a, p. 14). In the Netherlands only, about 200 million kilograms incontinence material waste per year is produced by households, not even including the amount produced by hospitals and nursing homes (Rijkswaterstaat, 2016). All European countries together produce about 4.5 billion kilograms of incontinence materials waste each year. In the Dutch government-wide program on circular economy the statement has been made to reduce residual household waste from 200-250 kilograms per person currently to 100 kilograms per person per year in 2025. In 2030 that should be further reduced to 30 kilograms. Disposable diapers and other incontinence materials are 10 kilograms of residual waste per person (Rijkswaterstaat and NVRD, 2015). So far the EU, national and local governments invested more than 40 billion euros in research projects and plants for the recycling of diapers (Eco-Innovation, 2018). However, with varying success. The most expensive pilot in Italy with high pressure steam technique proved to be a working technique but costed eventually €36 billion instead of the €2.7 million budgeted, which has been fully funded by the EU (Eco-Innovation, 2018). Besides, it is only a method to recover some valuable materials but you cannot make new diapers from it. Other pilots like the Orgaworld composting installation for diapers in Lelystad failed because of a problem with too many plastics in the compost (Van Leeuwen, 2015). Amsterdam and Nijmegen are planning to open a recycling installation any time soon but have problems with the financing of the project (AEB Amsterdam, 2017 and Linssen, 2018). Therefore the most common way to process this type of waste is to use it as landfill or incinerate it, which produces a lot of CO₂ emissions (EACI, 2013 and CE Delft, 2018, p. 18). Furthermore, the amount of disposable diaper waste will probably only increase with a rising amount of elderly and increasing use of the disposable diaper in less developed countries (Smouter, 2015).

This research will mostly focus on baby diapers, because that is a product for which there is an alternative for the disposable diapers: the washable diaper. Washable diapers are not the old-fashioned white towels with safety pins but colourful, modern, cotton or bamboo diapers which can be washed and reused. These kind of diapers require an investment between €500,- and €750,- at

first instance and including the costs for washing and additives, the average total costs are about €800,-. However, the washable diapers are cheaper on the long run than disposable diapers, for which the total average costs are €1300,-. Moreover, washable diapers decline the generation of waste dramatically (Ten Grotenhuis, 2018). Nevertheless, these are not very popular among young parents yet: some never heard of them or think it's an old fashioned product with a very bad image but the barriers for using washable diapers instead of disposable ones have never been researched well before (Milieu Centraal, 2017).

The main research question of this thesis is: *What are the most important barriers for consumers to use washable diapers?* Based on those barriers policy recommendations are made for the EU, the Dutch national and local governments on what they can do to stimulate the use of washable diapers. For this research theoretical insights from both the traditional neoclassical economic and the more modern behavioural economic approaches are used. Both approaches aim to explain consumer behaviour on how choices for certain products or goods are made but each approach has different assumptions on the essence of human behaviour (European Commission, 2012, p. 10-15). On one hand, the neo-classical approach assumes man to be rational, fully aware of its preferences and has perfect information on all choices. Therefore, consumers are mainly driven by factors like price, information and the utility of the product in relation to the consumers' preferences. According to this theory consumers base their choices on their own preferences solely and it does not take into account the impact of the consumers' social environment (Shepherd, 1996; Nelson, 1970; Stigler, 1957 and Fishburn, 1970). On the other hand, behavioural economists assume that human behaviour is rationally bounded and not based on perfect information or infinite time. To handle choices, heuristics are developed which can be biased. Besides, this approach includes the impact of the social environment on individual consumer choices (Thaler and Sunstein, 2008 and Green, Fry and Myerson, 1994). This approach states for example that consumers can be hyperbolic discounters: they undervalue long term savings compared to short term investments. Therefore it is likely that consumers are thus less interested in a more sustainable good with high purchase costs but with long term savings eventually because they discount on the savings over time (Green, Fry and Myerson, 1994). Besides, consumers are loss-averse and don't like to do not think hard about daily choices like groceries or diapers. Overall, according to this theory, consumers prefer the easiest choice which is actually guided by the choice architecture, but the consumer is unaware of that. By making use of flaws in consumer behaviour like the biases and heuristics, consumer choices can be steered in the preferential direction. For example, through intervening in the choice architecture and turning of the default, consumer behaviour can get a soft, hardly noticed push in the preferred direction which is also known as a nudge (Thaler and Sunstein, 2008, p. 4-6).

This study evaluates the barriers for consumers to use washable diapers based on survey data analysis from 429 Dutch parents. 360 respondents filled in a general survey about their diaper consumption. Besides, the survey data from 69 participants in three *Mazzelkontjes* pilots in the municipalities of Tholen, Haarlemmermeer and Breda are reviewed. The *Mazzelkontjes*² pilots have been organised by the NGO Milieu Centraal which advocates 'practical sustainability' and advises consumers on sustainable products and services. The pilots were done in cooperation with local governments and resellers who (partly) financed the washable diapers and resellers who provided information for the participants. The aim was to offer parents a try-out period to see whether they would change to the washable alternative (Milieu Centraal, 2017).

² Dutch word for 'lucky bottoms'

First part of the analysis of this research is devoted to find out whether this set up is effective in stimulating the washable diapers among parents. This is a natural field experiment, with the respondents from the general survey as control group and the *Mazzelkontjes* participants as treatment group (Babbie, 2013, p. 289-91). The second part of the analysis focusses on the most important barriers that consumers experience to use washable diapers. In this study both behavioural economic insights on sustainable consumer behaviour and neo-classical theories are applied and combined with a multi-level governance approach plus legal, economic and political perspectives. The Dutch situation is taken as the central point of this research. To take the all European countries into account would have been too extensive for this research. Nevertheless, it might assumed that the outcomes are still valuable as inspiration for other EU member states for example because the situation won't be that much different. For the Ministry of Infrastructure and Watermanagement, Rijkswaterstaat and the municipalities that participated in a *Mazzelkontjes* pilot this case study provides a useful exploration of barriers that consumers experience and help to improve the strategy to reduce residual household waste. Besides, the outcomes of this research might be valuable for policy strategies about other waste streams as well, like hygiene products for women and other disposable plastics.

However, first things need to be put into perspective. Therefore the following chapter outlines the current state of affairs of the problem caused by disposable diapers on national and local level in the Netherlands and on the European level according to a literature review. Besides, international, European and national ambitions on sustainability and consumer behaviour are further explained. Theories and philosophies which influenced these governmental ambitions like 'The Doughnut Economy' (Raworth, 2017), circular economy philosophy (Ellen MacArthur Foundation, 2013), the hierarchy of waste (Lansink, 1979) and the 'ladder of circularity' (Cramer, 2014) are taken into account in this part as well. The third chapter outlines a definition on sustainable consumer behaviour, the role of government and further discusses the neoclassical and behavioural economic theoretical approaches. In this chapter hypotheses are formulated on the barriers that consumers might experience to use washable diapers. In the fourth chapter the research design and data collection are further discussed. In the empirical analysis in chapter five the most important outcomes are presented and compared with hypotheses based on the two theoretical approaches as discussed in chapter three. Chapter six concludes and in chapter seven policy recommendations for European, national and local level are further explained. Chapter eight is the final discussion in which last remarks are made.

Chapter 2: Current state of affairs

The previous chapter gave a brief introduction to the research topic and the research question. However, somewhat more context is needed to put this issue into perspective. This chapter elaborates on waste management in general in paragraph 2.1. In 2.2 the amount of disposable diaper waste and 2.3 the current market situation for baby diapers and waste processing are discussed. In 2.4 the current status of policies plus legislation on diaper waste and in 2.5 the ambitions on local, national and European level regarding sustainable consumer behaviour are outlined. The last part also takes the underlying philosophies and frameworks of these ambitions into account.

2.1 Waste management

Waste can be managed and processed in many ways. However, each process has a different in environmental impact and value retention capacity. According to Lansink (1979) based on these two elements a hierarchy of waste can be composed: the best way is reduction of waste (prevention), thereafter reuse and recycling and the worst are incineration and landfilling (see figure 1 below).



Figure 1 Ladder of Lansink (1979)

Landfill and incineration are the least valuable ways to process waste because the value of the material is considered as zero. The D level of Lansink (figure 1) energy obtaining from incineration is somewhat better but the value of the material is only extended once. Although, recycling can, in theory, close the loop in the production chain, one should take into account that this process also has its costs: requires effort, management, energy, money, technical solutions, et cetera. Furthermore, recycling has various outcomes. In the best case scenario the material will be upcycled: the value of the material increases through recycling in the new application. However, more often the value of the recycled material is lower than the original. This is so-called downcycling (Sung, 2015) which is caused by the reduction of value of the material when it becomes second hand material (Treloar, e.a., 2003, p. 139). Therefore, in practice, recycling solutions usually extend the durability of a product or the material but eventually value of the material disappears.

Besides, recycling and energy obtaining from incineration also require a certain dependency on a stable production of waste: people still need to waste stuff otherwise there is simply nothing to recycle or to obtain energy from. This is also known as the lock-in effect of policy: once adopted it might lead to a situation in which men collectively act sub-optimal (Pierson, 1993, p. 606-607) and mainly in particular solutions that are not optimal for a longer period of time (Kemp, Loorbach and Rotmans, 2007, p. 81). Thus, recycling is actually the best of the worst, it is a solution to close the loop in the production chain but is at the same time based on the same norm of disposal (The Ellen MacArthur Foundation, 2013, p. 8). It is better to use non-waste products, which means prevention

and thus the reduction of waste generation at all. This requires rethinking of which type of materials and products we use (Cramer, 2014).

2.2 The problem: how much disposable diapers go to waste?

To get a grip on the size of the problem, some numbers and definitions are outlined here for clarification. Residual waste is considered as unusable material: it is incinerated with or without energy recovery or eliminated as landfill but cannot be recycled (Eurostat, 2017a). As long as there is no recycling possible, disposable diapers are residual waste. Most reliable numbers on the amount of disposable diaper waste are based on the share of this product in residual household waste. Hospitals and nursing homes also produce a lot of disposable diaper waste. However, waste from these organisations is not collected as household waste but is collected separately as medical waste because of health risks. Therefore it is hard to give concrete numbers on the exact amount of disposable diaper waste, except that it is very likely that the bulk of disposable diapers waste is bigger than counted from household waste only (Rijkswaterstaat, 2017a, p. 14 and Rijkswaterstaat, 2016).

In the Netherlands about 5-8% of the residual waste from households consists of disposable diapers. A child wears on average 5300 disposable diapers before it has developed bladder control (Ten Grotenhuis, 2018). This comes down to about 200 million kilograms of disposable diaper waste per year which is about 10 kg per person per year (Rijkswaterstaat, 2017a, p. 14; NVRD and Rijkswaterstaat, 2015, p. 8-9). All European countries together 36,25 billion disposable diapers are used which produce about 4.5 billion kilograms of disposable diaper waste per year (EACI, 2013). The amount of diaper waste in the Netherlands but also in Europe only increased in the last decade (Smouter, 2015). Due to the more advanced Super Absorbing Polymers (SAPs) disposable diapers absorb more. However, therefore the child gets less signals to ask for a new diaper and that slows down the learning process of bladder control. That means that the cleanliness of a child develops later and therefore a child needs to wear the disposable diapers for a longer period of time. Thus, eventually there are more diapers per child needed (Ten Grotenhuis, 2018). Besides, with a rising amount of elderly, also other kind incontinence materials are used more (Smouter, 2015).

The current processing of disposable diapers, incineration, produces a lot of CO₂ emissions. According to CE Delft (2018, p. 18) about 37g of CO₂ per kg of disposable diaper waste. Washable diapers reduce the waste generation a lot, however they still have some environmental impact due to production and processing of the material and the washing during the use (Ten Grotenhuis, 2018). Usually washable diapers are made out of cotton, polyurethane laminate, bamboo or hemp. Each material has its own pros and cons concerning the environmental impact. Cotton and synthetic fabrics are long lasting materials but require a lot of water and chemicals in the production process. Besides textile recycling is no common practice yet and often textiles are also incinerated. Bio-based fabrics like bamboo or hemp are more environmental friendly because these are biodegradable and need less chemicals in the production process (Van Doezem, 2009, p. 16). Furthermore, the washing of reusable diapers requires energy and water use. However, the impact can be limited by using an energy efficient washing machine and not using a drying machine which reduces the CO₂ by 2.5 times. Besides, consumers can use environmental friendly detergent and only use the machine when it can be fully loaded (Milieu Centraal, 2017). Although there have been some critical studies published which refute the environmental benefits of washable diapers compared to disposable diapers (for example UK Environmental Agency, 2005), the bulk of waste generated by disposable diapers cannot be solved by recycling either yet. The next paragraph will further elaborate on the market situation for waste processing and baby diapers in general.

2.3 The economic perspective

For this research both context on the market situation for waste processing as well as on the baby diapers themselves are relevant to get a grip on the problem. This paragraph discusses both markets for background analysis, however eventually the research is focussed on the demand side: the behaviour of consumers.

The market situation for diaper waste processing

Disposable diaper waste is currently incinerated with obtaining energy in some cases. Although it creates a lot of negative externalities: losing valuable material and CO₂ emissions (CE Delft, 2018, p. 20), at the moment incineration is the cheapest option to process this type of waste. The costs are between 80-90 euros per 1000 kg. On the other hand, recycling costs 110 euros per 1000 kg with the current options (EOS, 2015a NVRD and Rijkswaterstaat, 2015, p. 9). Complex products, which contain lots of different materials are hard to recycle (Hopewell, Dovrak and Kosior, 2009) and recycling can be a costly and time consuming process. Therefore, it should be simply financially beneficial to recycle. Currently the market fails because the costs for incineration are very low compared to recycling while for incineration there is not compensated for the negative externalities of the CO₂ emissions (NVRD and Rijkswaterstaat, 2015, p. 16).

This also explains why so far recycling of diapers hardly developed yet. It is too complex and expensive at the moment (EOS, 2015a, Rijkswaterstaat, 2016 and Eco-Innovation, 2018). Disposable diapers consist of many different materials and different kinds of plastics. According to the EDANA report (2015) a disposable diaper is, besides the SAPs from plastic, made of from fluff/pulp from wood, nonwovens from polypropylene, elastics and adhesive tape, polyethylene film and adhesives. All materials are mixed and the process to separate and reuse all of it is therefore not easy (NVRD and Rijkswaterstaat, 2015). Currently, both the EU and the Netherlands invest together with the recycling and disposable diaper industry in research projects to improve and further develop recycling for diapers (EACI, 2013; NVRD and Rijkswaterstaat, 2015; and Eco-Innovation, 2018). The state of affairs of these policies is further discussed in paragraph 2.4.

Current market situation for baby diapers

Market for baby diapers is known for high competition, both for disposable as for washable diapers. Disposable diapers cover the biggest part of market, about 80-90% (Smouter, 2015). Disposable diapers are available in all supermarkets, drugstores but also online via platforms like Bol.com. There are more than 40 different brands of disposable diapers available in the Netherlands only. There are many private labels but also two market leaders Proctor & Gamble and Kimberly-Clark (Smouter, 2015). The sellers compete on price, comfort and sometimes also on sustainability like the use of ecological materials (EOS, 2015b and Ten Grotenhuis, 2018). Although the products are relatively similar, there is no perfect competition since all of them have their own specialties. The prices differ between €0,13 to €0,40 per disposable diaper. However these prices do not include the environmental costs of processing the waste and thus there is not accounted for the negative externalities of the diapers (NVRD and Rijkswaterstaat, 2015). The total revenue of this sector is €200 million per year in the Netherlands (NVRD and Rijkswaterstaat, 2015, p. 18) and in the whole EU about €9 billion (EACI, 2013).

For washable diapers the situation is somewhat different. At first, there is less demand. Exact numbers on the market share of washable diapers are hard to give however, Bosma (2007)

estimated it a decade ago on 20% and Smouter (2015) states that 90% of the consumers uses disposable diapers. Since there is a substantial group that uses both kind of diapers, a 20% market share for washable diapers as estimated by Bosma (2007) is probably still a relatively suitable number. Although disposable diapers are still the norm there is a big amount of washable diaper brands surprisingly (Milieu Centraal, 2017). In the Netherlands there are at least 65 different brands available and a wide range of resellers. This assumes a high competition among resellers but they hardly seem to compete on price but more on the details like fitting, colours and technical details (Ten Grotenhuis, 2018). Usually the washable diapers are sold in packages of 24 pieces, which can be used for many years. The prices differ between €500,- and €750,- per package of 24 pieces. Besides, including the costs for additives and washing the total average costs are €800,-. This is a lot of money to invest all in once and there are additional costs involved for the washing. However, in the long run it is cheaper to use washable diapers instead of disposable diapers because washable diapers can be reused for a long period of time and even for another child (Ten Grotenhuis, 2018 and Milieu Centraal, 2017). Only when the cheapest kind of disposable diapers during the whole diaper period it would cost somewhat less than the most expensive washable diapers (Ten Grotenhuis, 2018). Nevertheless, it is not clear whether this price effect is taken into account by the consumer. The high purchase costs might have a deterrent effect (Rijkswaterstaat, 2016 and Ten Grotenhuis, 2018). Most strikingly, the washable diapers are hardly available in the usual stores where most parents buy the disposable diaper. Washable diapers are – some exceptions though – nearly only available online (Ten Grotenhuis, 2018). This means that consumers really need to know about them before they will find them. They are not next to each other in a drugstore and are not compared by the consumer in such a setting. Therefore, it seems that the washable diaper and disposable diaper hardly compete with each other although they are substitute goods.

