

Food Waste Prevention

a design intervention for Households.

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Preface

Dear reader,

In front of your eyes is the result of my master graduation project. This project marks the end of my six-years at the Technical University of Delft. The journey has been an incredible learning experience with great people and plenty of fun activities. Now, I feel ready and prepared for the next phase of my life as a graduated strategic designer.

Although I am proud of what I have accomplished for my final project, it would be ignorant to say that this project is purely the result of my own hard work.

I would like to thank my lovely friends and family, who despite of this so-called six-foot society were still able to provide me with the support and especially fun distractions to keep me going. I am happy to return the favor.

I would like to thank my girlfriend for supporting me and chasing me around when I was lacking motivation. Your encouragement has without a doubt helped me to finish this project in the way I now have.

I would like to thank my TU Delft coaches for the guidance. Although often short, our meetings always helped me to improve my project and strengthen the story I was trying to convey. As a coaching duo, you provided the perfect mix of focusing on the bigger story but not forgetting the smaller details. I would like to thank Mirte for her endless enthusiasm, which motivated me in this somewhat gloomy time. I Change is a wonderful and very much needed organization and I hope more people start realizing this as well.

Lastly, inherent to this graduation project were my weekly Bikram sessions. The yoga mat turned out to be the ideal outlet for all the excess cosmic energy I accumulated during this graduation. Thank you adhayapaka rupadyaya Jurre. An eye for an eye.

To anyone still reading this, feel free to reach out if you have any questions or would just like to hear more about it, there is still plenty of information that has not made it into this report.

Enjoy your read and may it positively influence your own food wasting behavior.

A handwritten signature in black ink that reads "Dott".

Abstract

Globally one-third of all food that is produced for human consumption is wasted (FAO, 2013). Although it happens across the entire Food Supply Chain, 53% of all food waste in Europe takes place within consumers' households (Stenmarck et al., 2016). All this waste has serious consequences for the environment and if we want to achieve our '*food waste reduction of 30% by 2025 and 50% by 2030*' (UN, 2020) more needs to be done. An assignment was formulated together, with the Delft based organization I Change, to develop a product/service that facilitates consumer food waste prevention by addressing the household routines.

By reviewing consumers' existing household routines and the motives of their food-wasting behavior, it has been discovered that conflicting goals are the main reason consumers are wasting food. On the one hand consumers are willing to reduce their food waste because it is a pure waste of money, ethically wrong and because they feel ashamed or guilty when doing it (van Dooren & Mensink, 2018). On the other hand, consumers waste food because they strive for convenience, want to be good providers by making sure there is enough to eat and want to be prepared for uncertainties (e.g.: working overtime, unexpected guests) (Graham-Rowe, Jessop & Sparks, 2014).

These food wasting motives have led to many consumers lacking the 'good food habits' needed to make both convenient and good choices.

These good food habits include making shopping lists, setting up meals plans and checking stock before going shopping. According to Ooijendijk et al. (2019) having and sticking to these routines can prevent up to 50% of the total amount of food consumers waste.

Through an iterative design and test process Eetkaartjes was developed. Essentially this product is a set of product category labels that consumers use in their fridge, freezer and/ or cupboards which enables them to become better organized. Based on results from the testing phase it was concluded that through better organization, several of the previously discussed lacking 'good food habits' improved. This ultimately resulted in less food being wasted.

I Change has been provided with several implementation options for the product. A production proposal was made which enables them to continue with a detailed physical version of the product. The affordable cost estimation and interest from the Netherlands Nutrition Centre, makes this an interesting direction to further look into.

A second proposal was made for a simplified flyer version of the product. This version is cheap to produce and easy to distribute but requires additional effort from the consumer to implement it.

A third proposal was made in the direction of education. Samen Tegen Voedselverspilling expressed interest into this direction and collaborative next steps are being discussed.

I Change is advised to continue the conversation with external parties and look into the different implementation possibilities of the product, conducting additional small scale tests to validate remaining uncertainties and determine which strategy has the most potential.

Table of Content

01. Context & Approach	06	05. Decide	51
01.1 The origin of food waste	07	05.1 The chosen concept	52
01.2 The problem of food waste	07	05.2 A design iteration	52
01.3 The client: I Change	09	05.3 Showcasing the final design	55
01.4 The aim of this project	10		
01.5 The approach	10	06. Develop	56
01.6 The impact of Covid-19	11	06.1 Production proposal	57
		06.2 Implementation strategy proposals	58
02. Discover	12	06.3 Implementation feedback	62
02.1 The household stages	13	07. Deliver	63
02.2 Conflicting behavior	16	07.1 Conclusion	64
02.3 The wasters	20	07.2 Discussions & Recommendations	64
02.4 Consumption developments	23	07.3 Final Note	66
02.5 The existing initiatives	24		
		08. References	67
03. Define	32		
03.1 The design challenge	33		
03.2 A list of requirements & wishes	33		
04. Design	34		
04.1 The ideation process	35		
04.2 The concepts	38		
04.3 Testing	46		
04.4 The results	47		

01. Context & Approach

This chapter briefly addresses the problem of food waste by providing a insight into the scale of the problem, the consequences and those mainly responsible. Next the chapter discusses the client for this project, I Change, as well as the aim and approach to tackle the problem.

01.1 The Origin Of Food Waste

Although food waste, to a certain extent, always existed, it was not until after World War II where things took a turn for the worst. After this period of food scarcity, the food system transitioned.

International, national and local food relationships were configured. *'Policy, technology and economics, combined with new production practices, farming approaches, production technologies and food commodities were at the heart of this change'* (Evans, Campbell and Murcott, 2012). Logistics improved, demands became higher and the production raised. Retailers had to find ways to extend products' shelf life and processing techniques offered the solution. These developments resulted in extensive food processing, so that no one ever had to be hungry again (Levenstein, 1993).

Making an abundance of food available and affordable for everyone however had one mayor consequence. It provided the perfect conditions for food waste to increase exponentially (Moffatt, 2020).

01.2 The Problem Of Food Waste

Nowadays one-third of all food produced for human consumption is being wasted (FAO, 2013) and this amount of waste is having serious consequences, socially as well as environmentally.

The main environmental problems of food waste can be split up into direct and indirect costs. Directly, it is said that the greenhouse gas emissions coming from all rotting food waste are three times higher than the emissions from the entire global aviation industry (Poore and Nemecek, 2018).

Without getting too technical, the main reason for this is that this rotting food waste mainly produces methane gases. The effect of methane is said to be 84 times stronger than CO₂ according to researchers at Stanford (Jackson, et al., 2019).

Indirectly, when wasting food, the resources and energy that went into the food are also wasted. This includes the labor, water and land needed to produce the products as well as the fossil fuels needed for processing, distribution and packaging. It is said that, if food waste were a country, it would be the third largest greenhouse gas emitter, after China and America (see figure 1).

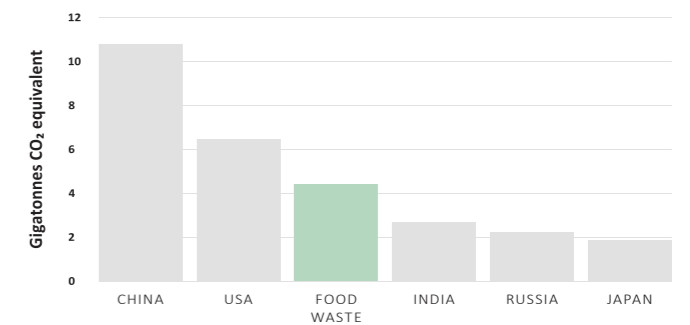


Figure 1: Food waste as the third largest contributor to greenhouse-gas emissions.

Source: Food Wastage Footprint and Climate Change (FAO, 2015)

Socially, food waste also raises several concerns. The main one being the undernourishment of some while others throw away an excess of food. According to the UN (2020), 8.9% of the world's population lives in hunger and these numbers are going up. If we would be able to use the food that is now wasted to feed those in need, it would be plenty to feed everyone twice (World Food Program USA, 2020).

Fortunately, steps are being taken in the right direction. Laws and agreements have been set up between UN members that are in line with the Sustainable Development Goals, to *'reduce food waste by 30% by 2025 and 50% by 2030'* (UN, 2020). However, in order to achieve these goals, a change is needed.

01.2.1 The Consumer's share

Although food waste happens throughout all stages of the food supply chain (FSC), consumers can be held responsible for the lion share. According to studies conducted by Stenmark et al., (2016) more than half (53%) of the amount of food waste that is produced in Europe originates from the consumer's household (see figure 2).