2.4 Current legislation and policy initiatives on diaper waste

There is no specific European or Dutch legislation on how disposal diaper waste should be managed. Just like nearly every other kind of waste disposable diaper waste is covered by European waste management legislation which is a part of the European environmental policy. Environmental policy is a shared competence according to Article 4 of the Treaty on the Functioning of the EU (TFEU) meaning that ‘the EU and EU countries are able to legislate and adopt legally binding acts. EU countries exercise their own competence where the EU does not exercise, or has decided not to exercise, its own competence’. In this paragraph relevant EU and national legislation is further discussed as well as current policy initiatives on EU, national and local level.

2.4.1 The EU legislation on waste

Currently the relevant EU legislation on waste and the environment are the following: the 7th Environmental Action Plan (EAP) (DECISION No 1386/2013/EU) and Directive 2008/98/EC on waste. The 7th EAP has been adopted in 2013 and outlines the priorities for the environmental policy until 2020. It is guided by the principles of the following long-term vision: *‘In 2050, we live well, within the planet’s ecological limits. Our prosperity and healthy environment stem from an innovative, circular economy where nothing is wasted and where natural resources are managed sustainably, and biodiversity is protected, valued and restored in ways that enhance our society’s resilience. Our low-carbon growth has long been decoupled from resource use, setting the pace for a safe and sustainable global society.’* This EAP is an European decision made by the Parliament and the Council meaning that it is binding upon the Member States. Although the focus of the 7th EAP is broader than waste solely, it elaborates on the improvement of waste management to achieve a better resource efficiency and the importance of the waste hierarchy. The waste hierarchy is based on the

‘Ladder of Lansink’ (see figure 1, paragraph 2.1) which ranks waste management from best to worst for the environment. It has been adopted in the Directive 2008/98/EC on waste as well.

Directive 2008/98/EC on waste outlines the framework for waste management within the EU. For example, Article 29 dictates member states to actively apply waste prevention programmes. For recycling the directive imposes that *‘member states should promote high quality recycling and set up separate collections of waste where technically, environmentally and economically practicable and appropriate to meet the necessary quality standards for the relevant recycling sectors’* (Article 11, ad. 1). Prevention of waste is defined in Directive 2008/98/EC Article 3, ad. 12 as *‘measures taken before a substance, material or product has become waste that reduce: a. the quantity of waste, including through the re-use of products or the extension of the life span of products; b. the adverse impacts of the generated waste on the environment and human health; or c. the content of harmful substances in materials and products.’* Recycling is defined as *‘any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes’* (Article 3, ad. 17).

The EU laws on waste are full of ambitions for better environmental protection and a more sustainable economic system. Nevertheless, the focus of the policy is still on recycling while prevention comes second and there are still significant differences between Member States on waste management. Belgium and Italy recycle most of their waste while Greece, Finland, Sweden still mostly landfill their waste (Eurostat, 2017b). Current proposals for the revised waste strategy and the EU strategy on plastics are even more ambitious and aim for more unification of waste recycling targets. However, current legislation is not very clear on non-compliance. It remains to be seen whether higher ambitions will encourage the stragglers to keep up. Besides, the main emphasis is recycling while prevention of waste is still a relatively small part of the waste legislation.

2.4.2. The Dutch legislation on waste

Directive 2008/98/EC had to be transposed in national law which resulted in the Netherlands in to following legal framework. In the Netherlands waste management is organised in the National Waste management Plan.³ According to this plan local governments have the responsibility and competences to collect household waste. How to organize this is a discretionary power of the local authorities. However, in line with ambitions for a more sustainable economic system, there are national targets for the reduction of residual household waste. Currently, Dutch citizens generate 200-250 kg of residual household waste per year. The aim is to have at maximum 100 kilograms of residual waste per person in 2025 and in 2030 that should be further reduced to 30 kilograms of residual waste per person. Residual waste is no longer residual waste if it is either prevented, recovered, re-used or recycled (Ministry of Infrastructure and Watermanagement, 2017, p. 114). This means that municipalities should implement policies to reduce the production of residual waste. Therefore most municipalities collect plastic waste separately and the frequency of residual waste collection declined in many places. Besides, some municipalities make use of price incentives via a pay-as-you-throw system. In this system households pay per bag or container of residual waste and this stimulates households to minimize their residual waste and separate as much as possible (VNG, 2017). Nevertheless, the current waste management policy is mainly focussed on improving of recycling, not prevention.

³ English translation of Landelijk Afvalbeheer Plan, also known as LAP

2.4.3 Current policy initiatives on disposable diaper waste

The current Dutch national and European policies disposable diaper waste are mainly focussed on recycling. The most successful recycling example so far is the RECALL project in Italy. This project took place between 2012 and 2015. Its costs were estimated on about €2,7 million but eventually it costed nearly €36 billion, which was fully funded by the EU. The system works with a high pressure steam technique and can process all kinds of incontinence materials waste and other single-use sanitary products. Through this process high-quality cellulose and specialty plastics are recovered (Eco-Innovation, 2018). Other projects based on this technique are being developed, for example in Amsterdam and Nijmegen. Both installations have been announced over a year ago. However, none of both runs yet so it is hard to say if they will be able to deliver the same results as the RECALL project (AEB Amsterdam, 2017 and GRAM, 2018). Furthermore, it is not possible to make new disposable diapers or sanitary products immediately. From the materials retrieved in this recycling process new raw materials are needed too to make new diapers. Moreover, other successes so far have been limited. For example, Orgaworld in Lelystad, the Netherlands, tried to ferment plastic disposable diapers to recover a material that could be used as compost but that failed lately. The compost lost its quality mark from the branch association because it contained too much microplastics which are harmful for the environment (Van Leeuwen, 2015). These examples show that recycling of diapers is not a fully developed reality yet because it is complex and expensive. Moreover, there are certain risks which should be eliminated in the recycling process, for example medicines residues and microplastics. However, the advice from Rijkswaterstaat for Dutch municipalities is to collect diapers and other incontinence materials separately (Rijkswaterstaat, 2017b), even though they are not recycled but incinerated like other residual household waste (NVRD and Rijkswaterstaat, 2015).

On the other hand, some local governments focus on prevention of disposable diaper waste. In the *Mazzelkontjes* pilot of Milieu Centraal in cooperation Dutch municipalities the aim is to convince new parents to choose for washable diapers (Milieu Centraal, 2017 and Rijkswaterstaat, 2017b). However, also this project is still on limited scale. The amount of participants varies per municipality between 15 to 46 families. Each pilot took about two months, provided information on washable diapers and social support like Facebook groups and social events with the other pilot participants. The washable diaper was the so-called default option in this setting. However, each municipality had a slightly different financial support system; some gave the set of washable diapers away for free while others offered a lease construction or required a deposit or fee (see table 2 in chapter 5 for an overview). The municipalities invest most time and money in this project: provide the diapers, recruit and select participants and provide information and social events. Data of these participants and their motivations are used in this research and further explained in the fifth chapter. The EU and the Dutch national government, however, did not explicitly supported waste prevention programmes for diapers so far. Nevertheless, in for example Directive 2008/98/EC on waste and in the 7th EAP, prevention is repeatedly named as the highest priority in waste legislation and policy.

2.5 International, European and national ambitions

The previous paragraph outlined what the EU, Dutch national and local governments are already doing to address disposable diaper waste. However, ambitions go further than current initiatives. Climate change, resource scarcity and environmental problems are given much attention nowadays by scientists, in the news and by policymakers on all levels of government. This resulted so far in many philosophies, plans, and accords how to create a more sustainable economic system to turn

the tide as far as possible. This section outlines the most important and relevant ambitions on international, European and national level and their underlying philosophies and frameworks.

2.5.1. International ambitions: The UN Sustainable Development Goals

The Sustainable Development Goals (SDGs) from the UN have been adopted in 2015 (UN Resolution 70/1) and form the UN sustainable development agenda till 2030. The goals aim for equality, end of poverty and protection of the earth at the same time by, among others, more sustainable consumption and production. In the context of this research, goal 12 is the most relevant. This goal aims to ‘ensure sustainable consumption and production patterns’. It endorses that consumer behaviour is an important power to make a difference and create a sustainable economic system (UNSEC, 2017, p. 13).

The SDGs are partly based on the new economic paradigm ‘Doughnut Economics’ created by Kate Raworth⁴. Raworth (2017, p. 10) assumes that a focus of economic development on endless growth should stop because it is unsustainable eventually. Instead the focus should be on a flourishing economy between the boundaries of a social foundation and an ecological ceiling. This means prosperity for everyone but within the ecological limits the earth can offer. According to Raworth (2017) the nine planetary boundaries – climate change, ocean acidification, chemical pollution, nitrogen & phosphorus loading, freshwater withdrawals, land conversion, biodiversity loss, air pollution and ozone layer depletion define the ceiling: the limits beyond which we should put no further pressure on the planet if we want to safeguard the stability of the earth. The social foundation is the minimum level of human basic needs which should be equal for all: social equity, political voice, peace & justice, income & work, education, health, food, water, energy, networks, housing and gender equality. These two barriers are interdependent and together they form the outer lines of the doughnut in figure 2 below. The doughnut is the spot that is ecologically safe and socially just for humanity (Raworth, 2017, p. 45-49).



Figure 2 Kate Raworth (2017, p. 44) 'The Doughnut'

Raworth (2017, p. 26-27) listed seven lessons that need to be learned by economists to adopt this new paradigm:

⁴ Raworth promoted ‘the doughnut’ since 2012 but published the book ‘the doughnut economy’ which explains the full framework later, in 2017.

1. Change the goal: stop focussing on growth but aim to get the economy in the doughnut; ecologically safe and socially just.
2. See the bigger picture: the economy is not a self-contained market but embedded in a greater international system and society.
3. Nurture human nature: the rational man does not exist, humans are socially adaptable.
4. Get savvy with systems: the economy is more complex than a simple demand and supply curve. Dynamic complexity should be included in the economic models.
5. Design to distribute: growth won't even up inequity, the economy must be distributive by design
6. Create to regenerate: growth won't make economies automatically more sustainable, the system should be regenerative by design.
7. Be agnostic about growth: focus on a flourishing economy instead of an endless growing economy.

According to Raworth (2017) increasing and unsustainable consumption is one of the main drivers behind current environmental risks and waste generation. To address these problems, the government can have an important market shaping role – in contrary to neo-classical thinkers - but also the behaviour of the consumer is an important factor for the outcome of the market. For example, to end unequal ecological and social pressure in the production chain, governmental intervention and sustainable consumer behaviour can turn the tide by changing the outcome through more sustainable choices. To realise an economy within the doughnut a transition to a circular economy as well as the use of new policy interventions which incorporate non-rational human choice making behaviour are needed. Participation of consumers, producers and governments are all necessary to make it happen (Raworth, 2017, p. 80-85).

In the report on the progress of the goals (UNSEC, 2017, p. 13) showed that there is still a lot of work to be done to realise sustainable consumer behaviour. Domestic material consumption still grows, both individually and totally. Besides, pollution is not properly monitored in many countries. It is hard to get the right information on the scope of the problem. Creating awareness is therefore even more difficult. UN resolutions are binding and state that the agenda must be implemented. However, this type of legislation is more used as a soft law and diplomatic instrument. Besides, the SDGs are not formulated concretely so assessing them is hard.

2.5.2. European Ambitions: The EU action plan for a circular economy and other recent developments.

In 2015 the European Commission launched the EU action plan on a circular economy based on, among others, the work of the Ellen MacArthur foundation (2013). The action plan is named 'closing the loop' and set out the ambitions of the EU to realise a sustainable, low carbon, resource efficient and competitive economy (European Commission, 2015, p. 2-3). A circular economy is an alternative for the linear take-make-waste model. In a linear economy raw materials are extracted from nature to make products. For example, petrol is used to make plastics which are applied in various products like disposable diapers. These products are used usually only once, thereafter they are no longer valuable for the consumer and then they are disposed and incinerated. The material disappears and for new disposable diapers new raw material need to be extracted from nature again. However, this is not maintainable on the long term because the availability of raw materials is not endless. There is no infinite amount of petrol available to make new virgin plastics. Moreover, the huge amounts of waste that are produced by this type of economy are serious problems for the environment and liveability on earth (Ellen MacArthur Foundation, 2013). A circular economy is based on principles of the natural ecological system: resources grow from nature, are eaten by animals, animals die and

eventually their remains feed the soil to grow new resources. This is a circular closed loop system of bio-degradable resources. A similar concept can be transferred to an economy, however, since a lot of non-degradable materials are used, technical solutions are needed to retain value from the resources that are used. This is the so-called 'butterfly of circularity' Ellen MacArthur Foundation (2013). See figure 3 below.

OUTLINE OF A CIRCULAR ECONOMY

PRINCIPLE 1

1
Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
ReSOLVE levers: regenerate, virtualise, exchange

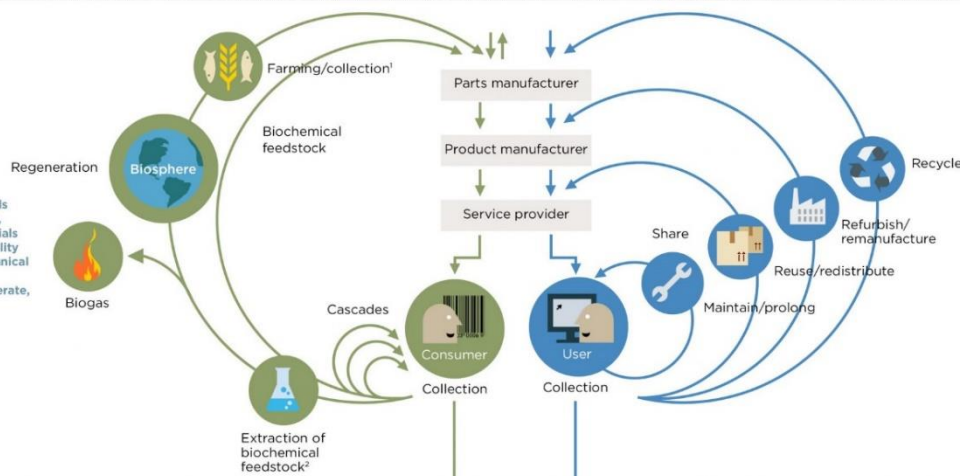


Renewables flow management

Stock management

PRINCIPLE 2

2
Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles
ReSOLVE levers: regenerate, share, optimise, loop



PRINCIPLE 3

3
Foster system effectiveness by revealing and designing out negative externalities
All ReSOLVE levers

Minimise systematic leakage and negative externalities

1. Hunting and fishing
2. Can take both post-harvest and post-consumer waste as an input
Source: Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C).

Figure 3 outline of the Circular Economy by Ellen MacArthur Foundation (2013)

To transit to a circular economy the Ellen MacArthur Foundation (2013, p. 7) outlined the following key principles: 1. Design without waste and pollution, 2. Keep products and materials in use and 3. Regenerate natural ecological systems. This can be done by example through innovative circular business models which close the loop in the production chain, design for recycling and extension of producer responsibility by lease contracts or a disposal fee for polluting products (EY, 2016). However, also consumer behaviour is an important factor here which can be stimulated by the right policies. Consumers should choose for the alternative that produces the least amount of waste: in this case washable diapers instead of disposable ones. This could be made more attractive for customers via lease contracts (Ellen MacArthur Foundation, 2013, p. 8-10). Besides there are specific customer benefits which should be promoted more to get the idea of the circular economy beyond a specific green niche. The main benefits for customers are; 1. Lower costs of ownership, 2. Increased choice and convenience due to service oriented contracts, 3. Secondary benefits like the

environmental benefits which increase liveability. According to MacArthur Foundation (2013, p. 11-12) there is already a new generation of customers who are adapting a more sustainable consumption pattern by focussing less on ownership. However, this is still in the pioneering phase and to make this transition mainstream barriers should be removed.

The aim of the EU action plan on circular economy is to ensure the right regulatory framework for this development in the single market. It contains long term waste targets as well as a concrete, broad and ambitious set of actions to be carried out before 2020. Consumption is one of the key elements of the program. It states *'choices made by millions of consumers can support or hamper the circular economy'* and *'this phase is also crucial for preventing and reducing the generation of household waste'* (European Commission, 2015, p. 6). The actions are mainly focussed on addressing false green claims and making information on sustainable choices more clear. Besides, it proposes to use policy instruments, like taxation, to provide incentives to ensure that product prices better reflect environmental costs (European Commission, 2015, p. 6). Furthermore, it emphasizes the hierarchy of waste and encourages recycling, reuse and repair. To reduce household waste, the plan proposes a facilitating role for the EU. The aim is to create the right legal context for the single market and support the transition through funding by for example the Cohesion Policy Fund and the Horizon 2020 research program. This can for example be used for awareness campaigns and economic incentives, executed on the local and national level (European Commission, 2015, p. 6-7).

Following on this action plan, the Commission made proposals for a revised EAP from 2020 and onwards (European Commission, 2018a) and presented in 2018 an EU strategy on plastics (European Commission, 2018b), a proposal for directive on the reduction of the impact of certain plastic products on the environment (European Commission, 2018c) and a Circular Economy Package (European Commission, 2018d). These documents are not adopted yet by the institutions and the member states. However, they outline in much more detail how the problem of single-use plastics and disposable products should be addressed. For example, they aim for better design and recycling processes and furthermore create viable markets for recycled and renewable plastics. The proposed directive on single-use plastics focusses on prevention of waste through a ban on the top 10 plastic products in marine litter, however disposable baby diapers are not included in this list (European Commission, 2018c). Moreover, it remains to be seen whether this eventually will all be adopted by all member states. The realisation of a circular economy is an ambition supported by the EU, but the difference between member states is significant (Dodick and Kauffman, 2017, p. 20-24). Some states hardly have a functioning waste collection system while others recycle about 80% of their waste (European Commission, 2015; Eurostat, 2017b). Besides, EU action plans are not legally binding, only directives, legislations and regulations are.

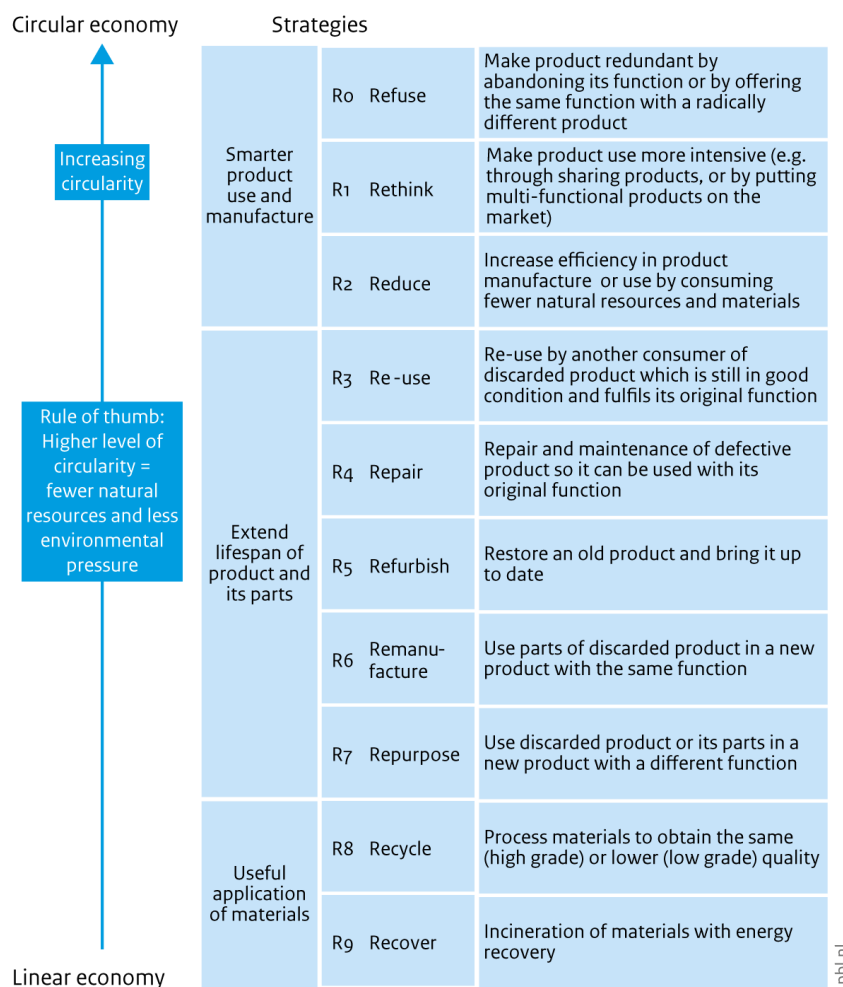
2.5.3. National and local ambitions: The Dutch government-wide program 'A circular Economy in the Netherlands by 2050' and other recent developments.

The Netherlands wants to be one of the frontrunners on circular economy. To contribute to ambitions of the European agenda and the SDGs the Netherlands adopted in 2015 a government-wide program called: 'A circular Economy in the Netherlands by 2050' (Ministry of Infrastructure and the Environment, 2015). The program is focussed on the reduction of raw material use and improvement of waste management through more and better recycling and prevention of waste generation. Currently, the huge demand for raw materials makes the growing potential of the economy dependent of other countries and turns scarce resources like energy and raw materials political instruments. Furthermore, the program also aims to contribute to reduction of greenhouse gas emissions (Ministry of Infrastructure and the Environment, 2015, p. 7-9). Although the Dutch government was already working on an improvement of its waste policies and recycling with the

program VANG⁵ ‘from waste to raw material’, this government-wide program set the ambitions even higher and cleared the pathway for the circular economy transition. As discussed previously, residual household waste should decline radically (Ministry of Infrastructure and the Environment, 2015, p. 65). Raw material use should be reduced by 50% in 2030 and by 2050 they strive for a full operating circular economy, which means efficient material use and reuse without polluting greenhouse gas emissions (Ministry of Infrastructure and the Environment, 2015, p. 15).

The program is based on the principles of the circular economy as outlined by the Ellen MacArthur Foundation (2013) and also incorporates the Ladder of Circularity / R9 Ladder which has been designed by the former Dutch Minister of Environment, Jacqueline Cramer (2014), see figure 4 below. According to this framework, which can be seen as an updated version of the hierarchy of waste by Lansink (1979), the way waste is treated determines the circularity of the economy. Recovery and recycling are suitable methods to give waste materials a useful application, however it is always better to prevent the ‘waste status’ of materials and refuse products that generate waste.

Circularity strategies within the production chain, in order of priority



Source: RLI 2015; edited by PBL

⁵ VANG: Van Afval Naar Grondstof

Figure 4 Ladder of circularity created by Jaqueline Cramer (2014), Source PBL/ RLI

The Dutch government-wide program applies a chain management approach for several product streams like textile, plastics and diapers to close the loop of materials and products and realise the targets (Ministry of Infrastructure and the Environment, 2015, p. 67). Next to that, consumer behaviour is an important part of the Dutch policy approach. It is focussed in the first place on incorporation and development of knowledge on behaviour to influence unconscious behaviour like norms and beliefs. Citizens participation in waste separation is one of the key points, however also the promotion of renewable and washable alternatives is mentioned as an important instrument to reduce the amount of single use products (Ministry of Infrastructure and the Environment, 2015, p. 65-70). For disposable diapers the NVRD, Rijkswaterstaat and the Ministry of Infrastructure and the Environment are in charge of a coherent policy approach to close the product chain (NVRD and Rijkswaterstaat, 2015). Several instruments are being considered to contribute to a reduction of disposable diaper waste. For example; 1. Better design and recycling, 2. Extended Producer Responsibility and 3. Promotion of the reusable alternative: washable diapers (NVRD and Rijkswaterstaat, 2015, p. 3-10; EY, 2016, p. 10).

Just as the EU action plan the Dutch government-wide program is not implemented through legal obligations yet but is currently more based on encouraging voluntary, intrinsic motivated cooperation of local and regional governments, businesses and knowledge institutes. There is no 'circular economy law' which would impose the implementation of this economic system in society by law. Also the targets for reducing waste generation by households are more like future milestones but no legal obligations that have to be imposed on citizens or other levels of governments. However, the transition can not only be realised by the national government solely. Cooperation and interaction between the strategic, tactical and operational level is necessary to manage a transition (Kemp, Loorbach and Rotmans, 2007, p. 81-82 and Loorbach, 2010, p. 171). Via the intergovernmental consultation for example Dutch municipalities, provinces and water boards are involved in the transition process. Besides, there are plenty of local and regional initiatives to encourage the development of a circular economy (Ministry of Infrastructure and the Environment, 2015, p. 3-4). Although the transition towards a circular economy is still in an early stage, according to the first monitoring results from research institute PBL the Netherlands are on track (PBL, 2018, p. 18-19). However, there is also still a lot of work to do to realise all ambitions, not only in the Netherlands but also world-wide. The first circularity gap report showed that the world economy is only for 9.1% circular. Meaning that still most economic processes are linear (take – make – dispose) and materials are still wasted instead of recovered (Circle Economy, 2018).

All the examples mentioned in this chapter show that there is a lot of political ambition to realise the transition towards a regenerative economy instead (European Commission, 2015; Ministry of Infrastructure and the Environment, 2015; SGD 12). This transition needs time, requires systematic changes and participation of governments as well as both the supply and demand side of the market (Raworth, 2017 and Ellen MacArthur Foundation, 2013). Some first important steps can be done by addressing especially single-use and disposable products like diapers but also hygiene products, disposable cutlery, plastic bags and so on. For these products there is often a reusable alternative while the disposable version creates a lot of waste and pollution, even when they are recycled. In this research diapers are the central case but it is exemplary for many other products. The focus of this research is on the demand side of the market solely. Production or producer behaviour are not taken into account. It is of course possible to stimulate the transition towards a circular economy via new business models, extended producer responsibility schemes and regulation on product design for recycling (Ellen MacArthur Foundation, 2013 and EY, 2016). However, the main incentive for

producers to change their behaviour is the behaviour of the consumers (Ceton and Van der Wal, 2006). Through policy interventions, the demand for washable diapers can be stimulated while the demand for disposable diapers can be deterred. This will help to let these goods better compete with each other. Eventually this will stimulate supply side of the baby diaper market to adjust to the new consumer standard. In the next chapter the theories on consumer behaviour and interventions will be further discussed.

Chapter 3: Theory and hypotheses

The previous chapter outlined the current state of affairs and international, European and Dutch ambitions for a regenerative economy and the need to stimulate sustainable consumer behaviour to get there. However, what is sustainable consumer behaviour and what is the role of governments concerning steering consumer behaviour? These two questions will be discussed in chapter 3.1 and 3.2. Thereafter paragraph 3.3 explains the barriers that consumers experience to choose for a washable diaper according to theory. For this research two approaches are compared; the neo-classical approach and the behavioural economic approach. These two approaches were chosen to compare because they represent two common manners for governing and steering consumer behaviour but have very different perspectives on human behaviour and the way governments should intervene (European Commission, 2012, p. 42-48). The regulatory approach is also a more traditional policy strategy however it is not taken into account here because it has more impact on the supply side of the market (e.g. requirements for sustainable diaper design) than on the consumer in this case. The lack of regulation or overregulation are therefore not assumed as barriers for consumers.

3.1 What is sustainable consumer behaviour?

For this research the definition of sustainable consumer behaviour is based on the theories of Raworth (2017), Ellen MacArthur Foundation (2013) and Cramer (2014) as these are the most important frameworks for the definition of a new sustainable economic system. Additionally definitions on sustainable consumption (Middlemiss, 2010) and sustainable economic development (Kemp, Loorbach and Rotmans, 2007) are taken into account.

In the first place, sustainable consumption should fit within the boundaries of the doughnut (Raworth, 2017, p. 45-49). This means that anyone should have access to the basic needs like diapers but at the same time those diapers and the way that they are used and processed should not bring the environment any harm. Secondly, as Middlemiss (2010, p. 151) states, unsustainable consumption is the kind of consumption that leads to environmental harm. Thirdly, according to the Ellen MacArthur Foundation (2013) the economic system and individual consumers should strive for minimum of leakage (waste) and minimal negative externalities. Furthermore, the R9 Ladder of Circularity from Cramer (2014) adds that it is the most circular to refuse products that generate waste at all (R0). Products should be made redundant by abandoning their functions or by offering the same function with a radically different product which applies the principles of a circular economy: 1. Design without waste and pollution, 2. Keep products and materials in use and 3. Regenerate natural ecological systems (Cramer, 2014 and Ellen MacArthur Foundation, 2013). Therefore, in this research sustainable consumer behaviour is defined as *'the consumers' choice for a product which generates minimal waste and requires the least amount of energy in during production and use. Eventually this product harms the environment the least from all other alternatives of the same product category.'*

In the case of diapers the washable diaper meets this definition the most of all other alternative because it generates the least amount of waste and harms the environment the least compared to other diapers (Milieu Centraal, 2017). Although, as discussed previously, also the washable diaper is not free of environmental impact. However, it is less than disposable diapers. Nevertheless, whatever is considered now as sustainable is only contemporary. It should rather be seen as the most sustainable alternative that is available for what is considered as unsustainable at this moment (Kemp, Loorbach and Rotmans, 2007, p. 79). Undoubtedly, there will be eventually even a more sustainable alternative for the washable diapers as they are here today.

3.2 What is the role of governments concerning steering consumer behaviour?

In the governmental ambitions and frameworks provided by Raworth (2017), Ellen MacArthur Foundation (2013) and Cramer (2014) sustainable consumer behaviour is seen as key towards a more sustainable economy. However, why should consumer behaviour be steered at all and what is the role of a government in that case?

First of all, increasing and unsustainable consumption is one of the main drivers behind current environmental risks and waste generation (Zwaans, 2011; Ellen MacArthur Foundation, 2013 and Raworth, 2017). This is a societal world-wide problem because the consequences like climate change due to excessive carbon emissions or the plastic soup go beyond individual interest. Secondly, sustainable consumer behaviour is not automatically secured by the market because sustainability is for many consumers just one of the preferences next to other preferences. Consumers can feel responsible for sustainability but are not always able to make a sustainable choice (Middlemiss, 2010, p. 160-163). The supply side of the market is powerful but producers also follow consumers preferences. If there is not enough demand for certain sustainable goods, there will be less supply as well (Ceton and Van der Wal, 2006). Policies however can influence the capacity of consumers. This capacity is crucial for behaviour and depends among others on cultural aspects like norms and beliefs, personal capacity of money, understanding and mobility and the infrastructural capacity like the access to sustainable facilities (Middlemiss, 2010, p. 164).

Lastly, the environment can be seen as the outcome of global choice architecture. Markets and producers can influence consumer choices by commercials and other marketing tools. However, governments can do that as well (Thaler and Sunstein, 2008, p. 194-195). Nevertheless, how far governments can go and what their responsibility is concerning behaviour of consumers, is a political question and depending on the political context of a country. For Thaler and Sunstein (2008) as Chicago economists, which are famous for their libertarian view on economics and assume minimal governmental intervention on the market, this is also a difficult balance. In their book *Nudge* (2008, p. 14-15) they advocate libertarian paternalism: smart and cheaper governmental intervention through nudges and incentives instead of coercion and constraint which is very costly and limits the freedom to choose. To conclude, without steering consumer behaviour at all, the ambitions as stated previously in chapter two would not be realised. Interventions are needed to fulfil these policy aims (Raworth, 2017). The amount and form of interventions should suit the situation and understand the nature of the problem. In the analysis the causes of the problem are further investigated by outlining the barriers that consumers experience to use washable diapers.

3.3 Explaining the barriers of consumers according to theory

For this research two approaches are compared. The neo-classical economists assume that behaviour of consumers is rational and based on individual preferences. Within these theories consumer behaviour can be influenced through interventions on price (Shepherd, 1996 and Den Hartog, 2012), information campaigns (Nelson, 1970 and Stigler, 1957) and product innovation to better match with the preferences of consumers and optimise utility (Fishburn, 1970 and Middlemiss, 2010). These theories assume that governments can intervene by providing what is missing on the market with 'carrot' and 'stick' instruments (European Commission, 2012, p. 42-46). On the other hand there are behavioural economists which assume that consumer behaviour is rationally bounded, driven by unconscious decisions due to biases and habits. Furthermore, humans are loss-averse and the behaviour of others matters as well according to this theories (European Commission, 2012, p. 48). For example, most people tend to discount extra on long term savings while short term gains are over-valuated (Green, Fry and Myerson, 1994) and only choose for a

certain product because it is the easiest option and everyone does so (Thaler and Sunstein, 2008). These theories advocate smart governmental interventions by implementing nudges and incentives which steer behaviour but don't require enforcement or visible governmental intervention that much. However, before the right interventions can be done or incentives can be given, it is important to identify the core of the problem: what are the barriers to change behaviour? In this chapter is further discussed what the potential barriers are that consumers experience for using washable diapers according to theory.

3.3.1. Neo-classical economic approach

The neoclassical implies an ideal type economic model in which consumers have perfect information, exactly know that they need, what a good is worth to them and there is perfect competition (Den Hartog, 2012 and Stigler, 1957). According to this approach consumers decide mainly based on price, information and to what extent the good meets their needs. In this paragraph these three elements are further discussed.

Price

According to Shepherd (1996, p. 40) is price a concept of deep meaning. It is '*the degree of value or esteem for the good that people feel, as shown by what they are willing to pay for it out of their own pockets*'. If consumers buy a product they agree that the price is reasonable. One of the reasons why more consumers choose disposable diapers over washable ones could be that consumers find the purchase costs of washable diapers too high compared to disposable diapers. The purchase costs of washable diapers are between €500,- and €750,- (Ten Grotenhuis, 2018). However, consumers are only willing to pay that if they estimate the value of this good the same (Shepherd, 1996, p. 40). Furthermore, the high purchase costs of washable diapers makes them hard to afford for families with young children who already have a lot of costs for things they need to purchase: a stroller, clothing, furniture for the baby's room and so on. The budget of young families might not be suitable to buy washable diapers at the moment they need them.