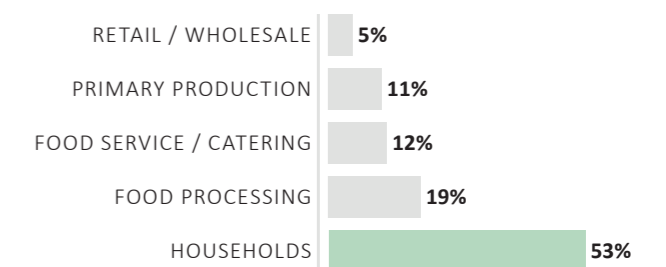


Figure 2: Percentages of waste through each of the chains in the FSC in Europe. **Source:** Stenmark et al., (2016).

Stenmark et al., (2016) state that 60% of this waste, thus roughly 32% the total amount of waste in the Europe, is in fact avoidable. Interestingly, according to Cox et al., (2010) there is no general way for consumers to effectively do this. This graduation project focuses on finding a solution to prevent this food waste from happening at the consumer's household.

According to Cox et al., (2010), consumers have allowed food waste to happen. It has become the more convenient option within our increasingly busier and demanding lives. The fact this problem has originated from convenience is precisely the reason numerous researchers refer to it as being an ‘avoidable environmental problem’ (Göbel et al., 2012; Graham-Rowe et al., 2014; Gustavsson et al., 2011; Stuart, 2009).

In the Netherlands, this avoidable problem led to the average Dutch consumer wasting 34.3 kg of perfectly edible solid food per person in 2019 (Ooijendijk et al., 2019). This amount equals 9.5% of all grocery products consumers buy. This essentially means that consumers throw away one out of every ten grocery bags full fresh of groceries.

Among the most wasted food products (which are categorized as unprepared food) in the Netherlands are bread, dairy, vegetables, fruits and meat (van Dooren & Mensink, 2018). These five product categories make up 63% of all food waste that the Dutch consumer generates (see figure 3). These five categories, especially dairy and meat are also found to have the biggest environmental impact based on the amount of resources needed to produce them (Ritchie & Roser, 2020).

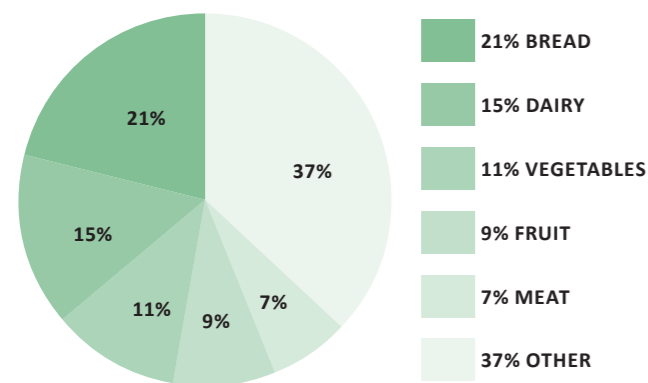


Figure 3: Most wasted food products. Percentage of waste, per product group. Source: van Dooren & Mensink (2018).

Apart from the negative impact food waste has on the environment, for the consumers it is also a pure waste of money. Based on what consumers waste, Temminghoff (2019) calculated that the value of 1 kg of edible food waste is set at €3.49. This means every Dutch consumer threw away more than €120,- worth of edible food last year. Although there are significant differences among households, this translates to €260,- per year for an average household in the Netherlands according to Ooijendijk et al. (2019).

Fortunately, the amount of food products being wasted has been decreasing since 2016 (van Dooren, 2019). Compared to 2016, consumers have reduced their food waste by 17%. Although things are going into the right direction, we are far from done. According to the Director of Samen Tegen Voedselverspilling, Toine Timmermans, ‘[...] at the same time, there is still much to do. In the supply chain, and certainly also with the consumer. The biggest gain is still at the consumer’s home.’ (Samen Tegen Voedselverspilling, 2020).

Interestingly, the amount of prepared food waste (food products that have been turned into meals) has instead increased since 2016 from 4.3 kg to 10.1 kg. Although the study by van Dooren (2019) does not provide any explanation to this increase, there seems to be an increased reluctance towards consuming leftovers.

According to van Dooren and Mensink (2018) seven out of ten Dutch consumers are willing to do something about their food waste yet the numbers do not show this. According to their study ‘in reality consumers are faced with several obstacles in preventing food waste, including buying or preparing too much of a specific product and incorrect storage habits.’ This project tries to address some of these obstacles and provide a solution that helps towards achieving the UN goal of 30% food waste reduction by 2025.

01.3 The Client: I Change

Trying to change the food system, and eliminate food waste is the Delft based organization I Change. I Change started from one vision from founder, Mirte van Eijl after she was confronted with the large-scale food waste practices of retail industries, a side of the food chain that is normally not visible to the average consumer. These insights fired up the entrepreneurial spirits and I Change was born. The aim of I Change is to make Delft into a minimal food waste role model, providing a practical example to other municipalities on how to reduce food waste and ultimately transform the entire food chain in the Netherlands.

I Change describes itself as the breeding ground that facilitates the transition of the entire food chain towards a healthy circulatory system. In this system, they envision, every stakeholder in the supply chain is connected and takes its responsibility to reuse and recycle where possible. This transition, according to them, is necessary to regain our sense of value for food. By making every chain in the entire process aware of its responsibilities and showing them the ecologic and economic opportunities, I Change believes it can be done.

The way they operate is straightforward. I Change opens up their breeding ground and network to entrepreneurs with ideas that want to reduce food waste. These ideas are developed further together with stakeholders in the supply chain or external parties.

Most of the concepts are implemented on their own breeding ground to prove they are viable. Ideas that cannot directly be implemented within their breeding ground are often continued by external developers, which I Change assists where it can. The resources needed to make these initiatives come to life they are currently obtaining from local government funding and the Rabobank, but I Change is working hard towards financial independence.

To achieve this, I Change follows their own developed circular business model (see figure 4). Their system revolves around the inner circle, consisting of the I Change organizational team. As the figure states, the purpose of this circle is to create ideas, communicate them to the right stakeholder and inspire and stimulate them to initiate further development. The I Change support circle is there to make sure the resources to make the concepts succeed, are there. Concepts that cannot be developed internally are taken on by external developers that then implement them using the support of the I Change family. When this concept is implemented, a share goes back to I Change. Then there is the community. This is where I Change aims to inspire and gain revenue. The community consists of normal consumers that share the same vision as I Change and want to reduce their food waste. To do this they can become ambassadors or ‘friends of’, where in exchange for a monthly donation they receive various tips and knowledge on how to reduce their waste, allowing them to earn back their monthly ‘investment’.