Hypothesis 1: The purchase costs of washable diapers are a barrier for consumers to buy washable diapers.

Information

The neo-classical approach assumes that consumers have all information to make a rational, well informed choice (Den Hartog, 2012). However, getting the right information can be a costly and time consuming process (Stigler, 1957). Therefore, if the purchase price is low the consumer won't take much time to search for the best quality (Nelson, 1970, p. 312). Disposable diapers cost between €8,- to €15,- per package, which is about €0,25 on average per diaper (Ten Grotenhuis, 2018). This is not a huge investment thus the probability of well in-depth consumer research for the right diaper will be low. And even if parents will put a lot of effort in finding the right diaper, the chances are still significant that they will compare disposable ones only. Washable alternatives are usually not sold in places where disposable diapers are sold and therefore consumer might not know about the alternative (Smouter, 2015). As stated above, the washable diaper is eventually cheaper but most people do not know that (Ten Grotenhuis, 2018). Besides, the environmental impact of disposable diapers is not always clear as there are many studies that give contradictory results (NVRD and Rijkswaterstaat, 2015). Furthermore, if you never searched for it or heard about it you might not even know about the alternative for disposable diapers (Middlemiss, 2010).

Hypothesis 2: Consumers need more information on usability, price and environmental impact of diapers.

Utility

People buy certain products because it needs to fulfil a specific preference to reach a certain level of utility (Fishburn, 1970). Even if people are interested in sustainability and feel individually responsible they will only make sustainable choice to the extent that they are able to and fulfils their needs. The ability and consumers' preferences are based on the capacities of the individual which are partly influenced by the context of infrastructure, social environment and partly by the individual capacities like money and time (Middlemiss, 2010, p. 148-163). This might explain why some people consider but not try washable diapers or try them but are disappointed because of the practicalities. For example, washable diapers need a long time to dry and require some extra work when changing and extra washing (Ten Grotenhuis, 2018). If a specific consumer has already a very busy life, this aspect of the product might conflict with its preferences. Even when consumers feel responsible for sustainability, these barriers keeps them from sustainable behaviour eventually (Middlemiss, 2010, p. 148).

Hypothesis 3: The washable diaper does not match with the preferences of consumers.

3.3.2 Behavioural economic approach

For this research two elements of the behavioural economic approach are applied. In the first place indications for hyperbolic discounting are further researched because according to the behavioural economic approach people are loss-averse and tend to overvalue short term benefits while long term benefits are undervalued. Besides, the impact of the social environment and the importance of the behaviour of others for choosing for either disposable or washable diapers is further reviewed.

Hyperbolic discounting

In general, most people have loss-averse behaviour. It is hard to oversee what will happen in the future and most risks are uncertain. Therefore, consumers tend to minimise current investments and high purchase costs because it might fail and rather postpone purchases if they are unsure about the value of the product (Thaler and Sunstein, 2008, p. 113-115 and Hoch and Loewenstein, 1991). However, when it comes to benefits over time then people prefer small benefits on the short term over bigger benefits on the long term. According to Green, Fry and Myerson (1994) humans can be 'hyperbolic discounters'. The benefits in the long run are undervalued while returns in the short run are over-evaluated. In other words, the trade-off between amount of money and time is skewed. Although washable diapers have high purchase costs, overall they are cheaper than disposable diapers. Consumers can save about €500,- with washable diapers compared to disposable diapers. Besides, it is possible to use them for a second child (Ten Grotenhuis, 2018). However, it might be assumed that consumers still choose for disposable diapers because they undervalue the financial benefits of washable diapers on the long term and only look at the purchase costs on the short term.

Hypothesis 4: Consumers undervalue the cost-saving aspect of washable diapers in the long term.

Default

According to Thaler and Sunstein (2008) and Kahneman and Egan (2011) human behaviour is only rational to the extent of choices that consumers see and they consider it as all there is. Only if really needed consumers take the time for complex choices. However, consumers prefer to make their

daily choices as simple and quick as possible. For the second type of choices this results into patterns of consumer preferences which are influenced by previous choices, social pressure but also by the whole choice architecture and which does not change so easily. The best choice is those cases is usually the easiest choice: it is the default and in line with 'what I always do' and everyone else does. The alternative is usually less popular, even if it is more sustainable and consumers know that, because it is not the most logic choice according to the choice architecture. By changing the default in the choice architecture, all options are still available however behaviour is steered in the desired direction. This is nudging (Thaler and Sunstein, 2008, p. 4-6).

A reason why consumers choose disposable diapers over washable ones could be that the disposable diaper is the current default option which is the easiest to choose for while the washable diaper is the alternative in this setting (Thaler and Sunstein, 2008). Disposable diapers are available in the drugstores and supermarkets while washable diapers are not. Furthermore, for washable diapers there are no commercials on TV for example. The biggest part of the market- about 80 to 90% - uses disposable diapers (Smouter, 2015). Because consumers use heuristics to make decisions, the easiest options according to the heuristic – which is formed by the choice architecture – will be the preferred product for the consumer (Thaler and Sunstein, 2008).

Hypothesis 5: People choose disposable diapers over washable ones because the current default option is disposable diapers instead of washable diapers.

The above outlines what is understood in this research by sustainable consumer behaviour, the role of the government in steering consumer behaviour and further discusses two theoretical perspectives on consumer behaviour and how the barriers that consumers experience to buy washable diapers can be explained. However, what are the most important barriers according to consumers themselves? In the next chapters the methodology, data and analysis are further outlined. In the analyses the hypotheses based on these theories are tested and also reviewed if the neo-classical approach or the behavioural economic approach is better applicable in this case. In chapter seven a policy advice based on the outcomes of the analyses will be given to give an evidence based policy approach for this problem.

Chapter 4: Method of research

In this chapter the research design and data collection will be discussed. The main question of research thesis is *What are the most important barriers for consumers to use washable diapers?* For this research a survey among 429 Dutch young parents have been conducted. 360 of them responded to a general online survey which has been posted on various (social) media platforms. The other 69 respondents are former participants of a *Mazzelkontjes* pilot. This chapter further outlines how the data has been collected and what kind of analyses are done.

4.1 Data collection

The data for this research comes from different resources. Most of the data is based on a general online survey filled in by 360 Dutch parents with young children. The survey has been spread through social media, e-mail, promoted by municipalities and places on intranet of University of Utrecht and the Ministry of Infrastructure and Watermanagement. See appendix I for a full list of places where the survey was posted. The respondents in this survey were anonymous. Besides their preference regarding diapers - disposable, washable or both - they were also asked to give some personal information including political preference, age, level of education and gross yearly income. However, they did not have to give the personal information if they did not want to. Based on their preference for a certain kind of diapers they were asked further motivate why they choose for this product. See for a full list of questions of this general survey appendix II. These respondents did not participate in a pilot but choose themselves to use either disposable, washable or both kind of diapers. The other part of the data is based on survey data from 69 former participants of a *Mazzelkontjes* pilot⁶ in the municipalities of Tholen, Breda and Haarlemmermeer. The data from Breda and Haarlemmermeer is based on secondary resources namely surveys made by the municipalities because these pilots took place a year before this research started. In Breda 30 out of 40 participants filled in a list of questions which was send to them by e-mail through the municipality. The participants were not anonymous. In Haarlemmermeer the municipality made an online survey in the middle and at the end of the pilot which could be filled in anonymously. Here 32 out of 46 participants responded to the survey. The *Mazzelkontjes* pilot in the municipality of Tholen took place during this research. Data is therefore based in a survey made for this particular research. In this survey participants were anonymous and 7 out of 15 pilot participants responded. See for the list of questions of these three surveys appendix III-V.

For this research online surveys has been used to collect data from consumers because it is very comprehensible to reach out to a big group of respondents, user-friendly and efficient. It can be done quick and is cheap compared to other types of data collection. However, there are some remarks which should be taken into account while evaluating these data. First of all, it is likely that respondents give more extreme answers in an online survey than in a face-to-face interview because they don't have to be that nuanced and don't get feedback on their answers (Babbie, 2013, p. 259). However, on the other hand, an anonymous online survey gives respondents the opportunity to be completely honest without any consequence or discomfort. Secondly, the selection of the sample is not representative. There was no preselection of candidates and the composition of the sample depended on the response on the survey. It is likely that those who are willing to fill in a survey are slightly different people with different motivations and behaviour than people who do not respond to a request to fill in the survey (Babbie, 2013, p. 259). In the case of diapers it is very much possible that people who use washable diapers see themselves as ambassadors of the

⁶ See for detailed information on the pilot paragraph 2.4.3

washable diaper and are much more willing to participate than those who just use disposable diapers because it was the easiest option they could think of. Furthermore, the respondents are parents with young children from the Netherlands only. The outcomes might probably not be representative for the rest of Europe. Moreover, the respondents were mainly found through an (in)direct network close to the researcher. Therefore, it can be assumed that this sample is somewhat biased because it is related to a network which has its own specifications. For validation similar research should be conducted among a randomized group of Dutch respondents or other European countries as well. Thirdly, this research is focussed on behaviour and a survey is not the most optimal tool for measuring behavioural change. The answers in a simply survey don't guarantee that a respondent really changed his or her behaviour (Babbie, 2013, p. 270-290). However, concerning the short time and zero budget for this thesis research, online surveys and secondary collected data was therefore the most suitable option for data collection.

4.2 Research design

In this research first the descriptive statistics concerning the sample and control variables political preference, age, income and education are taken into account and further explained. Thereafter two analyses are done. First, the impact of the *Mazzelkontjes* pilot - to stimulate the use of the washable diaper - has been reviewed according to a natural experimental analysis to see what instruments of the pilot are effective to stimulate washable diaper use. The second analysis compares the data of all 429 respondents to evaluate what the most important barriers are to buy washable diapers. In this paragraph the research designs for both analyses are further explained.

Analysis 1: Impact of the Mazzelkontjes pilot

For this part of the research a natural experiment has been used as method of observation instead of a classical experiment because it was more suitable for this type of research and the resources that were available. A natural experiment is a situation which usually occurs without purpose of the researcher. However, it can be used in advantage to measure the impact of a factor on behaviour which is presented in one group but not in the other. Luckily, the *Mazzelkontjes* pilots provided natural experimental setting by themselves, therefore this method has been chosen for this research. Nevertheless, in contrary to a classical social experiment there are factors which might have an impact on the outcomes but which cannot simply be eliminated in this setting. It should thus be taken into account that the outcomes of a natural experiment may be less reliable than in for example a longitudinal study in a classical experimental set up with independent observers (Babbie, 2013, p. 270-290).

However, a classical experiment requires extra conditions which could not be provided for in this research. At first, samples of consumers should have been randomly selected and with a large number of participants however, the survey was spread online and depended on the willingness of the parents to respond. There was no preselection of participants in this research. Secondly, in this setting there should have been multiple observations and control moments. Preferably, over a longer period of time. Moreover, ideally the observant should observe consumers at places where the diapers are 'consumed': at home or in other private locations. Besides, there should have been some budget to provide diapers for and observers. This would not have been doable for this research. However, the strength of the natural experimental setting is that it already takes place a normal social setting. Instead of an classical experimental set-up the artificial effect of the experiment is no problem (Babbie, 2013, p. 290-291).

For a natural experiment it is important to compare groups which are as much as possible alike each other to make sure that analysis is comparing apples with apples (Babbie, 2013, p. 289-290). However, for the *Mazzelkontjes* participants most data is based on secondary resources. Unfortunately, control variables were not taken into account in these data sets. Therefore there cannot be checked whether the experiment and control group represent similar people with similar backgrounds, except for the fact that they use the same kind of diapers.

The experimental group in this natural experiment consists of the *Mazzelkontjes* participants (N= 69)⁷. These group has been treated with financial benefits, information on environmental impact and social support instruments to stimulate the use of washable diapers. After the try-out period parents could choose to continue or not. Some parents were disappointed in the washable diapers after trying them for several reasons and who went back to disposable diapers (Nexperiment = 10). However, others decided to continue after the pilot and use washable diapers all the time ever since (Nexperiment = 19) or use washable diapers part of the time next to disposable diapers (Nexperiment = 40). The control group (N = 251) consists of parents who filled in the general survey online. The respondents in the control group tried washable diapers or still use them but did not participate in a pilot and thus found out on their own if washable diapers would work for them. They are either disappointed in washable diapers (Ncontrol = 5), are full-time washable users (Ncontrol = 155) or use both washable and disposable diapers (Ncontrol = 91). The respondents of the general survey who never tried washable diapers (N = 109) were left out of this analysis because a similar group does not exists among the *Mazzelkontjes* participants.

For this part of the analysis quantitative Students' t-test independent sample analysis and a Fisher exact test are used to calculate the significance and effect of the instruments used in the pilot according to the Cohen's d. The Students' t-test analysis is conducted via statistical programme JASP and is suitable for measuring whether the experimental group and the control group are significantly different from each other if sample size is large (N > 30). This test also takes into account the Cohens' d, which calculates the effect size of an instrument (Gravetter and Wallnau, 2010, p. 264). Fisher exact test is used as control test. It is also an instrument to measure the significant difference between the experimental group however, it is suitable for 2x2 contingency tables and for both small (N < 30) and larger (N > 30) sample sizes. The Fisher exact test is executed with Excel via the following formula:

$$p = \frac{\binom{a+b}{a} \binom{c+d}{c}}{\binom{n}{a+c}} = \frac{\binom{a+b}{b} \binom{c+d}{d}}{\binom{n}{b+d}} = \frac{(a+b)! (c+d)! (a+c)! (b+d)!}{a! b! c! d! n!}$$

Respondents in both groups were asked whether financial benefits, information on environmental benefits or social support were main reasons to try or use washable diapers (group C) / participate in the pilot (group E). If a reason was mentioned by the respondent the score is 1. If a reason were not mentioned, score is 0. Note however that there are no separate experimental groups in this natural experiment. The analysis looks at the effect of each instrument individually although the instruments

⁷ See for detailed information on the pilot paragraph 2.4.3

were applied together. Further this part of the analysis is complemented with a qualitative review where statistical measures were not suitable.

Analysis 2: The most important barriers according to consumers to buy washable diapers

Secondly, the main question of this thesis is what the most important barriers for consumers are to buy washable diapers. For this part of the analysis the survey data of both the 69 former *Mazzelkontjes* participants and 360 respondents of the control group is merged into three groups based on the kind of diapers that they use: disposable diapers (N = 124), washable diapers (N = 191) or both (N = 131). The most important barriers that these types of consumers experience with washable diapers are discussed according to the outcomes of the survey and hypotheses from chapter three are tested. For this analysis, the outcomes of the survey are qualitatively reviewed because statistical analysis would not be suitable for this type of data (categorical) and sample size (for some categories $N < 5$).

Chapter 5: Empirical Analyses

In this chapter both the impact of the *Mazzelkontjes* pilots has been reviewed as well as the most important barriers according to all 429 respondents. Each paragraph concludes on its own substance and in chapter six a general conclusion is further discussed. First, descriptive statistics and the outcome of the control variable analyses concerning the sample of respondents are further outlined.

5.1 Descriptive statistics and control variables

This part of the empirical analyses can be seen as a background check for the sample of respondents in this research. First a general overview of respondents is given, thereafter the variables political preference, age, income and education are taken into account to review whether indeed only 'deep dark green consumers' - which are mainly high educated, young, rich and politically left oriented people - may choose washable diapers over disposable ones (NVRD and Rijkswaterstaat, 2015 and Ten Grotenhuis, 2018). This gives an indication of the characteristics of the current washable diapers consumers and outlines the background of disposable diaper consumers who need to be stimulated to use washable diapers through policy instruments.

Table 1 Overview number of respondents

Group	N Respondents General survey	N Respondents <i>Mazzelkontjes</i>	Total
Disposable	114	10	124
<i>Always disposable</i>	109	0	109
<i>Disappointed washable</i>	5	10	15
Washable	155	19	174
Both	91	40	131
Total	360	69	429

As table 1 shows, most respondents in this research are consumers that use washable diapers (N = 174). Remarkably, most of them responded to the general survey and are thus no participants in a pilot. It is therefore likely that although there is in general a relatively small part of the consumers that uses washable diapers, those who do use them are very much willing to share their experiences. Besides, among the *Mazzelkontjes* participants most respondents use both kind of diapers. Possible reasons for this phenomena are further discussed in paragraph 5.2. Moreover, among this group there are twice as much respondents that use disposable diapers because they are disappointed in the washable diapers then among the respondents of the general survey. It is hard to say what the exact reason can be besides that is it just a random outcome of this sample selection. Concerning the control variables there is for each variable a relatively large share of respondents for which the answer is unknown. This has two reasons. First of all, the data from the *Mazzelkontjes* pilots in Breda and Haarlemmermeer is based on secondary data because these pilots took place before the start of this research. Therefore, unfortunately, control variables are not taken into account for this group of respondents (N = 62). For the pilot in Tholen this has been taken into account but this sample is quite small (N = 7). Secondly, respondents in the general survey were free to not answer these questions if they did not want to because it also concerns personal information. Therefore the amount of unknown answers differs per variable.