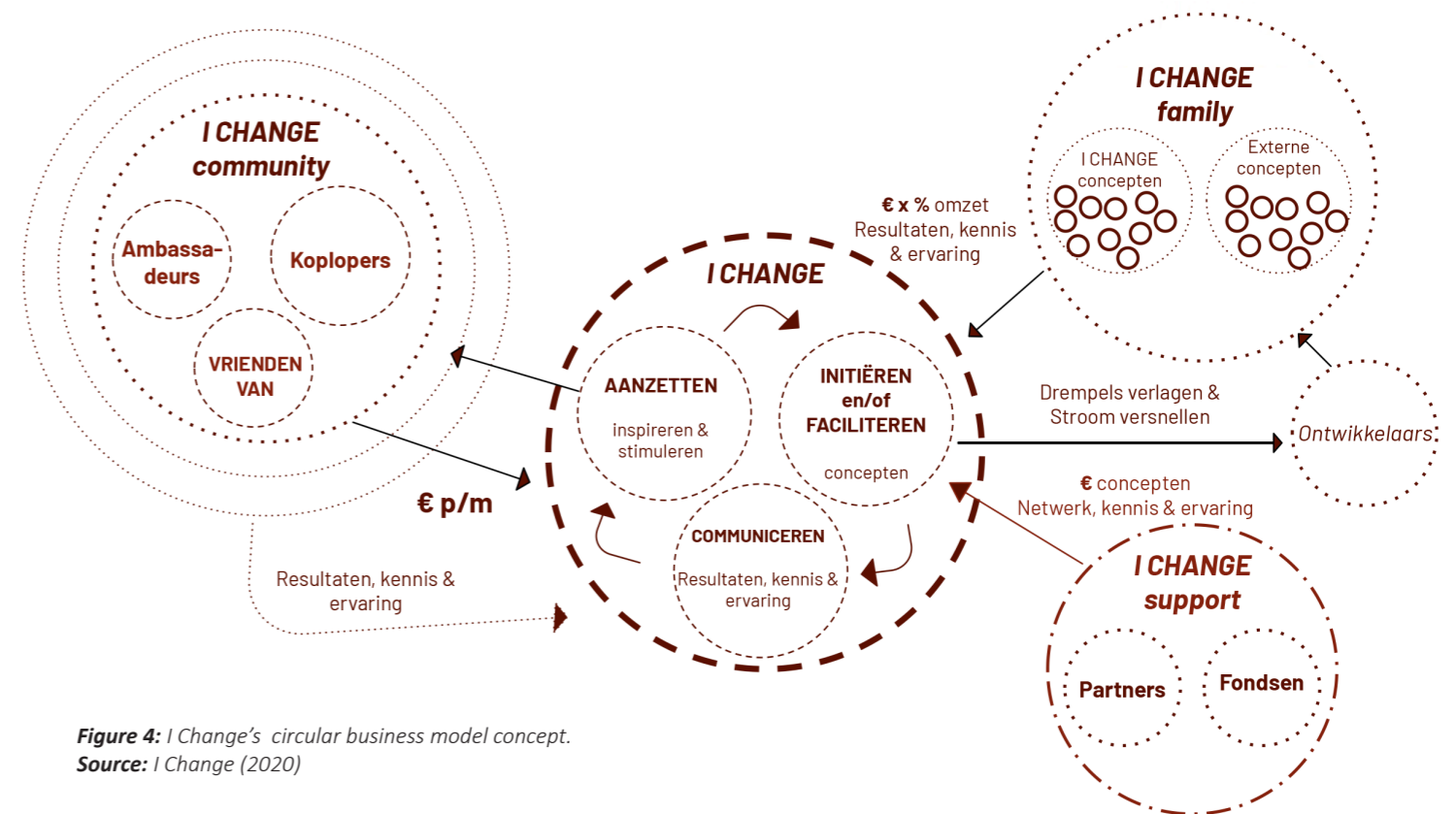


Figure 4: I Change’s circular business model concept. Source: I Change (2020)

01.2.2 Key Takeaways

- The percentage of **food being wasted** by the average Dutch consumers has **decreased** over the last few years.
- The amount of **prepared food waste** (which can be seen mainly as leftovers) has **significantly increased**.
- **60%** of consumer food waste is said to be **avoidable**.
- Bread, dairy, vegetables, fruits and meat are the five product categories that make up 65% of all consumer food waste. **Dairy and meat** furthermore have the **biggest environmental impact**.



01.3.1 Their Initiatives

In the past year that I Change has had their breeding ground, it has been able to set up many concepts through this method. For example:

- Every Wednesday I Change hosts a ‘culture cook’ that cooks a dish from his or her country to anyone that signs up, the only requirement being that the cook has to use at least 60% of wasted products in their dishes.
- Once a month they host a food rescue dinner during which a culinary three-course meal is prepared by a Michelin Stars chef, again using mainly leftover ingredients. Participants pay what they believe the evening was worth.
- On the breeding ground itself I Change has a vegetable garden, where visitors can rent a piece of land to grow their own vegetables, they have a food waste market stall where these produce are sold and they host various workshops, lectures and other events to make consumers more aware about food and food waste.

All these initiatives help people to regain value for food, and helps I Change to work towards ‘making Delft a minimal food waste municipality’.

01.3.2 Their ‘Problem’

In order for I Change to reach their goal of making Delft a minimal food waste municipality, a lot of work is still needed. Although they have quite some initiatives and have grown significantly in the last year, their target audience is rather small and built up of consumers that, in my opinion, already actively want to engage in food waste reducing practices. I Change is mainly focusing on raising awareness around food waste and is showing people what is still possible with ‘wasted products’.

Although this is very much necessary, in order to tackle the problem and achieve their goal of a minimal food waste municipality, they also need to reach the people of Delft that are less willing to actively do something about their food waste.

This project aims to do this by looking at the origin of food waste and developing something that also makes these motivated consumers of Delft more aware about the problem and willing to do something, in a way that is convenient.

01.4 The Aim Of This Project

This project aims to provide I Change with a product/service that facilitates consumer food waste prevention by addressing the household routines. The solution should be economically viable and allow I Change to reach a bigger target audience.

In order to achieve this aim, the project aims to answer the following questions:

- Where within the consumer household does food waste occur?
- Why do consumers waste food?
- Who are the biggest food wasters, which types of households waste the most?
- What is already being done to prevent it?

01.5 The Approach

In order to achieve the previously set aim and answer the research questions this project will follow the human centered triple diamond process (Buijs and Meer, 2013). This process is in total built up by six phases (see figure 5).

During the **discover** stage mainly desk research and interviews with relevant parties will be conducted on the topic of consumer food waste. Together with the necessary field research, a complete understanding of the context around the topic will be created. In the **define** stage the outcomes of this phase will be used to formulate a design challenge which will serve as the starting point for the ideation phase.

In the **design** stage, creative sessions will be held after which several concepts will be developed that are aimed at reducing consumer food waste.

These will be tested with consumers to gain insights on their use and success. Based on the results of this testing phase the most promising concept will be chosen. This marks the beginning of the **decide** phase. This concept will be further developed and iterated on based on the gained feedback. In the **develop** stage an implementation strategy will be developed for the product and finally the **deliver** stage will conclude this project and critically discuss several aspects of the product and project.

01.6 The Impact Of The Covid-19 Pandemic

The Covid-19 pandemic has had a rather interesting impact on the amount of food consumers waste. It is assumed that the strict regulations regarding grocery shopping and having to spend more time at home, especially in the beginning, forced consumers to re-think their food situation. According to a study conducted in the UK (Restorick, 2020) this led to consumers being better prepared and making more conscious decisions when doing groceries. The study found that 48% of the participants (n=2000) valued their food more and threw away less (Restorick, 2020). Over 50% of them turned out to plan meals more carefully and deliberately and 41% is using leftovers in a better way. Furthermore, Restorick (2020) found that 44% of people who partook in the questionnaire said to enjoy cooking more because of the crisis.

Whether these results are solely linked to the Covid pandemic is unclear, mainly because online shopping has also seen a rapid growth since the outbreak. The revenue of online supermarkets has grown by 40% (Radar, 2020). This growth may partially explain why consumers throw away less food, simply because online shopping requires more deliberate planning.

The big question here of course is: (How) can this positive change of behavior be maintained once the pandemic ends and consumers start their normal, busy, routine lives.

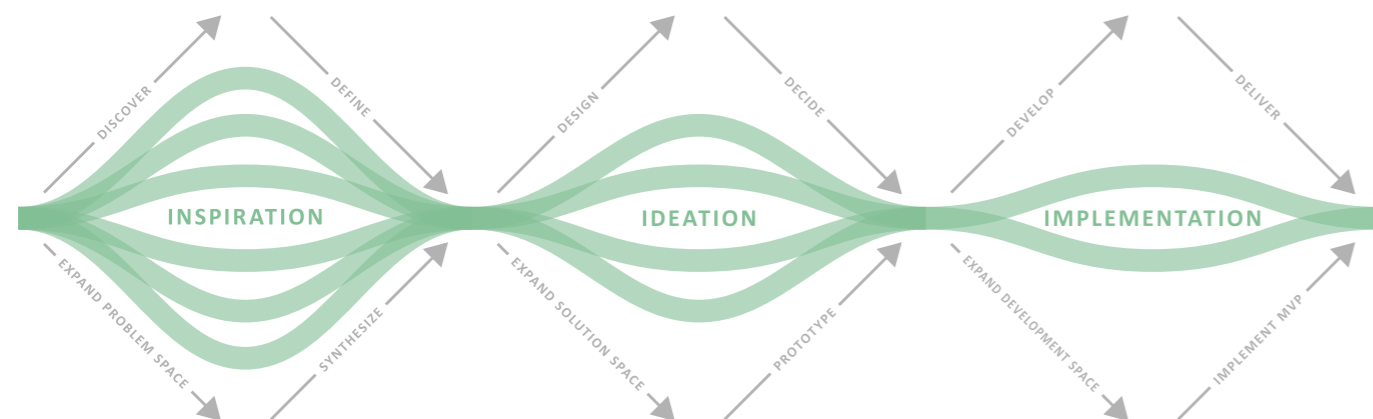


Figure 5: Triple Diamond Design Model.
Source: Buijs & Meer, 2013

02. Discover

This chapter aims to deepen the knowledge on consumer food waste by taking a synthetic approach towards the problem. This is done by answering the previously formulated research questions. The chapter uses the key insights from each of these questions as input for a customer journey. The customer journey, the final part of this chapter, is made to identify the key opportunities that could facilitate consumer food waste prevention.