Taking political preference in to account it becomes clear that although most washable diaper consumers in this survey have a left political preference, also in other groups left and middle scored pretty high (see figure 5). Nevertheless, it is remarkable that disposable diaper consumers are

much more represented in among those who have a right political preference than among those who have a left political preference where the situation is the other way around. This indicates that there could be a relation between political preference and diaper consumption.

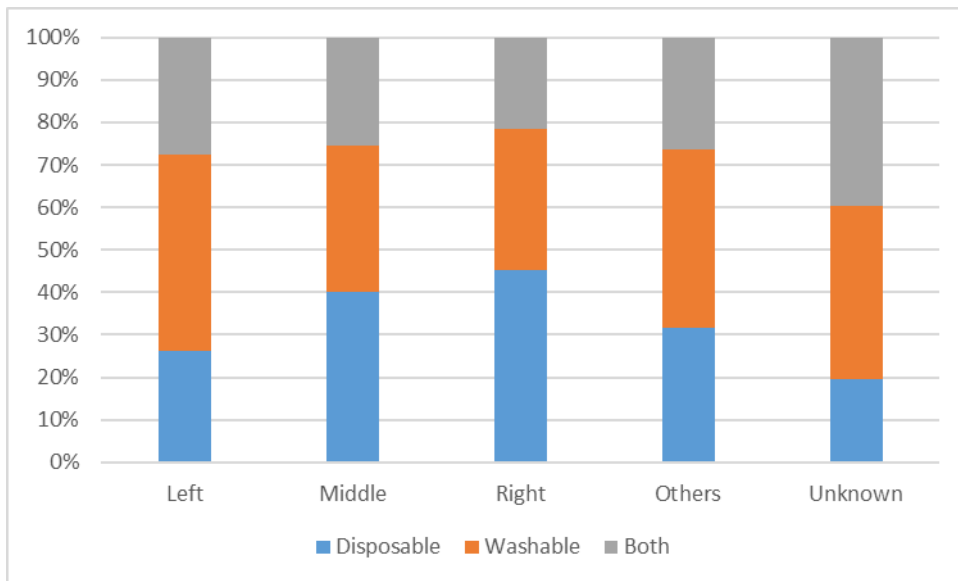


Figure 5 political preference (N_{left} = 134; N_{middle} = 90; N_{right} = 42; N_{others} = 19; N_{unknown} = 144)

Secondly, concerning age, by far most respondents are between 30-40 years old: over 50% of this sample (see figure 6). However, the washable diaper seems to be the most popular among the 20-30 year olds while the disposable diapers are the least popular in among respondents from this age. For the respondents older than 40 years old this is vice versa. This also indicates that there might be a relation between this variable and the kind of diaper consumption.

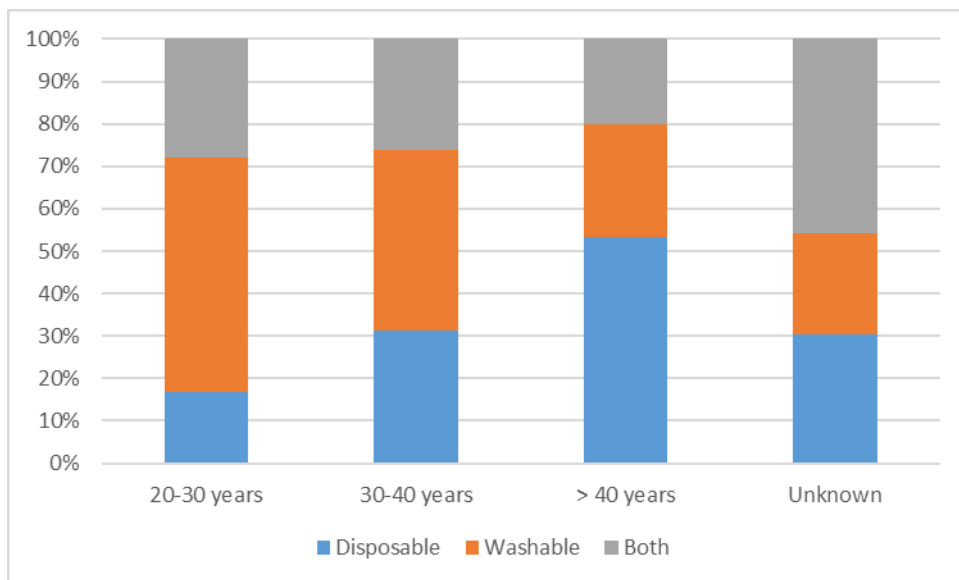


Figure 6 Age (N₂₀₃₀ = 89, N₃₀₄₀ = 233, N₄₀ = 15, N_{unknown} = 92)

Thirdly, taking education into account it is remarkable is that by far the most respondents are higher educated (see figure 7). This is probably mainly caused by the selection of the sample group. The survey has been spread via a Ministry and at University where more people are higher educated. However, there is one conclusion that might be made carefully. It seems, based on these data, that

there is no indication that the level of education relates to the kind of diapers that consumers choose. For each level of education the distribution of kind of diaper consumers is relatively similar.

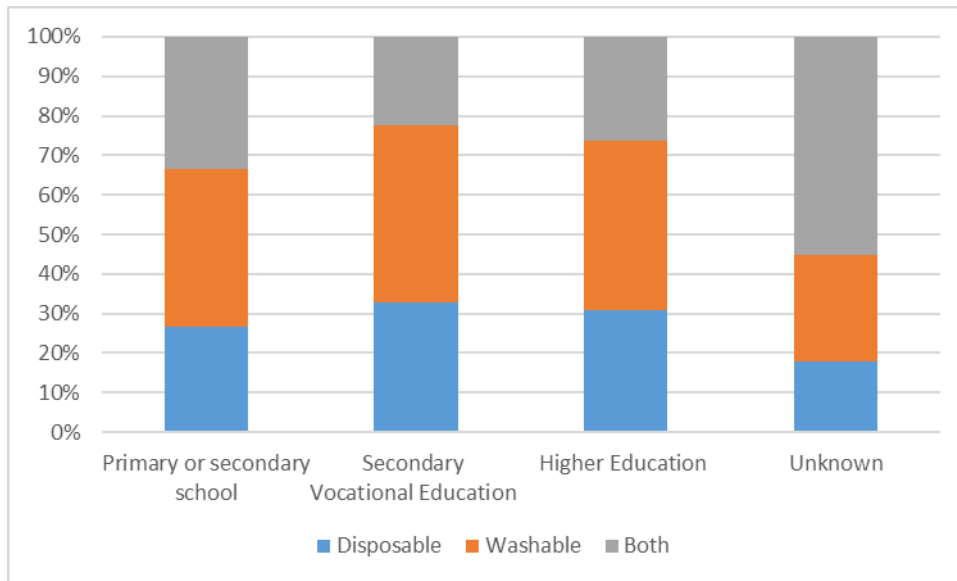


Figure 7 Highest level of education (N_{pss} = 15; N_{sve} = 67; N_{he} = 280; N_{unknown} = 67)

Lastly, taking the yearly gross income per family into account, it seems that in this sample mainly the highest incomes - €70.000 or higher – prefer disposable diapers while washable diapers are most popular among the lower incomes (figure 8). This also indicates that there is a possible relation between the amount of income and the preference for a specific kind of diaper.

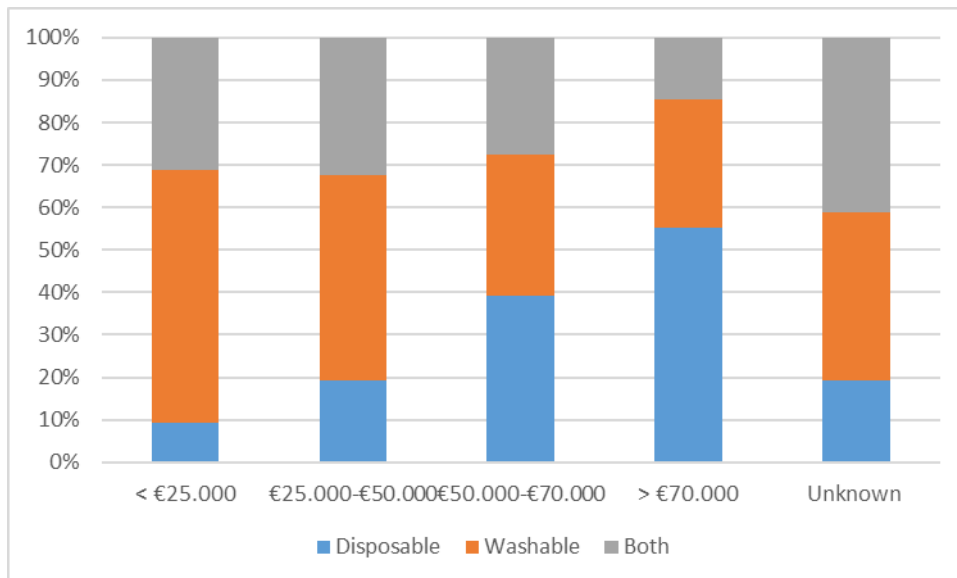


Figure 8 Gross yearly family income (N₂₅ = 32; N₂₅₅₀ = 120; N₅₀₇₀ = 87; N₇₀ = 76; N_{unknown} = 114)

To conclude, based on the qualitative analysis of the data in this sample it seems indeed that the characteristics of washable and disposable consumers differ slightly taken the control variables political preference, age and income into account. The consumers that use both kind of diapers are very diverse. The respondents who use washable diapers tend to have more often a lower income, are younger and more politically left orientated. Respondents who use disposable diapers have more often a higher income, are older and more right politically orientated. Education however does not show any specific relation with the kind of diapers consumers choose. It gives some indications

that the current washable diaper consumers have slightly different characteristics than those who use disposable diapers which might have some implications for the policy strategy. Nevertheless, this is a relatively small and biased sample and therefore, conclusions are hard to make based on these outcomes.

5.2 Natural experiment: *Mazzelkontjes* compared with non-pilot participants

In the *Mazzelkontjes* pilots three main instruments have been used: 1. Financial benefits, 2. Information on environmental benefits, 3. Social support. In this analysis the effect of each instrument is further reviewed by comparing the *Mazzelkontjes* pilot participants - experiment group E (N = 69) - and the parents who did not participate – the control group C (N = 251) according to a statistical analysis of this natural experiment. The respondents from the *Mazzelkontjes* pilots come from three different municipalities: Tholen (N = 7), Breda (N = 30) and Haarlemmermeer (N = 32). In overview of the distribution of respondents can be found in table 2 below. The outcomes of each statistical test can be found in appendix VI.

Table 2 overview treatment and control group

	Treatment group Total	<i>Tholen Lease</i>	<i>Tholen Buy</i>	<i>Breda Buy</i>	<i>Haarlemmermeer Free</i>	Control group
Disposable, disappointed in washable	10	0	1	8	1	5
Full-time washable	19	2	1	12	4	155
Both washable and disposable	40	1	2	10	27	91
Total	N = 69	N=3	N=4	N=30	N = 32	N = 251

Test 1: Financial benefits

As discussed previously, the total average costs of washable diapers are €500,- lower than for disposable diapers. However, the purchase costs are quite high (Ten Grotenhuis, 2018). Through the *Mazzelkontjes* pilot the participants got financial support from the municipalities to lower the purchase costs of washable diapers (Milieu Centraal, 2017). The respondents in the control group did not get the financial support but still tried the washable diapers. According to the statistical analysis (see tests in appendix VI) the financial benefits are significantly more important to those the respondents in the experimental group than in the control group. For the control group the mean on financial benefits is 0,48 while the mean for the experimental group is 0,74. The Cohen's $d > 0,5$ meaning that this instrument has a medium strong effect Gravetter and Wallnau (2010, p. 264). This implies that the pilot is an effective instrument for those who experience the high purchase costs as a barrier or are not sure about the cost-saving on the long term.

However, each municipality used a slightly different intervention on price and also the kind of diaper use after the pilot differs (see table 2). The municipality of Tholen offered to lease washable diapers for €20,- per month instead of €30,- or buy a full package including additives for €445,50 instead of €665,50. The municipality of Haarlemmermeer offered all participants a package of washable diapers for free. In the municipality of Breda the participants had to pay a deposit of €175,- and eventually €225,- extra if they want to buy the package of washable diapers. If they decided to quit they got €50,- deposit back. It is remarkable that in Haarlemmermeer, where they got the diapers for free, a substantial group is part-time user: 27 out of 32 respondents. Only 4 out

of 32 use the washable diapers full-time. In Breda, where the only option was to buy the diapers with discount, more respondents than in the other two pilots decided to quit, about 1/3. However, the respondents that decided to continue used the washable diapers more often full-time compared to Haarlemmermeer: part-time (10) and full-time (12). Tholen gave financial support through two options: lease or buy with discount. Among the respondents from this pilot these options were evenly popular (3 choose to lease, 3 choose to buy and 1 quit) and did not seem to have an effect on whether they would use the diapers part-time (3 participants, 2 bought and 1 leased) or full-time (2 leased and 1 bought). However, the samples in these pilots are too small ($N < 5$) for a statistical t-test analysis and too complex for a Fisher exact test to find out whether there is any significant difference between the kind of financial support and the eventual kind of diaper use, so further research is needed. Therefore, based on this data and analysis, it is not possible to draw conclusions yet on what financial support stimulates the use of washable diapers the most. However it indicates that the amount and kind of financial support matters for the kind of diaper consumption after the pilot.

Test 2: Information on environmental benefits

The participants of the *Mazzelkontjes* pilot got before their application and during the pilot information on the environmental impact of disposable diapers and how washable diapers could help to reduce waste (Milieu Centraal, 2017). Those who are part of the control group could also have the same information but in that case they found it without participating in the pilot. The analysis shows that mean of both groups is relatively close but for both groups the environmental benefits are important that the washable diapers have environmental benefits (see also appendix VI). For the *Mazzelkontjes* participants the environmental benefits of washable diapers seem somewhat more important (mean = 0.899) than for the consumers that choose for to try them by themselves (mean = 0.892). However, the probability of the t-test ($p = 0.08$) and based on the Fisher Exact test ($p = 0,057547513$) are not significant according to the Levene's test ($p > 0,05$). Therefore, there is no evidence that the information on environmental benefits given during the *Mazzelkontjes* participants experiment is more effective than information that other consumers use to stimulate the use washable diapers. However, the environmental benefits are for both groups important reasons to use washable diapers.

Test 3: Social support

The *Mazzelkontjes* participants were offered social support through social events and online platforms to share knowledge on how to use the washable diaper (Milieu Centraal, 2017). In this way they were also part of a community in which the washable diaper is the default. For respondents in the control group it could be the case that they are part of a such a group, however that is an unknown factor. The analysis shows that in both groups social support or being part of a community of washable diaper users did not seem to be an important reason to try washable diapers (see appendix VI). The means for both groups are relatively low. However, the statistical analysis gave a probability of $p < 0.04$. Thus, the *Mazzelkontjes* participants value the social support significantly more than the respondents in the control group. This implies that overall less consumers seem to attach value to the social aspect. However for those to whom it is important to have that social support, it has a positive effect when it is there. This social support is therefore an effective instrument of the pilot to stimulate the use washable diapers.

To conclude on this analysis, it seems that the pilots convinced most participants of the (part-time) use of washable diapers (table 1). Besides, according to the statistical analysis 2 out of 3 instruments of the pilot proved to have a significantly positive impact on the experimental group.

Nevertheless, the pilots are relatively expensive and time consuming for the municipalities. They have to provide the diapers, recruit and select participants and provide information and social events. The impact however is relatively small because the size of pilot groups limited. Therefore, policy instruments which can be applied to a bigger group of consumers might be more effective. However, due to the limitations of the method of observation and the lack of control variables the outcomes should be reviewed taking this factor of uncertainty into account.

5.3 Most important barriers for consumers to use washable diapers

In the last part of the analysis the barriers that consumers experience to use washable diapers are further analysed. Based on the answers on the surveys the respondents have been placed in three groups: disposable (N = 124), washable (N = 174) or both (N = 131) (see also table 1). In this paragraph the hypotheses as stated in chapter three are tested based on the outcomes of the survey answers that all 429 respondents gave on their experience with disposable and/or washable diapers. The aim of this part of the analysis is to find indications that support or reject the theoretical hypotheses.

Hypothesis 1: The purchase costs of washable diapers are a barrier for consumers.

As discussed earlier, the purchase costs of washable diapers are substantial: between €500,- and €750,- (Ten Grotenhuis, 2018). For those who use washable diapers after participating in a *Mazzelkontjes* pilot the purchase costs were indeed a barrier to start themselves. The discount the pilot offered was for 63,7% of the participants a reason to participate. Important to note is that 81% of the *Mazzelkontjes* participants already knew about washable diapers before (see figure 9) and decided earlier not to do it because of, among others, the high purchase costs. This supports the theory of Shepherd (1996) which states that consumers will only pay something for a good if they are convinced that it is worth it.