02.1 The Household Stages

This chapter dives into the different household stages and corresponding routines in/through which consumer food waste occurs. This is crucial because these insights help to find opportunities to prevent it. In order to keep the story clear, the chapter also briefly touches upon some of the reasons these consumer routines are causing food waste, however this will be further elaborated on in chapter 02.2.

02.1.1 The Consumer Household Stages

According to Geffen et al. (2020) food waste is the ‘*the unintentional result or consequence of several household routines*’. In order to understand what these ‘household routines’ are, it is key to look at the different stages which food goes through and which food practices (routines) are present at each stage. Based on a study by Boyd and McConocha (1996), who developed the household management model, the main different household stages are said to be planning, provisioning, storing, preparing, consuming and disposal.

Planning is categorized as a separate stage, which it is, however within each stage of the household model, planning routines are present (see figure 6). Secondly, although each stage has its own routines that are responsible for food waste, the stages influence each other, forming a ripple effect. Choices made in the early stages (e.g.: not making a shopping list) have an impact throughout the each stage of the entire chain, eventually leading to an increase in edible food being disposed of. According to Setti et al. (2018) this problem exists because there is a gap in awareness of how early stage decisions contribute to the outcome of food waste.

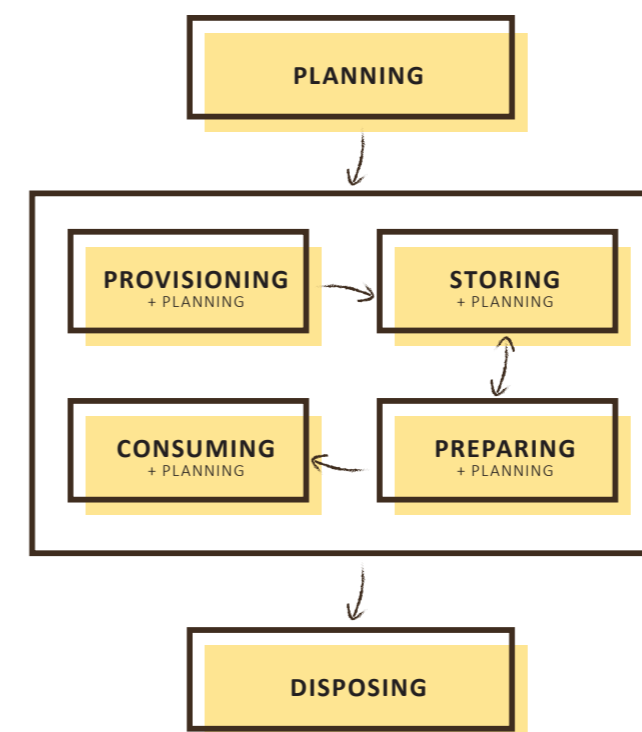


Figure 6: The stages of the household management model.
Source: Boyd & McConocha (1996)

PLANNING

This stage refers to anything around managing food before it enters the household. There are different routines within the stage that can help to do this effectively. The most important ones are setting up meal plans, making and using shopping lists including quantities. Furthermore, checking which products are still in stock at the house, the amount of storage space available for new products and the shelf life of current products all help. It was found that there is a general lack of these routines among consumers. According to Farr-Wharton et al., (2014), most consumers are improvising when planning shopping trips. Their focus of food related routines is on the pleasure of eating it and having flexibility in choice. These are both high ranked values that limit effective planning.

Planning routines are said to have a significant influence on the amount of food waste that is generated. Setting up weekly meal plans, making (and sticking to) shopping lists and checking stock can reduce food waste by up to 50% according to Ooijendijk et al. (2019).

However, the percentage of consumers that follow one or more of these routines is rather low. A study conducted by WasteMINZ (2018) looked into which of these so-called ‘good food habits’ consumers implemented and concluded that just 36% of the respondents plan a weekly menu or meal and 42% of consumers make shopping lists before doing groceries. Of them, 55% of participants actually stick to these plans. These numbers however are much better compared to a similar study in 2014. Many of the ‘good food habit’ routines have seen an increase by up to 50% since then (WasteMINZ, 2018).

Although these habits do not directly lead to an increase in food waste, a lack of right planning routines does create a ripple effect further down the line. Not using a shopping list or not checking what you still have in stock leads to things such as impulse buying or over purchasing, which ultimately leads to an increased amount of food waste (Quested et al., 2013).

Similarly, an Italian study from 2018 concluded that in order to influence household food waste generation effectively, upstream phases need to be addressed. Planning and also Purchasing (Provisioning) are seen as the critical moments that contribute most to food waste generation downstream (Setti et al., 2018). Consumers lack awareness of how these decisions influence their food wasting behavior.

Setti et al., (2018) state that initiatives aimed at enhancing the awareness and knowledge upstream can have a positive effect on consumer belief, attitude, motivation and behavior, downstream.

PROVISIONING

Provisioning refers to all ways food can enter the household. The most common ways of course being food that is bought at stores such as supermarkets, butchers the farmers market but nowadays more and more online.

Critical provisioning routines here are impulse purchases, buying (too) large quantities or discount food products (Evans 2011; Graham-Rowe, Jessop and Sparks 2014). Buying large quantities is especially a problem for smaller households. Bigger quantities are not always used completely and difficult to portion, which means they are stuck with a small unusable portion, which is often wasted. Furthermore, consumers that have a higher tendency to impulse purchase, generally wastes more food (Stefan et al. 2013).

Whether discount pricing increases food waste is uncertain. A study conducted in Finland (Koivupuro et al. 2012) has not shown a significant result. Instead, according to them, people that focus on discount products, wasted less. Chapter 02.3 will dive a bit deeper into the problems in this stage.

STORING

The storing stage and the corresponding routines refer to the way consumers store their groceries and leftovers. Storing products and meals correctly can extend their shelf life significantly, doing it incorrectly or suboptimal increases the amount of food that is wasted. The two main problems that occur here are chaotic and suboptimal storage. Although some of these are linked to a lack of knowledge or awareness, others are just a result of unwillingness.

There are several underlying routines that influence waste in this stage, the most significant one being how consumers store their groceries. According to a study in the UK, consumers are lacking the knowledge on how to optimally store food products WRAP (2015). Many consumers have developed their own preferences when it comes to where or how to store products, while these are often far from ideal. Consumers might store products in the fridge or freezer that should not be stored there, or when they should be stored there, place them in suboptimal places (e.g.: placing fruit or vegetables not in the designated crisp drawers).

An interesting example of this 'lack of knowledge' is the fruit bowl. Many of the most eaten fruits such as apples, pears are in fact better kept cold, in the fridge, to prolong their shelf life (Voedingscentrum, 2020). Many consumers however place them in fruit bowls, which are often located on the kitchen table or counter. While having a fruit bowl present encourages children and other household members to eat more fruit (Evans, 2012) it decreases the shelf life of the product significantly. Storing apples in the fridge can double their shelf life (Voedingscentrum, 2020).

Common routines consumers have with storing leftovers are not labelling them, suboptimal wrapping them and/ or leaving them somewhere in the back of the fridge / out of sight (Quested et al., 2011). The problem here is that these routines increase waste significantly.

Consumers tend to forget about products or meals, which they have placed in the back of the fridge eventually these get spoiled which also affect the general quality and air circulation in your fridge, decreasing the shelf life of other products (Evans 2012).

The amount of available space often also plays a role. Having a small fridge or freezer changes how much products can be stored and thus the routines consumers have (Cox and Downing 2007). Some products will have to be stored elsewhere, which can result in decreasing a product's shelf life. According to a study by Waitt and Phillips (2015), these appliances play a crucial role in our modern households. They enable convenient living, freshness and safe food.

Although bigger fridges and freezer allow more food to be stored in them, this is not always a good thing. Having more space is also not the solution, free space often leads to more food being stored there, increasing the disorganized feeling, resulting in more food ending up being wasted as it had become 'lost' or got spoiled (Farr-Wharton, Foth, and Choi 2014).

Basing whether or not food products are still safe to eat on date labels is another wasteful routine. Consumers often stick to 'best before' or 'due by' date labels instead of using their senses. This while products are often perfectly fine to eat, days sometimes even weeks after the dates have ended (Terpstra et al., 2005).

Generally, consumers already tend to have a negative attitude towards leftovers (Terpstra et al., 2005) which makes it even easier to neglect them and eventually throw away.

PREPARING

This stage refers to handling food products, mainly through cooking routines. Routines that are crucial in this stage are cleaning, cutting and or preparing ingredients as well as measuring quantities and following certain steps of a cooking process. Knowing how to do all these steps is key to keeping food waste to a minimum.

Feeling comfortable planning and executing this entire process and knowing how to put every single element into a meal. Having a feeling and understanding of quantities and ratios means being able to adapt dishes so that you do not end up with too many leftovers ingredients.

A lack of cooking skills is also seen as a significant routine that is contributing to an increase in consumer food waste. A lack of skill may result in food not tasting according to the wishes or standards of the consumer, which often means it will be discarded (Evans, 2011).

Some consumers have the tendency to only use ingredients partially, if indicated on the recipe, which increases the likelihood that the leftover ingredient ends up being wasted (Farr-Wharton, Foth, and Choi 2014).

Being left with a half used ingredient that you perhaps do not use that often, means finding a new recipe in which this ingredient can be used. This takes effort and might lead to other ingredients being used partially, repeating the process (Evans, 2011). Paying attention to quantities is something that is rarely done. This happens either intentionally or unintentionally (Williams et al. 2012). When consumers make dinner for their household or friends and family they prefer making sure there is enough for everyone. Since you can never know how much everyone will eat, overcooking if something that happens regularly. The food that is leftover is not always stored, and even if stored not always eaten.

CONSUMING

The consuming stage revolves around the eating routines. Crucial here is how households deal with plating up and finishing it, dealing with members of the household disliking some food and how they deal with pan leftovers.

As mentioned in the previous section, households overcook and dealing with this highly determines how much food is wasted in this stage. Simple household rules on 'do not plate up too much and finish your plate' or 'eat your vegetables' determine how much is wasted. Having small children or fussy eaters influences this and increases the amount of food waste.

Similarly, as a result of the lack of knowledge on cooking, food might end up not being tasty or under/overcooked. This often means it will be wasted more easily (Evans, 2011).

Dealing with the pan leftovers is also key. Some consumers don't even store or eat leftovers and others forget about them due to suboptimal or chaotic storing. Consumers may also lack the skill to determine whether something can still be eaten (Watson and Meah, 2012).

DISPOSING

This stage, the stage at which food is wasted, is a consequence of all the different food waste increasing routines within each stage. As can be concluded by now, the decision to waste can be made after every stage.

However even when disposing there are still different crucial decisions to be made. Food can be wasted by throwing it in the trash, which is what happens with more than 77% of all solid food waste (Ooijendijk et al., 2019). Of this 77%, only 15% is actually thrown away in the organic waste bin, where it should be.

The remaining 23% of food is wasted through the sink or toilet, fed to animals or composted (Ooijendijk et al., 2019). Although this is not a common routine and many consumers do not have the ability to compost their food waste, this would be a better option, since it prevents food from ending up in landfills and instead is used as something useful.



02.1.2 Key Takeaways

- **Upstream phases**, such as planning and storing are **crucial stages** that have a significant effect on the amount of food waste generated downstream.
- A lack of proper upstream routines has a **ripple effect** downstream, meaning they lead to an increased amount of food waste at the end.
- Many consumers still **lack the 'good food habits'** such as making shopping lists, checking stock and making meal plans.
- Addressing the lack of proper planning routines can lead to a **potential food waste reduction of 50%**.
- Consumer **lack skill and knowledge** on where and how to store various food products.
- **More storage space** does **not** have a **significant** effect on the reduction of food waste.
- **Improving the existing routines** might be a crucial step towards changing the food waste problem.
- The project will **not focus on** finding solutions that are implemented in the **provisioning stage** because this stage mainly takes place outside the the consumer's household.
- The project will **not focus on** finding solutions for the **disposal phase**. Solutions for this phase cannot be considered to be 'preventing' food waste.

02.2 Conflicting Behavior

Although the previous chapter already briefly addresses some routines (essentially behavior) that influence the generation of consumers' food waste, it does not go into much further detail on why consumers waste food. This chapter aims to answer that question, in order to do this, it uses the Motivation-Opportunities-Abilities (MOA) model (see figure 7). This model addresses the motivation, opportunity and ability aspects, which, in this case, allows to map out the behavior of consumers towards wasting food. The chapter will not go into extensive detail about the individual factors of the model, but it is important to understand that within the motivation factor consumers experience conflict. This conflict negatively influences their intention to do 'good' (waste less food), leading to an increased wasteful behavior. In order to prevent consumer food waste, this factor should be addressed.

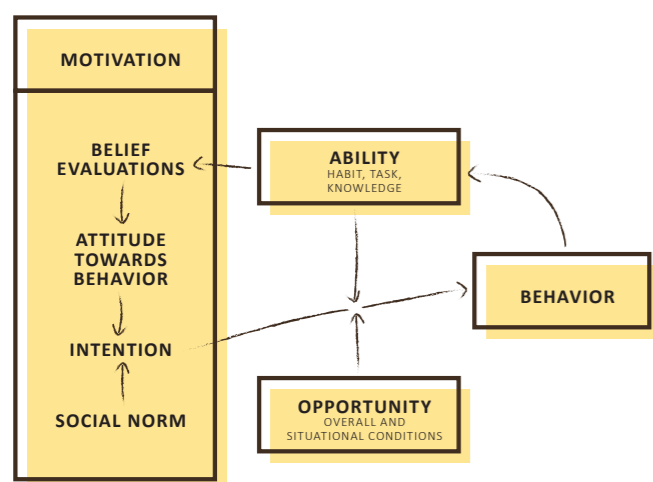


Figure 7: The MOA model, useful to understand the food waste behavior of consumers. **Source:** Ölander & Thøgersen (1995).

02.2.1 Motivation

Motivation describes the needs and wants of an individual and how they are influenced. As mentioned, motivation consists of a conflict. On the one hand consumers are concerned about the impact food waste is having, and are willing/ have a desire to do something about it. On the other hand consumers have several goals they are trying to achieve within their households. This often interferes with their willingness to do good, keeping them from actually, in this case, reducing their food waste (Graham-Rowe, Jessop & Sparks, 2014). The three factors that determine the motivation of consumers towards food waste reduction are found to be attitude, awareness and social norm (van Geffen, van Herpen & van Trijp, 2016).

ATTITUDE

Attitude, in this context, refers to how consumers feel and act towards (wasting) food. This attitude is already determined at an early stage, when planning and provisioning. Food products are considered low involvement products. They are low in cost, there is not much risk involved in buying them and they are considered a routine response behavior (Kotler & Armstrong, 2010).

Because of this, consumer value towards food is low. This means the little consideration that goes into buying it, also goes into disposing food products. Combining this with our already impulsive early stage provisioning behavior, contributes to a significant increase in consumer food waste.

In contrast to this however, are the negative feelings consumers are experiencing when disposing food products. Consumers experience a feeling of guilt and shame when throwing away food that is still edible (Graham-Rowe, Jessop & Sparks, 2014). This feeling comes from the fact that consumers know (ethically) it is not right to throw food away. According to a study conducted by van Dooren and Mensink (2018), 67% of Dutch consumers rank this as their highest motivation to why they would consider reducing their food waste.

Another high-ranking reason for consumers to reduce food waste is the fact that food waste is seen as an unnecessary loss of money. 61% of the consumers that participated in the study of van Dooren and Mensink (2018) argued that it is just more economical to use everything.

A third crucial factor that plays a role in the attitude of consumers to waste food is linked to having known times of crisis, scarcity or hunger. This is something that has undoubtedly happened to some consumers during the Covid-19 pandemic. When a significant negative change in the household financial situation occurs or (e.g. someone loses a job) this generally changes the household food routines. Households start cutting down on costs, by for example planning better and eating leftovers, resulting in less waste Van Dooren and Mensink (2018).

One of the main competing goals for not adopting food waste reducing behavior is found to be convenience. According to (Graham-Rowe, Jessop & Sparks, 2014) *'inconvenience was a widely cited reason for not adopting household waste minimization behaviors.'* Consumers expect things to be effortless and contribute to an easy life. This goal explains why consumers buy too much, namely avoiding unnecessary extra trips to the shops and why they throw away food that is still safe to eat, avoiding the risk of the food making them sick or being unhealthy (Evans, 2012).

The desire to be a good provider is seen as the second highest conflicting attitude (Graham-Rowe, Jessop & Sparks, 2014). A good provider is seen as someone whose goal it is to make sure everyone in the household is nourished, eats healthy and varied food. Generally for consumers this means having an abundance of food at the household, making sure everyone has something to their liking. Dittmar (2014) talks about this attitude as a way to be identified by others, this will be further discussed in the social norm section.