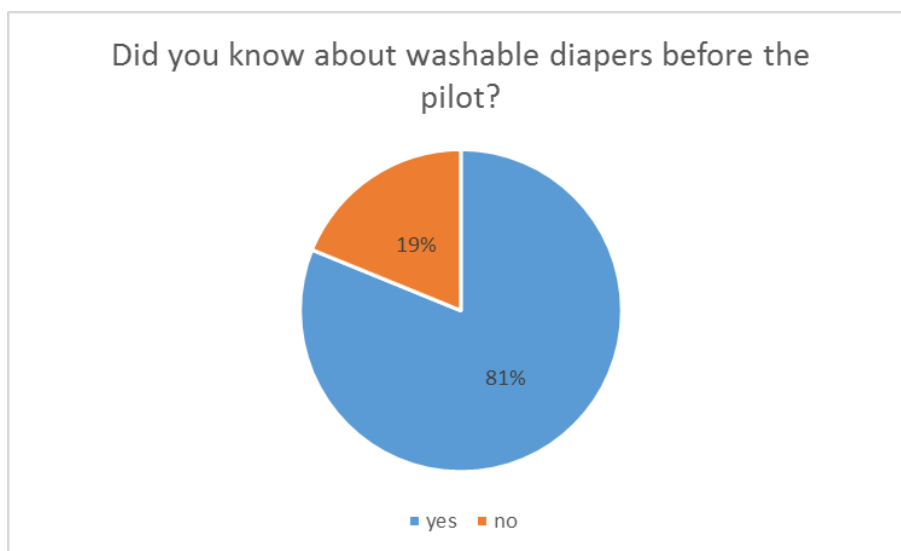


Figure 9 Did you know about washable diapers before the *Mazzelkontjes* pilot? (N = 69)

From the respondents that responded to the general survey and currently use disposable diapers 53 out of 109 considered using washable diapers but did not do it. For 47% of them the high purchase costs of washable diapers were one of the main reasons not to try them. Other reasons were restraints from the partner or practicalities like the long drying time. However, in general too high purchase costs of washable diapers were hardly mentioned as a reason to use disposable diapers by

the 'disposable' consumers. User-friendliness and hygiene were the most mentioned reasons (figure 10).

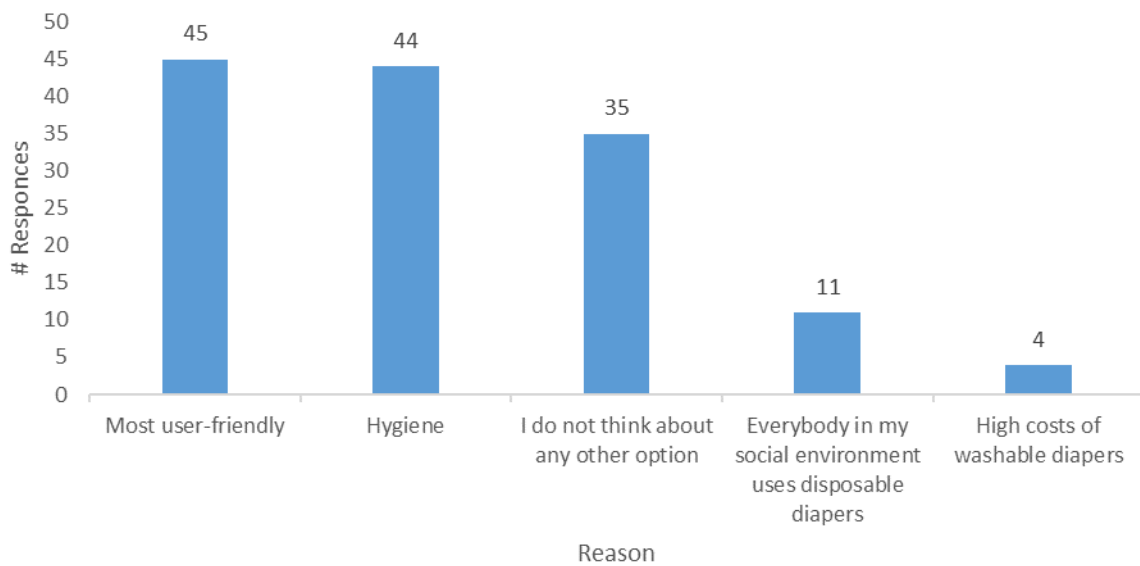


Figure 10 Most important reasons to buy disposable diapers according to 'disposable' consumers (N=109)

Furthermore, about 58% of the 'disposable' consumers is not convinced to try washable diapers with a discount. For these consumers practical reasons like hygiene, the risk of leakage and the extra work are the most important barriers. Only 21% of the 'disposable consumers' answered yes and another 21% of that group said 'maybe' when they were asked if they would like to participate in a pilot with financial support. For this group of 'interested disposable' consumers the most important reasons to participate in a pilot is however not the financial support for this group but more often they just want to know if washable diapers will work for them and they want to generate less waste. Besides, to lease or rent washable diapers not popular at all among the 'disposable' consumers. Nearly all respondents – even if they are interested in a pilot - answered that they thought that it would be not hygienic. Some respondents motivated their answer with *'I don't buy second-hand underwear for myself either'*. To sum up, yes the purchase costs are a barrier for consumers to try washable diapers so the hypothesis is accepted. However, it is mainly a barrier for those who are already interested or know something about washable diapers. For the irreclaimable disposable consumer which is not interested in washable diapers other reasons like practicalities are much more important barriers and they are probably still not convinced to try washable diapers with some financial support.

Hypothesis 2: Consumers need more information on usability, price and environmental impact of diapers.

Besides a stroller, furniture, breastfeeding and all other things that need to be bought and thought about when a baby is born, diapers are just another 'issue' to solve for parents. Many parents to try immerse themselves in all the choices and information. However, the reactions of many respondents confirmed that it is not that easy to make a well informed decision on either washable or disposable diapers because there is a lot of information available, it is very complex and too much to choose. For example, one respondent said: *'the information was too overwhelming and it hold me back from trying washable diapers in first instance because there was so much to choose'*. Furthermore, information on washable diapers does not reach all consumers. For example, about 30,7% of the

'disposable' respondents did not think of any other option for disposable diapers (see figure 9). Besides, 42% of the 'disposable' respondents did not search for information washable diapers (see figure 11).

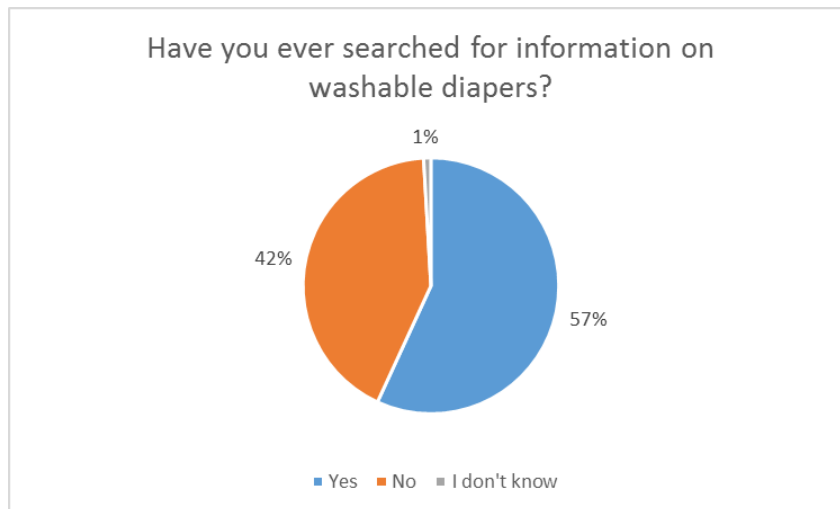


Figure 11 Disposable consumers - searched for information on washable diapers (N = 109)

Moreover, each group of consumers is interested in other information. As discussed with the first hypothesis, usability and hygiene is most important for 'disposable' consumers (see figure 10). For the part of the 'disposable' consumers that is interested to try washable diapers less waste generation is one of the most mentioned reasons. However, for most of them it is even more important to just experience if it will work (see figure 12).

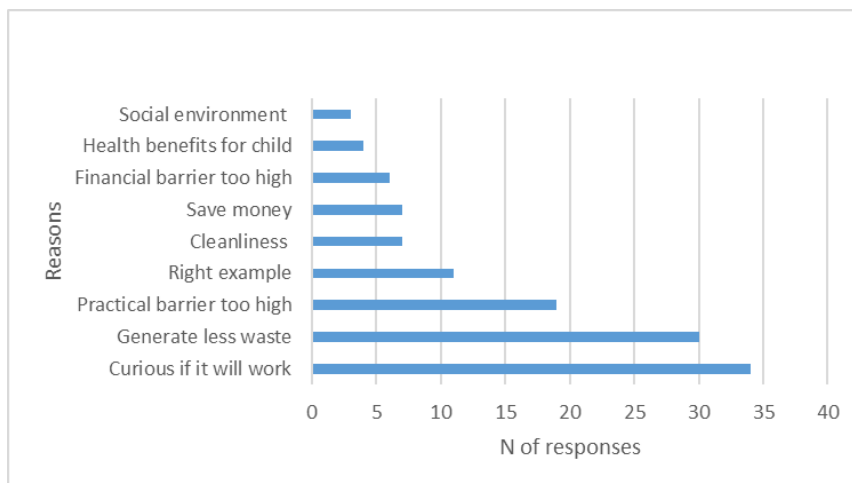


Figure 12 reasons to try washable diapers according to 'disposable' consumers (N = 109)

To conclude, information on price, usability and environmental impact of both kind of diapers might help consumers to make better choices however there are a few important remarks. At first, there is no lack of information but the information is currently not well communicated. There is a significant part of consumers who does not know about washable diapers at all because they are not interested themselves and therefore the information hardly reach them. Besides, there is too much and too complex information for those who are interested which can be deterrent. Secondly, not all information will appeal to all kinds of consumers. Each type of consumer has other preferences and is interested by other kinds of information: some will be more convinced by the environmental benefits of washable diapers, while others just want to know if the diaper is user-friendly or

affordable. Therefore the theory of Den Hartog (2012) which implies that more information will help consumers automatically to make a more sustainable choice does not seem to apply here. Instead, there is enough but it takes time which confirms the assumption of Stigler (1957). Besides, the assumption made by Middlemiss (2010) that it is very important to know about the alternative in the first place does apply as well in this case, as still the biggest part of the consumers does not know about the washable diapers at all and therefore never considered an alternative.

Hypothesis 3: The washable diaper does not match with the preferences of consumers.

In this research it became clear that there is a specific group of consumers who tried washable but went back to disposable diapers because they were disappointed in the washable product, both in the general survey (N = 5) and among the *Mazzelkontjes* participants (N = 10). The most important reasons they mention are related to practicalities: the long drying time of the diapers, the extra work, leakage during the night and the restraint of a partner or kindergarten made them decide to quit and go back to disposable diapers. Moreover, 131 out of 429 respondents in this research uses both washable and disposable diapers. This is 40% of the respondents in the general survey and 58% of all *Mazzelkontjes* participants that have been taken into account in this research. This 'both' group does not use washable diapers all the time for practical reasons similar to the group of consumers that is 'disappointed'. For example, washable diapers are not allowed at most Kindergartens and it is not practical during vacation to use washable diapers. Furthermore, this group also rates the user-friendliness of the washable diaper much lower than the 'washable' consumers. 'Both' consumers give the washable diaper an 8.6/10 on average for user-friendliness inside home, while 'washable' consumers give an 9.2/10 on average. Outside home 'both' consumers give on average 6.9/10 while 'washable' consumers ranked the user-friendliness on 8.1/10. The data show that those who are convinced of washable diapers have very different experiences with these kind of diapers than the other groups of consumers.

However, for most of them the environment or less waste generation were important reasons to try washable diapers in first instance. This confirms the theories of Fishburn (1962) and Middlemiss (2010) that the sustainability of consumer behaviour is limited to the boundaries of utility and capacity. If consumers need to put too much effort in the sustainable alternative compared to the disposable option, most will not change their behaviour eventually. Therefore, this hypothesis seems to be valid for the 'both' and 'disposable' including the 'disappointed' consumers.

Hypothesis 4: Consumers undervalue the cost-saving aspect of washable diapers in the long term.

Some respondents doubt indeed about the cost-saving aspect of washable diapers. For example, a respondent from *Mazzelkontjes* pilot in Breda states: *'I spend much less on disposable diapers than stated by Milieu Centraal because I buy them, like many others, in bulk with discount'*. Besides, most money is saved when consumers start with washable diapers in the beginning. Parents who start later are less optimistic about the cost-saving aspect. For those who use disposable diapers but are interested in washable diapers, the high purchase costs are indeed a barrier, as discussed for hypothesis 1. However, this is much more driven by loss-averse behaviour – *'I'm afraid it doesn't work'* – than by ignorance on the cost-saving aspect because most of these people do search for information on washable diapers but were not sure to try them because of the high purchase costs. Nevertheless, it could be that most disposable users don't know that it is possible to save that much money with washable diapers. For example because they are not interested and do not search for information. However, this research also shows that 'disposable' consumers estimate the price of washable diapers lower than the normal retail price, which is between €500,- and €750,-. Those who did not search for information estimated the price even lower (see figure 14).

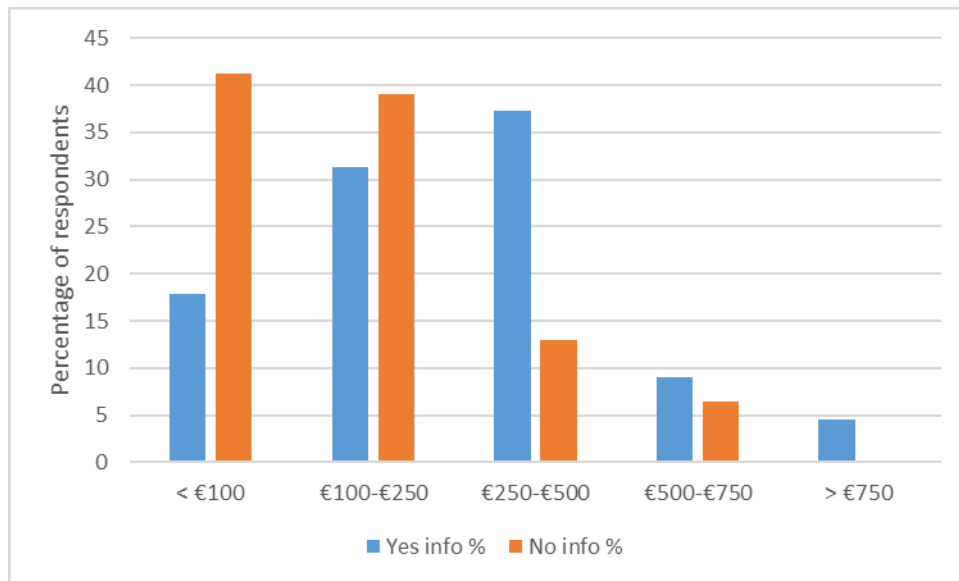


Figure 14 Estimated price of 24 washable diapers according to 'disposable' consumers who did and did not search for information (Nyes = 46 ; Nno= 63)

On the other hand, this group estimated their yearly expenses on disposable diapers overall close to the average yearly costs as calculated by Ten Grotenhuis (2018). Therefore, irreclaimable disposable diaper consumers probably do know that washable diapers are cheaper eventually but it does not matter to them. Eventually hygiene and user-friendliness are the most important drivers to choose for disposable instead of washable diapers (figure 12) and apparently they are willing to pay more for that. Thus the assumption that man is loss-averse (Hoch and Lowenstein, 1991) can be confirmed, however that does not lead necessarily to hyperbolic discounting as stated by Green, Fry and Myerson (1994). Therefore, undervaluation of the cost-saving aspect is probably not one of the main explanations for why most people choose disposable over washable diapers.

Hypothesis 5: People choose disposable diapers over washable ones because the current default option is disposable diapers instead of washable diapers.

The outcomes of these surveys seem to confirm that unknown is unloved. As figure 15 shows, 56% of the disposable consumers don't know anyone who uses washable diapers.