Similarly, this goal explains why consumers cook too much. This is something that is either done on purpose, being prepared to have unexpected guests over or undeliberate, not knowing how to deal with quantities and ratios. Food that is prepared but not directly consumed has a high chance to end up being wasted. The main reason leftovers are not consumed, apart from avoiding the risk to become sick, is the unwillingness of consumers to eat food that lacks taste and freshness (Evans 2012).

This lack of taste and freshness however does not only apply to leftovers. Eating in general should be a pleasurable experience and when food products or meals do not taste according to the preferences or expectations of the consumer(s) at that moment, they are often not eaten and have a chance to eventually be thrown away (Graham-Rowe, Jessop & Sparks, 2014). This scenario often happens when new products are bought, with the expectation you or the person you have bought it for will like the product or dish. Taste but also preferences change over specific periods of time, which often makes it difficult to make correct predictions and finish the food in time. *'If, in the morning, I feel like having cauliflower, well then I'm going to get cauliflower that day' ... 'If something is left over I throw it away.'* (van Geffen et al., 2020).

Lastly, coming back to the earlier described feeling of guilt and shame towards throwing away food, it often does not lead to a change in behavior for many consumers. When it comes to leftovers, some consumers are known to manipulate the food instead, allowing them to lower their feeling of guilt and make it 'OK' to throw them away (Hval, 2012). This manipulation is often done by sub optimally storing leftover food items in the fridge, out of sight and letting them spoil. Once the food becomes 'inedible' according to the consumer's preferences, it is okay to throw it away without feeling guilty when doing it (van Geffen et al., 2020).

AWARENESS

To an increasing extent, consumers are becoming aware about the environmental problems and how food waste is contributing to it. According to van Dooren and Mensink (2018), 93% of consumers in the Netherlands are aware about how much food an average Dutch household throw away, yet only 2 out of 3 consumers expressed awareness about their own food wasting behavior. Although aware, consumers generally do not think or believe they waste too much. Several studies have concluded that there is a lack of awareness when it comes to how much households think they waste themselves (Brook Lyndhurst, 2007; WRAP, 2007). Households felt as if *'their own behaviour did not contribute much to the food waste problem.'* (Graham-Rowe, Jessop &

Sparks, 2014). Instead, they often blame other consumers to waste much more than they themselves do.

This behavior however makes sense, since food waste is seen as an *'unintentional result'* of several household routines (Geffen et al., 2020). This because wasting food is done a bit at a time and not always visible. Food waste, as was found in chapter 01.2.1, is often being mixed with general household waste. This makes it understandable that awareness on how much is actually wasted, is lacking.

Increasing awareness by focusing on the right motivations has proven to be effective in reducing food waste (Quested et al., 2011). The Love Food Hate Waste initiative, which will be further discussed in chapter 02.5, has used this technique in several of their campaigns. By creating awareness campaigns that showed consumers *'You could save up to £50 per month by throwing away less food'*. According to a study by WasteMINZ (2018), 52% of the consumers that were familiar with the campaign, felt as if it had had an impact on their food wasting behavior.

Another awareness campaign of Love Food Hate Waste that has shown to have a positive influence was focusing on the social consequences. It referred to the fact that consumers are wasting food while many other people are undernourished, referring back to the feeling of guilt and shame when throwing away food.

SOCIAL NORM

Social norm describes the perception of a consumer's behavior compared to his/her peers. As already briefly touched upon in the previous section. Social norms can be split up into injunctive and descriptive. Injunctive refers to a consumer's perception that others believe food waste is wrong while descriptive refers to the extent of which consumers think others prevent food waste.

This has shown to cause mixed results. On the one hand wasting food, to a certain extent, is seen as acceptable behavior because consumers perceive it as being inevitable (Graham-Rowe, Jessop & Sparks, 2014) while on the other hand it is seen as unacceptable to throw away edible food. The reason these mixed results exist may be the fact that food waste is an in-home event, which often lacks social interference.

A situation in which this is present is when households host events. In these situations, there is a desire for households to have plenty to plate for their guests, making sure no one goes home hungry, referring back to the desire of being a good provider. This *'making sure there is plenty'* is however also to avoid embarrassment of not having enough. In this context, leftovers are not important. As concluded by Graham-Rowe, Jessop & Sparks (2014) this behavior also means not always storing or keeping leftovers after dinners with guests. The main reason is that in these situations spending time with guests is much more valuable. Consequences of this are postponing cleaning, which means leaving leftovers out in the open for too long. This of course is lowering the willingness for consumers to still pack and consume them.

02.2.2 Ability

Ability, according to van Geffen, van Herpen & van Trijp (2016), refers to two factors: knowledge and skill. Both of these are needed to make sure less food is wasted. Knowledge determines how and where we store products, how we interpret a products edibility and what we do with leftovers. Skill mainly refers to handling the food products in the household food management stages. According to Cox and Downing (2007), skills enable us to for example make and use shopping lists, set up meal plans but also how to prepare food and create new meals using leftover ingredients. In general, a lack of one or both of these routines, in many cases leads to an increase of food waste, which could have been prevented.

According to Quested et al., (2011) consumers are unsure how to effectively plan food purchases or how and where to store products. Because of their desire to eat healthy and varied food consumers tend to purchase many short shelf-life products such as fresh fruits and vegetables (Evans, 2011). The problem with this is that, because consumers often experience a busy lifestyle, they purchase these products in abundance and all at once. Since they do not know how these products are best stored or how to preserve them to prolong their shelf life, this leads to fresh food eventually having to be thrown away because it either has gone bad or has lost its healthy or fresh look.

In an attempt to increase a products shelf life and keep products fresh, some consumers tend to unwrap or -pack products before storing. Unaware that packaging, in which the product is bought, already does this (Aschemann-Witzel et al. 2015; Graham-Rowe, Jessop, and Sparks, 2015).

Next to this, consumers also tend to lead themselves on by date labels too much, while they often lack the knowledge on how to interpret them. Consumers often determine food edibility based on whether or not it is past its due date, instead of looking, smelling or tasting the product (Evans, 2011). Although date labels indicate before which date products are best consumed, things such as storing have a big impact on a products' shelf life, making it possible to significantly increase the shelf life, far past the date.

A lack of skill is often found in the inability of consumers to cook. Consumers end up wasting food because it is not prepared well: undercooked, overcooked or burned. Even when the food is prepared properly, a lack of flavor can also lead to food waste (Evans, 2011). Simple because the dish is not tasty enough according to the wishes of the consumer.

Even consumers that are capable of cooking waste. Many still lack the skill and knowledge to use leftover ingredients or meals to create something that is still tasty and fresh (Aschemann-Witzel et al., 2015).

02.2.3 Opportunity

Opportunity, according to Shwom and Lorenzen (2012) refers to *'the availability and accessibility of materials and resources required to change behavior'*. Three elements that are seen as most influential are: Time and Schedule, Material and Technology and Infrastructure (Darnton & Evans, 2013).

TIME AND SCHEDULE

Time and schedule are characterized by the busy lifestyles of consumers. This aspect was already raised before, but it highly determines a consumer's day-to-day routines. As mentioned earlier a consequence of this is buying too much to prevent running out of food in case unexpected events such as having to work overtime, or spontaneous social appointments, having someone over for dinner (Evans, 2011). A shortage of time also leads to ordering takeaway instead of cooking, especially when a lack of cooking skills is present. The choice to order take away or ready to eat however can influence the amount of food waste. Making such a decision spontaneously often means that the ingredients for the dinner that had already been bought, are left in the fridge (Quested et al., 2013). This increases the change of this food ending up being wasted. Van Geffen et al. (2020) also concluded that *'due to busy lifestyles even motivated and skilled consumers end up wasting food.'* Solutions therefore need to be easy and accessible otherwise consumers will likely not engage.

MATERIAL AND TECHNOLOGIES

This aspect refers to things such as little storage space or a low quality fridge or freezer. Having good equipment is important to prolong a products shelf life and thus reduces the amount of food that eventually has to be thrown away. On the other hand, having plenty of space is often an excuse that allows for more purchasing. A big freezer for example does allow for more storage, but leads to consumers forgetting about what is in them (Janssen et al., 2017). This eventually increases the amount of waste because of the many 'Unidentified Frozen Objects' (Love Food Hate Waste, 2020).