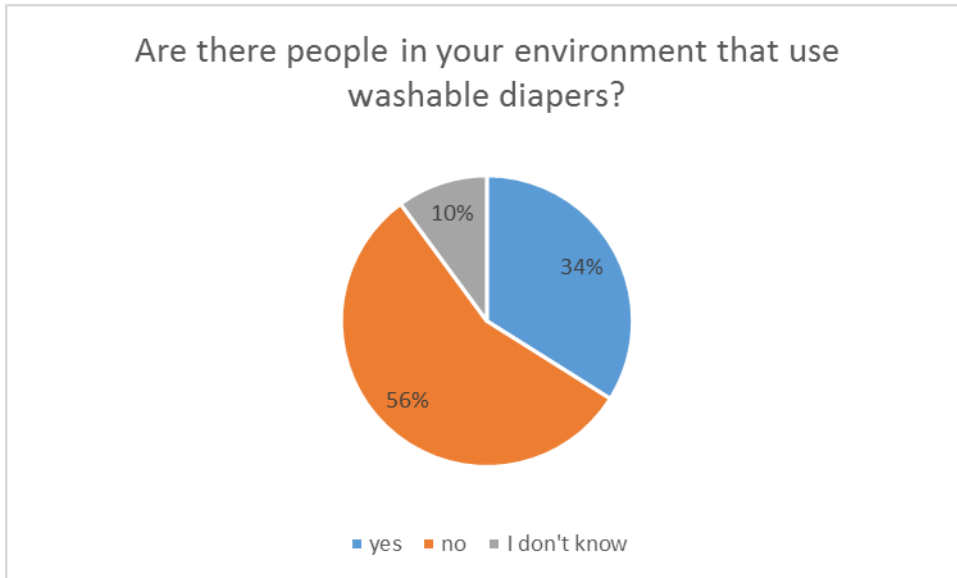


Figure 15 Are there people in your environment that use washable diapers? According to 'disposable' consumers (N = 124)

Besides 32% of the respondents who use disposable diapers stated that they choose that, among others, because they did not think of any other option and 10% stated that also because everyone around them uses disposable diapers, they use them too (see figure 12). Reactions on the question why the *Mazzelkontjes* participants did not start with washable diapers before the pilot also confirm that: 'I never thought of washable diapers before the pilot', 'I did not even know they existed', 'You don't find washable diapers in the normal shops' and 'I didn't know what to expect.' were mentioned in the survey. However, for those who use part-time or full-time washable diapers, their social environment reacts overall positive on the washable diapers (see figure 16). Besides, among *Mazzelkontjes* participants the community feeling of the pilot had significant impact (see paragraph 5.1).

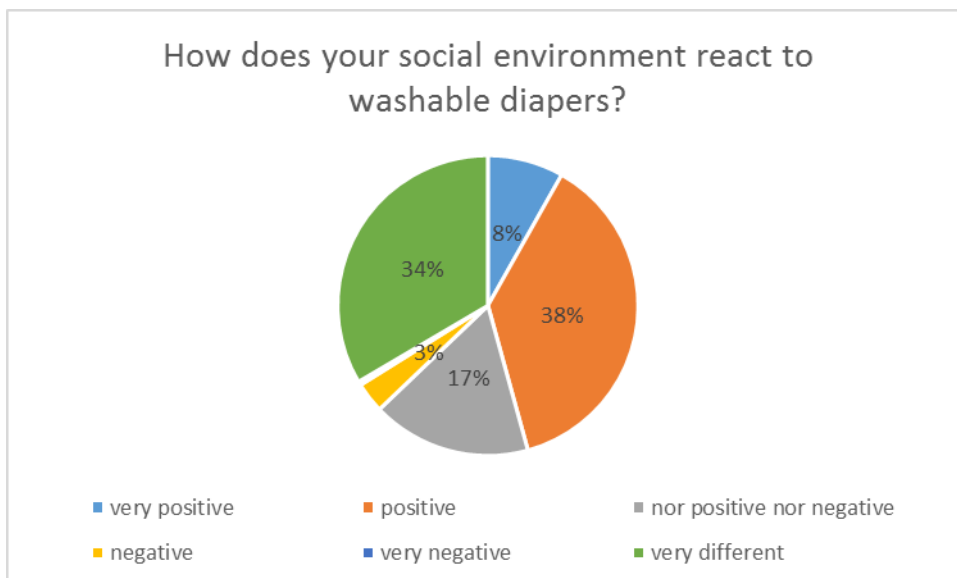


Figure 16 reactions of social environment on washable diapers - according to 'washable' and 'both' consumers (N=305)

Therefore, the fact that the washable diapers are currently the alternative compared and the disposable diaper is the default is probably a substantial barrier for most people to choose for disposable diapers. Many consumers are just not that familiar with the washable diaper and

consumers need to put more effort in it to get them. This is inline with the theory of Thaler and Sunstein (2008) that consumers prefer the easiest and most common option because the alternative is harder to get and that does not match with the heuristic that consumers developed for this specific product.

To conclude on this analysis, in general the most important barriers for consumers to buy washable diapers are; 1. the high purchase costs; 2. The ignorance about the washable diapers among one part of the consumers and the too complex information for interested consumers, 3. the practical downsides of the washable diapers and 4. the default option is the disposable diaper while the washable diaper is the alternative which is why so many consumers are unfamiliar with the product. Based on this analysis there has been no indication found that hyperbolic discounting is a relevant factor in the case of washable baby diapers. Furthermore, this analyses showed that both neo-classical and behavioural economic insights are appropriate and comprehensive approaches for explaining unsustainable consumer behaviour and stimulating sustainable consumer behaviour. Although each approach has different assumptions on consumer behaviour, they complement each other. In this case it is most relevant to implement instruments based on both approaches.

Chapter 6: Conclusion

Disposable diapers are a substantial waste problem, in the Netherlands but also in the rest of the EU. Since the 1980s the disposable diaper replaced the washable diaper. Since then, the market for disposable diapers only increased with also an increasing bulk of disposable diaper waste (Smouter, 2015). So far the EU and national government of the Netherlands try to solve this problem by stimulating diaper recycling (EACI, 2013; Eco-Innovation, 2018; NVRD and Rijkswaterstaat, 2015). However, it is no solution for the cause of the problem. With the current technique only a couple of materials can be retrieved and it is very expensive (Van Leeuwen, 2015; NVRD and Rijkswaterstaat, 2015). Moreover, it also does not match with the ambitions of the same governments to reduce waste production, it only holds the cause of the problem into existence (Pierson, 1993). This research therefore states that the policies of the EU and in the Netherlands on national and local level should be much more focussed on prevention of waste and encouraging sustainable consumer behaviour by addressing the barriers that consumers experience to behave sustainable.

In this research sustainable consumer behaviour is defined as *'the consumers' choice for a product which generates minimal waste and requires the least amount of energy in during production and use. Eventually this product harms the environment the least from all other alternatives of the same product category.'* In the case of diapers the washable diaper meets this definition the most of all other alternative because it generates the least amount of waste and harms the environment the least compared to disposable diapers (Milieu Centraal, 2017). This research assumes that consumer behaviour should be steered by governance because consumption is the main cause of waste generation which creates environmental and thus societal problems (Raworth, 2017 and Ellen MacArthur Foundation, 2013). Besides, suppliers tend to follow consumer behaviour (Ceton and Van der Wal, 2006). Therefore, changing consumer behaviour is the key towards the further development of a transition towards a more sustainable economy.

However, to develop interventions that stimulate the use of washable diapers it is needed to outline the barriers that consumers currently experience. According to this research the most important barriers that consumers experience to use washable diapers instead of disposable diapers are; 1. the high purchase costs, 2. the ignorance among one part of the consumers but at the same time also the too complex information for the interested part of the consumers, 3. the practical downsides of the washable diaper and 4. the fact that disposable diaper is the default option which is the easiest to get. Based on this analysis, there were no indications found that hyperbolic discounting on long term savings is a relevant barrier for consumers. Or at least, for this research it does not explain why consumers choose disposable over washable diapers in the first place because consumers more often underestimate the costs of washable diapers instead of overestimating them. The cost saving aspect is probably for the irreclaimable disposable consumers not relevant.

Overall the outcomes of the research came quite close to the expectations at first instance which assumed that it would be simply not easy for consumers to choose because most are unfamiliar with the alternative, it evokes a wrong image or the purchase costs are deterrent (Milieu Centraal, 2017). This research confirmed that there is indeed a lot of unfamiliarity about the washable diaper as an alternative for disposable diapers. Those who are interested in washable diapers or tried them still experience some inconveniences or are deterred by the high costs at first instance which hold them back from using them all the time or using them at all. This confirms that policy incentives are needed to stimulate the washable diapers and make diaper consumption more sustainable.

For theory this research showed that, although neo-classical and behavioural economic approaches differ on assumptions concerning the essence of consumer behaviour and manners in which a government can intervene on consumers choices, they both provide relevant insights for addressing the root causes of this problem. In this particular case a combination of both neo-classical and behavioural economic instruments will contribute to stimulate washable diaper use and decline the amount of waste that is caused by disposable diapers eventually. For society this research showed that the cause of the problem of disposable diaper waste can be solved by making the washable alternative more attractive instead of investing in recycling solely. This paved the way free for an alternative policy approach for this problem which might be more effective and cheaper eventually. For academia this research contributed to the further development of the behavioural economic approach within the field of governance by applying the insights to a societal problem for which effective governance is needed. It further showed that the neo-classical economic approach is not outdated by the more modern behavioural economic approach. However, a combination can strengthen both theoretical perspectives and make them both more comprehensible for application of policy interventions for societal problems.

Besides, this research showed that the *Mazzelkontjes* pilots seem to be quite effective for stimulating washable diapers use among parents with young children. Although the results should be read taken the limitations of this natural experiment into account. In general, most participants continue, either full-time or part-time with additional use of disposable diapers if needed. However, it does not seem to be the most efficient policy instrument because it is costly and time consuming for the municipalities while the impact is only limited to those who participate. Nevertheless, the results of the analysis indicate that the pilot is a successful recipe for making consumers who are interested in washable diapers more familiar with the washable diaper in a relatively simple way. Furthermore, the outcomes of the analyses on control variables of political preferences, income, education and age indicate that other variables than the barriers might have an impact on the kind of diapers that people use. The washable diapers are most popular among young, left politically oriented people with a middle-income. Contrarily, among respondents older than 30, with a relatively high income and more often a right political preference the disposable diapers are more used. Nevertheless, the sample is relatively small and biased so to validate these indications further research is needed but it might be relevant for the eventually policy strategy. This research can be a relevant source of inspiration for further research on how to implement a policy strategy for products that cause a lot of waste but are hard to recycle, for example other incontinence materials or hygiene products.

Taking all of the above into account, it is most important that the focus of the policies on European, national and local level aims at prevention of waste instead of in the first place. If these governments want to realise their ambitions of a sustainable and regenerative economy, alternatives like the washable diaper should get much more attention and become the consumer standard eventually. The tendency of all levels of government so far seems to improve recycling first and then move on to prevention. However, the other way around - first aim for prevention and strive for recycling when prevention does not work – would be much more effective in this case because recycling is very expensive and inefficient while prevention is a more reduces waste generation directly. Based on the outcomes of this research in chapter seven policy recommendations for the European, national and local level are made to outline the first necessary steps to address the barriers of washable diaper use. In chapter eight last remarks are discussed.

Chapter 7: policy recommendations

What can the EU, the Dutch government and local levels do to address the barriers that consumers experience to use washable diapers? In this chapter the policy recommendations for each level are further discussed and based on a combination between both neoclassical as well as behavioural economic insights. The aim of these recommendations is to align the strategy on different levels of government.

The European Union

The EU invested a lot in diaper and incontinence material recycling so far: in the recall project solely €36 billion (Eco-Innovation, 2018). However, as discussed earlier, recycling is no complete solution for this type of waste because only a couple of materials can be recovered and it still stimulates the use of the disposable diaper. For example, if 100% recycling of disposable diapers does become a reality, there will be an infrastructure for separate collection as well. This whole recycling structure depends on the production of disposable diaper waste and holds the cause of the problem into existence. Prevention is therefore better than cure meaning here: make prevention of waste as easy as possible instead of implementing recycling applications only.

The commission proposal for a ban on the top 10 single-use plastics that cause marine litter and for which there is a reusable alternative is a step in the right direction. Nevertheless, urban litter and other types of products that generate a substantial amount of waste and lot of environmental harm like disposable diapers are not addressed in this proposal yet. However, also for disposable diapers there are a reusable and sustainable alternatives: the washable diapers. To stimulate the use of the washable diaper, the EU could focus more on prevention of waste in legislation similar to the single-use plastics ban and stimulate prevention of waste initiatives through financial support. For example, the EU can provide financial support via the cohesion policy fund for countries who want to stimulate the use of washable diapers but lack resources for an information campaign or to provide for free test samples of washable diapers. Besides, one of the downsides of the washable diapers are the long drying time and the extra work that comes with it. As the analysis showed, this is for many consumers a reason to quit or use the washable diapers only part-time. The Horizon 2020 fund could be used for example to stimulate product innovation research that helps to make the washable diaper a more user-friendly product.

The Dutch government

Just as the EU also the Dutch government could focus more on prevention of waste initiatives instead of supporting recycling initiatives like in Amsterdam and Nijmegen solely. For example, the national level could support the local levels to enlarge the scale of initiatives like the *Mazzelkontjes* pilots with financial support. Besides, the national government could start an information campaign to inform consumers on the washable alternatives for disposable products, not only for diapers but also for disposable hygiene products, straws or cutlery for example. Next to that, further research should be done on how to address the problem of the high purchase costs of washable diapers. For example, a lower VAT rate for washable diapers – 9% instead of 21% - would reduce the retail price by 11,5% and might help to stimulate the use of this product. Next to that, the price of disposable diapers might need to be increased to compensate for the negative externalities and make the disposable diaper less attractive. However, the effect of these measures depends on the price elasticity and this needs to be further researched.

Besides, next to Horizon 2020 funds, national funds could be used for product innovation research to improve the usability of the product. Furthermore, knowledge and experiences on

prevention of waste initiatives can be shared with other member states. The Netherlands probably do not qualify for further EU funding because it can provide for its own budget implement an information campaign. However, other member states who do need the financial support for prevention of could apply for the cohesion policy fund for example.

Local governments

The analysis showed that the *Mazzelkontjes* pilots are effective for promoting the use of the washable diaper among parents who are interested but did not dare to try them yet. However, the effect of the pilots is limited mainly to those who participate while the investment of the municipality concerning time and money is relatively high. Municipalities should search for ways to enlarge the impact, within their budget and still use the successful instruments of pilots. For example, municipalities could provide information for parents on washable diapers and provide for example one test sample for free when they register their new born child. This would be available then to all parents in this category instead of only a limited sample of participants in a specific pilot. Furthermore, it is the most effective to let consumers choose for washable diapers in the most early stage: consumers do not get used to the comfort of disposable diapers and the financial benefit is the highest. Besides, the analysis showed that the social events have a positive effect on the use of washable diapers. The municipalities could organise social events for parents who use washable diapers or are interested in them. This contributes to the community feeling and set a setting in which the washable diaper is the default instead of the alternative. Furthermore, municipalities could help parents with the purchase costs by pre-financing the washable diapers and offer a hire purchase system similar to the lease system used in the *Mazzelkontjes* pilot in Tholen.

Each of these recommendations aims to have a direct effect on the stimulation of washable diapers however if these policies are aligned they can enforce each other. As stated earlier, a transition requires effort of governments and other actors on all levels (Raworth, 2017, p. 63-66; Kemp, Loorbach and Rotmans, 2007, p. 81-82; Loorbach, 2010, p. 171). In that case big steps can be made to reduce disposable diaper waste and stimulate the demand for washable diapers. The eventual aim of this proposed policy is to turn norm of diapers from disposable to washable. This multi-level policy proposal will help to create more demand for the washable diaper and thereafter the market will have to adapt to these changes as well. However, that won't be an easy process. The disposable sector is very strong and has a big market share, about 80-90% (Smouter, 2015). If the washable diaper will be promoted through governments, multinationals like Proctor & Gamble and Kimberly-Clark will probably invest a lot in promotion of the disposable diaper and in recycling. They already invested for example the recycling plants in Amsterdam and Nijmegen to keep their good image and market position. Therefore, it is also important that the resellers and producers in the washable sector find ways to gain more market power. They are very diffused at the moment and compete a lot with each other instead of with the disposable actors on the market. By better cooperation between these actors through for example a branch organisation would enforce their position towards the disposable sector.

Chapter 8: discussion

In this chapter last remarks concerning this research are made. First of all, this research focusses solely on baby diapers. Other incontinence materials, disposable sanitary products and diapers for elderly are part of the same waste problem but were not taken into account in this research because the scope of this research and the unit of analysis would be too broad. Nevertheless, the outcomes of this research might be a valuable source of inspiration for other policy initiatives to reduce the waste caused by for example incontinence materials for elderly and disposable sanitary products as well. However, it is likely that the barriers for these types of consumers are somewhat different because it are other target groups with other preferences. Besides, for sanitary products there are washable alternatives available but for incontinence materials used by elderly there aren't that many alternatives at hand yet. Therefore it is recommended to do some additional research among this specific types of consumers and market situations before outlining a new specific policy proposal for these kind of products.

Secondly, the context of this research is European and predominantly Dutch. The outcomes of research might be valuable for other member states but probably not that much for non-European countries. In the first place because the governance structure is different in non-EU countries. However also cultural differences and economic circumstances could have an impact on the behaviour of consumers. In this research the group of respondents is relatively homogeneous taking these circumstances into account. Therefore, it is valuable if countries share knowledge and experiences however, the outcomes of this research will not automatically be valid in another context.

Thirdly, the theoretical framework of this research does not include the concepts of motivations or ethical beliefs because it is a whole field of studies in itself. However, it is likely that it has an effect on the kind of diapers that people use. Nevertheless, for this research is assumed that there are hardly consumers who don't believe that it is important to take care of the environment. In this case it is much more important to find out what holds specific consumers back to try washable diapers regardless they attach high or low value to environmental protection. Besides, this research did not take cultural or religious variables into account. For this type of research with this particular unit of analysis there were no indications that culture or religion might have an impact on the kind of diapers that consumers use. Nevertheless, additional research might provide some clarity whether these aspects correlate to a certain type of consumer behaviour.

Fourthly, there some limitations concerning the methodology and analysis of this research. In the first place, it is mainly a qualitative study, supported with quantitative methods where it was suitable. Nevertheless, the data was mainly categorical and the sample is relatively small which limited the possibilities for quantitative evaluations. Besides, the sample seemed overall biased because a substantial amount of the respondents is higher educated and politically left or middle orientated for example. Therefore, further research with a bigger and more representative sample is needed to validate the outcomes.

Fifthly, the policy recommendations mainly focus on prevention of waste instead of recycling. However, even if these recommendations are successfully implemented, it is very much likely that a substantial part of consumers will only use the washable diapers part-time. For example, because the Kindergarten has some restraints or it is unpractical to use washable diapers outside home in some situations. Therefore, effective waste management of disposable diapers like recycling should also be possible. Luckily, the EU and national governments already invested a lot of money in recycling plants which can obtain at least some material from this type of waste. This research is not

meant as a statement against recycling. However, recycling should be seen as a second best option besides prevention of waste.

Sixthly, this research is based on literature which attributes an important, guiding role for the government to steer consumer behaviour and stimulate the development of transitions. Nevertheless, the supplier on the market also have an important role and responsibility in creating a more sustainable economic system and governments cannot lead these kind of transitions solely. However, the government can have a guiding role but it should be executed cautiously. It will be easily understood as paternalism or patronizing if a government would actively stimulate a certain type of consumer behaviour which can have an adverse effect.

Lastly, this research has been supported by the Ministry of Infrastructure and Watermanagement, Rijkswaterstaat, the municipalities Tholen, Breda, Haarlemmermeer and Hengelo, Milieu Centraal and washable diaper shops Bamboobaby, de Billenboetiek and Kaatje Katoen. They provided lots of valuable information and helped to find respondents. However, within this network there are probably overall more people in favour of washable diapers than on average in society. This aspect should be taken into account while reviewing this research because it probably framed the context within this research took place.

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Legislation

TFEU article 3-6

Decision No 1386/2013/EU

Directive 2008/98/EC

Appendix I – platforms through which the online survey has been promoted

- Facebook
- LinkedIn
- Intranet Utrecht University
- Intranet Ministry of Infrastructure and Watermanagement
- Twitter Municipality of Tholen
- Facebook Municipality of Enschede
- Friends, family, colleagues

Appendix II – list of questions and answers general online survey

Format: Google Form <https://goo.gl/forms/CODRXLSATf5w3bZ02>

Target group: parents with young children who did not participate in a Mazzelkontjes pilot

Original language: Dutch

Date: 23-4-2018 till 17-5-2018

Part 1: control questions

- What is your highest level of education?
 - Primary school
 - Secondary school
 - Secondary vocational education
 - University of applied science or research university (bachelor and/or master)
 - Other
 - I don't want to say
- What is your age?
 - < 20 years
 - 20-30 years
 - 30-40 years
 - > 40 years
 - I don't want to say
- What is the yearly gross income of your family on average?
 - < €15.000
 - €15.000-€25.000
 - €25.000-€50.000
 - €50.000-€70.000
 - >€70.000
 - I don't want to say
- What is your political preference?
 - Left
 - Middle
 - Right
 - Other
 - I don't want to say

Part 2: questions about diapers

1. What kind of diapers do you use for your child?
 - (eco) disposable diapers (go to question 2)
 - Washable diapers (go to question 14)
 - Both (go to question 14)
2. What are the most important reasons for you to use disposable diapers? (max. 3 answers)
 - Hygiëne
 - Everybody in my social environment uses disposable diapers
 - I did not think about any other option
 - Most user-friendly

- Other, namely..
3. Are there people in your social environment that use washable diapers?
 - Yes
 - No
 - I don't know
 4. Have you ever searched for information on washable diapers?
 - Yes
 - No
 - I don't know
 5. How much does a starter package of washable diapers costs, do you think? (about 24 pieces)
 - <€100
 - €100-€250
 - €250-500
 - €500-€750
 - >€750
 6. How much money do you spend on a yearly basis on disposable diapers?
 - <€250
 - €250-€500
 - €500-€750
 - €750-€1000
 - >€1000
 7. Have you have considered or tried to use washable diapers?
 - Yes, considered but never tried
 - Yes, considered and tried but went back to disposable
 - No (go to question 9)
 8. If you ever considered or tried washable diapers, which reasons were the most important not to use them (anymore)? (max. 3 answers)
 - Not hygienic
 - High purchase costs
 - Lots of washing
 - Not user-friendly outside the home
 - Nobody in my social environment uses washable diapers
 - Dull image
 - Change more often
 - The diaper is very thick
 - Afraid of leakage
 - Other, namely...
 9. If you could participate in a pilot with washable diapers in which you can try the washable diapers for a while with discount, would you be interested?
 - Yes
 - No (go to question 13)
 - Maybe
 10. If yes or maybe, what would be the most important reasons for you to participate in a pilot? (Max. 3 answers)
 - I'm curious if it will work
 - The financial barrier to start by my self is too high
 - The practical barrier to start by my self is too high
 - Save money

- I want to generate less waste
- In my social environment there are more people who use washable diapers
- I want to give the right example
- It is better for the health of my child
- My child will learn to go on the potty sooner
- Other, namely..

11. If you would participate in a pilot, how much would you contribute yourself for a starting package of 24 diapers?

- €0
- Up to €100
- Up to €200
- Up to €300
- Up to €400
- Up to €500
- > €500

12. A If you would have the possibility to rent or lease washable diapers, would you be interested?

- Yes
- No
- Maybe

B Why?

- ...
- Question 13 is only for those who are not interested in a pilot. If you use (partly) washable diapers, go to question 14. If you fit in none of these categories you may send the survey now. Thank you very much for your help!

13. If you don't want to participate in a pilot with washable diapers, what are the most important reasons for you? (max. 3 answers)

- Not hygienic
- High purchase costs
- Lots of washing
- Not user-friendly outside the home
- Nobody in my social environment uses washable diapers
- Dull image
- Change more often
- The diaper is very thick
- Afraid of leakage
- Other, namely...

➔ The following questions are only for those who use (partly) washable diapers. If you do not use washable diapers you may close the survey now. Thank you very much for your help.

14. What are the most important questions to use (partly) washable diapers? (Max. 3 answers)

- I want to save money
- It is better for the environment
- It is better for my child

- Less waste generation
 - I would like to give the right example
 - In my environment more people use washable diapers
 - I like the prints and colours
 - My child will go on the potty sooner
 - Other namely..
15. Do you still use partly disposable diapers? If so, why?
- Open answer..
16. How does your social environment react to the fact that you use washable diapers?
- Very positive
 - Positive
 - Not positive not negative
 - Negative
 - Very negative
 - Very different
 - Not relevant
17. A What are the most positive elements of washable diapers according to you? (max. 3 answers)
- Always diapers at home
 - Different colours and prints
 - Health benefits for my child
 - Positive effect on the cleanliness of my child
 - Money saving on the long term compared to disposable diapers
 - Less waste generation
 - Other, namely ..
- B What are the most negative elements of washable diapers according to you? (max 3 answers)
- High purchase costs
 - Washing more often
 - Change more often
 - The amount of work
 - The size of the diaper
 - Risk of leakage
 - Other, namely...
18. On a scale of 1 to 10, how would you rate the user-friendliness of the washable diaper at home?
- 1 absolutely not user-friendly
 - 10 very user-friendly
19. On a scale of 1 to 10, how would you rate the user-friendliness of the washable diaper outside home?
- 1 absolutely not user friendly
 - 10 very user-friendly
20. Would you recommend other parents to use washable diapers?
- Yes
 - No
 - Maybe

21. What are according to you the most important reasons to convince other parents? (Max. 3 answers)

- It saves money
- It is better for the environment
- It is better for your child
- It will generate less waste
- Your child will go on the potty sooner
- It is not that much more work than disposable diapers
- It is not unhygienic
- The prints and colours are nice
- You will always have enough diapers at home
- Other, namely ...

Appendix III – list of questions survey Haarlemmermeer

Format: online survey

Target group: participants first Mazzelkontjes pilot

Original Language: Dutch

Date: 1-11-2017 till 7-1-2017

1. How did you know about this pilot?
 - Open answers
2. Have you ever thought about the use of washable diapers before?
 - Yes
 - No
3. Why did you want to participate in this pilot?
 - Curious whether it would work
 - To save money
 - Better for the environment
 - Less waste generation
 - The practical barrier to start myself is too high
 - The financial barrier to start myself is too high
 - I expect that my child will go on the potty sooner
 - Better for butt of my child
 - I would like to give the right example
 - Other namely, ..
4. Can you estimate how much of your residual household waste consisted of diapers?
 - 5-10%
 - 10-25%
 - 25-50%
 - More than 50%
5. How long did it take before you knew how to work it washable diapers
 - Less than 1 week
 - 1 week
 - 2 weeks
 - 3 weeks
 - More than 3 weeks
6. How much washable diapers do you use per day now?
 - Open answer
7. Is that more or less than with disposable diapers?
 - More
 - Less
 - Same
8. How many more times do you need to use the washing machine?
 - 2
 - 3
 - 4

- More than 4
9. Only answer if you still use disposable diapers: how much of them do you still use?
- Open answer
10. Only answer if you still use disposable diapers: when do you use them?
- At kindergarten
 - At the babysitter
 - On the way
 - When we go out for a day
 - During the night
 - If we run out of washable diapers
 - For variation
 - Other, namely..
11. Only answer if you still use disposable diapers: how do like the combination between the two?
- Open answer
12. What do you like the least about washable diapers? (max. 3 answers)
- Extra laundry
 - Long dry times
 - Change more often
 - Unpleasant smell
 - Too thick package
 - Leakage
 - Financial barrier
 - Red or damaged butt
 - Poop in the diaper
 - Extra work
 - Extra wateruse
 - Spots
 - Limited freedom of movement for my baby
13. What do you like the most about washable diapers? (max. 3 answers)
- Always diapers at home
 - Better for the environment
 - Better for the butt
 - Saving money
 - Less waste generation
 - Child signals earlier if it needs a new diaper
 - Can go on the potty sooner
 - User friendliness
 - Nice colours
14. Based on your experiences, would you like to continue using the washable diapers?
- Open answer

Appendix IV – List of questions survey Breda

Format: list of open questions via e-mail

Target group: participants first Mazzelkontjes pilot Breda

Original language: Dutch

Date: 21-6-2017 till 05-07-2017

1. Do you still use disposable diapers?
2. What is your experience in general with washable diaper use
3. Was it hard to change from disposable diapers to washable diapers?
4. Can you make an estimation of how much disposable diaper you have saved during the pilot?
5. How much less waste did you generate during the pilot?
6. How can we get more attention for washable diapers?
7. What should the municipality do?
8. Would you have used washable diapers also if there was no pilot?
9. Anything else you want to share?

Appendix V – list of questions survey Tholen

Format: google form <https://goo.gl/forms/kSu4np0wYqCLLHEs1>

Target group: participants first Mazzelkontjes pilot Tholen

Original language: Dutch

Date: 26-4-2018 till 29-4-2018

Part 1: control questions

- What is your highest level of education?
 - Primary school
 - Secondary school
 - Secondary vocational education
 - University of applied science or research university (bachelor and/or master)
 - Other
 - I don't want to say
- What is the yearly gross income of your family on average?
 - < €15.000
 - €15.000-€25.000
 - €25.000-€50.000
 - €50.000-€70.000
 - >€70.000
 - I don't want to say
- What is your political preference?
 - Left
 - Middle
 - Right
 - Other
 - I don't want to say

Part 2: questions about diapers

1. How did you know about this pilot?

- Website of the municipality
- Friends and/or family
- Local news
- Other, namely..

2. Have you thought about washable diapers before?

- Yes
- No
- I don't know

3. Why?

- Open answer

4. What were the most important reasons for you to participate in this pilot? (Max. 3 answers)

- I'm curious if it will work
- The financial barrier to start by my self is too high
- The practical barrier to start by my self is too high
- Save money
- I want to generate less waste
- In my social environment there are more people who use washable diapers
- I want to give the right example
- It is better for the health of my child
- My child will learn to go on the potty sooner
- Other, namely..

5. What are the most positive elements of washable diapers according to you? (max. 3 answers)

- Always diapers at home
- Different colours and prints
- Health benefits for my child
- Positive effect on the cleanliness of my child
- Money saving on the long term compared to disposable diapers
- Less waste generation
- Other, namely ..

6. What are the most negative elements of washable diapers according to you? (max 3 answers)

- High purchase costs
- Washing more often
- Change more often
- The amount of work
- The size of the diaper
- Risk of leakage
- Other, namely...

1. On a scale of 1 to 10, how would you rate the user-friendliness of the washable diaper at home?

- 1 absolutely not user-friendly
- 10 very user-friendly

2. On a scale of 1 to 10, how would you rate the user-friendliness of the washable diaper outside home?

- 1 absolutely not user friendly
- 10 very user-friendly

3. How does your social environment react to the fact that you use washable diapers?
 - Very positive
 - Positive
 - Not positive not negative
 - Negative
 - Very negative
 - Very different
 - Not relevant
4. Do you still use partly disposable diapers? If so, why?
 - Open answer..
5. Would you like to continue to use washable diapers?
 - Yes
 - No
 - Maybe
6. If you would continue using washable diapers, would you choose to buy or lease?
 - Buy
 - Lease
 - Not relevant
7. Why?
 - Open answer
8. Would you recommend washable diapers to other parents?
 - Yes
 - No
 - I don't know
9. Why?
 - Open answer
10. What are the most important reasons according to you to convince other parents to use washable diapers?
 - It saves money
 - It is better for the environment
 - It is better for your child
 - It will generate less waste
 - Your child will go on the potty sooner
 - It is not that much more work than disposable diapers
 - It is not unhygienic
 - The prints and colours are nice
 - You will always have enough diapers at home
 - Other, namely ...
11. Are there arguments that you wouldn't use?

Appendix VI – Statistical Tests paragraph 5.2

Test 1: Financial benefits

H0: the financial benefits of washable diapers are just as important for the experiment group and the control group

H1: the financial benefits are more important to the experimental group

Independent Samples T-Test

	t	df	p	Cohen's d
Financial benefits	-3.869	318.0	< .001	^a -0.526

Note. Student's t-test.

Note. For all tests, the alternative hypothesis specifies that group C is less than group E .

^a Levene's test is significant ($p < .05$), suggesting a violation of the equal variance assumption

Group Descriptives

	Group N	Mean	SD	SE
Financial benefits	C	251	0.482	0.501
	E	69	0.739	0.442

Fisher exact test

Financial Benefits	E	C	Total
Yes	51	121	172
No	18	130	148
Total	69	251	320

$$p = \frac{(51+121)! (18+130)! (51+18)! (121+130)!}{(51!*121!*18!*130!*320)} = 0,000000000026345610038862$$

Test 2: Information on environmental benefits

H0: there is no substantial difference between the experimental and control group on the importance they give to information on the environmental benefits of washable diapers

H1: The information of the environmental benefits are a more important reason to try washable diapers for the *Mazzelkontjes* participants than for the non-pilot participants.

Independent Samples T-Test

	t	df	p	Cohen's d
Environmental benefits	-1.416	318.0	0.079	^a -0.192

Note. Student's t-test.

Note. For all tests, the alternative hypothesis specifies that group C is less than group E .

^a Levene's test is significant ($p < .05$), suggesting a violation of the equal variance assumption

Group Descriptives

	Group N	Mean	SD	SE
Environmental benefits	C	251	0.829	0.378
	E	69	0.899	0.304

Fisher exact test:

Environmental benefits	E	C	Total
Yes	62	208	270
No	7	43	50
Total	69	251	320

$$P = (62+208)! (7+43)! (62+7)! (208+43)! / (62!*208!*7!*43!*320!) = 0,057547513$$

Test 3: social support

H0: social support or being part of a community of washable diaper users is for both groups an important reason to try washable diapers

H1: social support or being part of a community of washable diaper users is more important for *Mazzelkontjes* participants

Independent Samples T-Test

	t	df	p	Cohen's d
Social support	-1.784	318.0	0.038	^a -0.243

Note. Student's t-test.

Note. For all tests, the alternative hypothesis specifies that group C is less than group E .

^a Levene's test is significant ($p < .05$), suggesting a violation of the equal variance assumption

Group Descriptives

	Group N	Mean	SD	SE
social	C	251	0.120	0.325
	E	69	0.203	0.405

Fisher exact test:

Social support	E	C	Total
Yes	14	30	44
No	55	221	276
Total	69	251	320

$$P = (14+30)! (55+221)! (14+55)! (30+221)! / (14!*30!*55!*221!*320!) = 0,032818889$$