INFRASTRUCTURE

Infrastructure in this case refers to the quality and quantity of products sold at retail outlets. For example, the number of supermarkets close by and the opening hours, influences the amount of food waste that is generated. When many stores with long opening hours are within short range of the consumer's house, consumers tend to go more frequently, purchasing more deliberately van Geffen, van Herpen & van Trijp (2016). However, stores in short range also lead to more last minute impulse purchases.

On the other hand less stores, especially in combination with a busy lifestyle leads to consumers buying large quantities and fresh produce just once a week, which also has a negative influence on the amount of food being wasted (Evans, 2011).



02.2.4 Key Takeaways

- Addressing **motivation is crucial** because it deals with a **conflict** for the consumer.
- The presence of **competing goals** seems to be the **main issue** why consumers are not effectively reducing their food waste reduction.
- There is a **general awareness** of the **environmental problems** surrounding food waste and **consumers** show a **willingness** to do something against it. However there seems to be a **lack of awareness** when it comes to **how much food waste** is generated by a consumer's own household.
- **Groceries** are low involvement & low risk products, this creates the **low value** consumers have towards them, increasing this value might be an interesting direction.
- A feeling of **guilt /shame** when **wasting food** and the fact that food waste is (ethically) **not right** are the highest ranked motives consumers have to reduce their food waste.
- The third highest motive is the fact that **food waste** is seen as an **unnecessary loss of money**.
- **Convenience** was found to be the **main reason consumers waste food**. It is therefore crucial that solutions that prevent food waste, are as convenient.
- Being a **good provider and being prepared** for unexpected events are the **second and third highest ranked reasons**.
- **A busy lifestyle** was found to be the most significant factor that **increases food waste**, even for motivated and skilled consumers. In order for consumers to engage with the solution, it needs to seamlessly fit within this lifestyle.
- Consumers tend to throw away **leftovers** because of a **general dislike** towards eating them and to avoid the risk of becoming sick.
- Consumers **manipulate** food **leftovers** to make it **acceptable** for themselves to **throw them away**.
- **Addressing** the **right motives** for consumers to reduce food seems to be **effective**, especially when **positively** and **encouragingly framed**.
- **Consuming** is generally seen as a **pleasurable experience**, more important than cleaning up and storing leftovers.
- **People care** about what **other people** do and **think**. Using this element might motivate consumers to do something that conflicts with their motivation simply because others do it as well.
- **Consumers**, in general, do **not** have the **goal** of **reducing** their **food waste**, food waste is the **collateral results** of the goals consumers have in all other stages.
- Consumer generally **lack skill and knowledge** when it comes to **how and where to store** products as well as how to prepare reuse food products.

02.3 The Wasters

Although indirectly many stakeholders can be identified, the chapter solely focuses on the two that play the most significant role in the generation of consumer food waste within the household: these are the consumers themselves and supermarkets. The first part of this chapter discusses the role of supermarkets. The second part of this chapter dives deeper into the different types of consumer, looking at which demographics have a significant influence and how.

02.3.1 The Supermarkets

A separation is made between physically grocery shopping and online shopping (e.g.: via services such as Picnic or Pieter Pot).

PHYSICAL GROCERY SHOPPING.

Supermarkets are accomplices in a relatively big share of consumer food waste. This is mainly due to the retail/marketing tricks they have implemented. These tricks affect consumers significantly, increasing both their number of purchases and the quantities per product, thus increasing the amount of food that is wasted (Crouch, 2019). Essentially, supermarkets make consumers buy products they were not planning to buy, which is the main reason waste increases. Several significant techniques that many of the well-known supermarkets use on a day-to-day basis, according to Mutton (2019) are:

- **The store's layout.** The entire layout of a supermarket is a marketing trick used to make consumers buy more. Playing slow music (making consumers spend more time in shopping and thus spending more), putting healthy produce at the front of the store (making consumers feel less guilty to buy unhealthy snacks later on) and placing popular combinations next to each other (encouraging consumers to buy both products) all contribute to unwanted purchases, that again increase the chance of food being wasted.
- **Bulk sizes.** Supermarkets lure consumers into buying bulk quantities by lowering their prices. For example buying three products is made slightly more expensive than buying one, triggering consumers to purchase them, because of getting your money's worth, because it is relatively a bit cheaper. Buying this bigger quantity now means having too much at stock which then has a chance to become too much to be consumed, making it end up as waste.
- **Discount deals.** Similarly, confronting consumers with promotion deals such as: '50% off on the second product', 'buy 1, get 2' and 'top deal', consumers are tricked into spending money on products they did not intend to buy, because now they are cheap and they might use them in the future. However, these products are often not consumed in the future.

These tricks have existed for many decades and are most definitely not going to change. However the past few years, online grocery shopping has become more popular.

ONLINE GROCERY SHOPPING

Many of the well-known supermarkets now have home delivery options and consumers are making more and more use of it. One out of every five Dutch consumers shopped at an online supermarket last year. This is an increase of 100% compared to 2016 (Trouw, 2020). The study revealed that especially since the Covid-19 pandemic started, there was an increase in the number of consumers using online supermarkets.

When it comes to online grocery shopping, the previously discussed retail tricks are far less effective, if not impossible. Consumers have cited online grocery shopping as one of the main reasons to avoid impulse purchases that often happen in-store (Rossio, 2019). Furthermore, consumers mentioned convenience, time saving and the fact that there are no limitations to opening hours (although delivery is time specific) as other main advantages to adopt it (Hanus, 2016). The convenience of shopping from the comfort of your own house also makes it more likely for consumers to plan their shopping better and check which product they still have in stock.

However, stating that online grocery shopping would be the solution to reduce food waste is too soon. Making it even more convenient to purchase products also means an even lower perception of value and ownership, increasing the intention of discarding purchased food items (Ilyuk, 2018).

02.3.2 The Types of consumers

This chapter tries to identify 'high food waste' consumer types by discussing demographic data and behavioral traits that were found to have a significant impact on the amount of food that is wasted. Many of these behaviors are results of the competing goals earlier discussed in chapter 02.2. The findings are used to understand what the most significant routines and moments to waste food are and from where they originate. These, together with the finding from the other chapters, will be used in the customer journey to identify the biggest opportunities to intervene.

DEMOGRAPHIC INSIGHTS

Several studies have looked into which demographic data have a significant impact on the amount of food waste that is generated. A study conducted by Ooijendijk et al. (2019) concluded several consumer groups that wasted significantly more than others do. They have found that households consisting of more than three members waste significantly more per capita than one or two people households. The reason being that larger households buy and prepare relatively more food per household member.

Surprisingly, van Dooren and Mensink (2018) concluded that single person households waste significantly more. The biggest reasons being the fact that portion sizes in supermarkets are often too big and food products are not being used before they becoming spoiled. This group is interesting, mainly because this group has been growing since 2013 and it is expected that this will keep rising in the coming years (CBS, 2019).

Furthermore, households with children (especially with children below the age of five) waste significantly more than households without children (Ooijendijk et al., 2019). They also concluded that people younger than 25, waste significantly more. However, students, as well as elderly, waste significantly less (Ooijendijk et al., 2019). This finding may be conflicting but it was found that income plays an important role in food wasting behavior. Consumers that have less to spend are generally more considerate on what they spend it on, which is often the case with students and elderly. It was found that wealthier people, with an above average income, generally waste twice as much than people with a below-average income (van Dooren and Mensink, 2018).

Another characteristic that leads to an increase in food waste is gender. A study conducted by Secondi, Principato and Laureti (2015) looked at individual food waste and found that males waste significantly more than females. The main argument they found for this was the fact that females are more conscious of food waste.

BEHAVIORAL TRAITS

WasteMINZ (2018), who investigated the effectiveness of food waste campaigns on consumers, identified high food wasting groups. The study links several of the already discussed demographic data to different behavioral traits such as attitude, main causes and motivators (to change), which were found to be responsible for food waste. As already addressed in chapter 02.2, a lack of planning routines is key to many of the food wasting behavior consumers exhibit. Three demographic groups showed interesting behavioral traits, that fitted well to this. Although the study was conducted in New Zealand, based on the overlap already existing with the study conducted by Ooijendijk et al., (2019), there can be assumed the findings would correspond if conducted here in the Netherlands.

- **Young (Working) Adults.** Young Adults were found to mainly waste food because their busy lifestyle makes it hard to avoid it. According to the study by WasteMINZ (2018), this group is also less likely to admit food waste is wrong and that they are not making a conscious effort to do something about it. The main causes for food waste to occur, apart from their busy lifestyle is leftovers not being eaten and food being forgotten and ending up spoiled in the fridge or freezer. The prospect of saving money is the main motivator for this group to reduce food waste. To a lesser extent, this group is also likely to reduce because they value the food they buy. This group mentioned being most willing to change their food wasting behavior by planning meals in advance (WasteMINZ, 2018).

- **Families With Children.** According to WasteMINZ (2018), this group is aware of the environmental problems associated with food waste, and has a budget that helps them to effectively do groceries. However, food waste still occurs quite frequently. Similar to the young adults, this group lists a busy lifestyle as one of the main factors, together with having fussy eaters (children) that just do not eat everything. Another cause of food waste among this group is the reluctance towards eating leftovers. The main reasons for this is because they have been forgotten, sub optimally stored, or do not look tasty anymore. Again, the prospect of saving money, but also the feeling of guilt or shame when throwing it away, are the biggest motivators. The group mentioned being most willing to do something about it by again planning meals in advance but also by increasing their number of shopping trips, purchasing less at once.

- **Larger Households (4+ members).** Confirming the findings of Ooijendijk et al. (2019), households consisting of more than four members waste significantly more food compared to smaller households. According to WasteMINZ (2018), in fact almost two of five large households are considered high food wasters. In general, this group is less likely to consciously try to reduce their food waste and consume or reuse leftovers into new meals. These households have found to be less likely to have good food storage practices and often sub optimally keep leftovers, letting them spoil. Just like the other two groups, the prospect of saving money and the feeling of guilt are main motivators for these households to reduce their waste. The third motive these households have is the fact that food waste is not right, because of others having food shortages.

Oh the other hand, consumers that were identified as low food wasters, were also the ones more aware of their food wasting behavior. By planning and thinking about the specific ingredients (e.g. for a recipe or dish you want to make) they wasted significantly less (van Dooren and Mensink, 2018).



02.3.3 Key Takeaways

- Physical **supermarkets** play a **significant role** in the **food waste generation** of **consumers** by the use of marketing and retail techniques that encourage consumers to over purchase, resulting in an increase of food waste.
- Although **online supermarkets** are less prone to these marketing techniques, the **added convenience** could lead to a **lower perception of value**, increasing food waste intentions.
- **Three people households waste** significantly **more** per person than smaller households.
- **Households with children**, especially when younger than five, **waste** significantly **more** food.
- **Single households waste** significantly **more** food, furthermore they are a **growing demographic** in the Netherlands.
- Consumers that only use a **low percentage** of their **income towards food**, **waste** significantly **more** than the average while consumers that have less income, generally students and elderly, waste significantly less.
- Consumers that experience a **busy lifestyle and have unforeseen events** are bigger contributors to **food waste**.
- Consumers that **plan** their **meals** and think about ingredients, **waste significantly less** than consumers who do not.
- Consumers that were identified as **high food wasters** were found to be most **willing** to reduce their food waste by **planning meals, using leftovers and cooking proper servings**.

02.4 Consumption Developments

This chapter will dive deeper into the context of food waste by taking a closer look at some developments regarding the future of consumerism to get a better understanding on how food consumption, and thus food waste generation, might be changing in the coming years.

In order to get a better understanding of how the concept will eventually have to fit within a changing context and to make sure it can fit, a trend analysis was conducted using a study from Trendwatching BV. (2020). Two developments were found to potentially play a significant role in the way future consumption will be done, changing the way consumers consume.

BETTER BUSINESS

This development, which is referred to as Better business (Trendwatching BV, 2020), refers to the increasing awareness of consumers and businesses about the major social issues and the negative impact their behavior has on the environment, society and themselves. Consumers are more often dealing with internal conflict, where they on the one hand have certain desires that they want to fulfill while on the other hand they want to feel that the choices they make are the right choices, more often based on environmental factors.

In order to solve this internal conflict, consumers are 'demanding' more transparency about the environmental impact these businesses are having, somewhat successful. The increasing influence of social media has given the consumers the power to make sure these businesses act accordingly.

It leads to businesses shifting more and more towards environmentally neutral solutions, simply because this is something consumers are expecting (and demanding).

A clear result of this can for example be seen in the growing number of meat replacement products. Since 2016 this number has grown by 33%, to more than 100 different products, mainly due to consumer demand (NOS, 2019). Specific to this project, this would mean highlighting making sure the solution fits with the consumer's desire, while also showing the positive impact it can have on the environment.

HELPFUL

Trendwatching BV (2020) furthermore concluded that, because consumer lives are getting busier and time is getting more valuable, convenience will stay key. Consumers expect products and services to seamlessly fit within their daily routines and take away any pain points for consumers to adopt it. Furthermore products and services need to make their life easier, save them money and time, the information that these product and services provide should be clear, intuitive and actionable.

For this project, it would mean making sure the solution is simple and requires minimal effort to implement into the consumer's routines. The solution needs to prove itself as being a convenient addition to the routines of consumers, to make it likely they will adopt it. It should especially focus on making life easier, saving money and/or time.



02.4.1 Key Takeaways

- Consumers experience an **internal conflict**, they want to make **positive social decisions** but also **fulfill** their **consumption desires**.
- Consumer **awareness** is **increasing** and they will put increasing pressure on companies to go into a more **sustainable direction**.
- Consumer lives are getting **busier**, therefore **time** is becoming more and **more valuable** and **convenience** of products and services is **key**.
- In order to be **successful** at preventing food waste, the outcome of this project should **seamlessly fit** within the consumers **existing routines**.
- In order for the solution to **trigger consumers** into buying/using it, it should be **money saving, easy accessible, and intuitive**.

02.5 The Existing Initiatives

This chapter will look at several existing initiatives that are focused on reducing consumer food waste. Based on what they are doing and how well they do it, gaps and opportunities for improvement are identified. These gaps and opportunities will be used as insights for this project on how the solution can best operate within the context, in order to be successful.

Over the last decade, more and more initiatives have been set up that tackle the food waste problems. In the Netherlands alone are several government and non-government led initiatives focused on reducing food waste. These initiatives have proven to be somewhat successful because between 2016 and 2019, consumer food waste has gone down 17% (Ooijendijk et al., 2019).

Although this is a good step in the right direction, according to the Director of Samen Tegen Voedselverspilling, Toine Timmermans, '[...] at the same time there is still much to do. In the supply chain, and certainly also with the consumer. The biggest gain is still at the consumer's home.' (Samen Tegen Voedselverspilling, 2020).

The last few decades' food waste has become an increasingly pressing and known environmental problem to address (Hawthorne, 2017). This has led to a growing number of organizations working towards food waste reduction in all stages of the FSC. Governmental and non-governmental organizations, businesses, social movements, and even role models are getting involved in the consumer food waste sector. They are launching awareness campaigns, selling products and services, host events and even make series or films all focused on reducing the consumer food waste share, in any way possible. The biggest Governmental organization in the Netherlands, which is leading many of these initiatives, is the Netherlands Nutrition Centre (NNC).

02.5.1 Netherlands Nutrition Centre

NNC as an organization is mainly focused on providing consumers with tips on how to eat and live healthier. In order to achieve this, they have solutions that provide consumers with tools that (try to) help them reduce their waste. The best-known products and services they have are eetmaatje, the fridge and freezer stickers and the slim koken app.

EETMAATJE

Eetmaatje (see figure 8) assists consumers in measuring the right quantity for several paste products, such as rice, couscous and several pastas, instead of following your instinct (which often overestimates). This helps consumers to prevent overcooking, which often means having to throw away food. The products can be found on their website for free, consumers only pay the delivery costs of €6.95 per delivery.



Figure 8: Eetmaatje. Source: Voedingscentrum.

THE FRIDGE AND FREEZER STICKER

These products provide consumers with knowledge on where to best keep several commonly used food products and product categories (see figure 9 and 10). The stickers need to be placed on the fridge or freezer and help to remind consumers.

Just as with Eetmaatje, the stickers are available for free on the website and consumers only pay a delivery fee of €2.45. A government funded initiative in 2015 made it possible for 1.2 million consumers to get the fridge sticker for free at the fruit and vegetable isles of many Jumbo, Dekamarkt, Dirk, Plus and Coop supermarkets in the Netherlands.



Figure 9: The 'Koelkaststicker'. Source: Voedingscentrum.



Figure 10: The 'Vriezersticker'. Source: Voedingscentrum.

THE 'SLIM KOKEN' APP

NNC has developed and launched the 'Slim Koken' app to help consumers throughout every stage of the cooking process (see figure 11). The app offers consumers functions such as a digital shopping list, a digital fridge to store your ingredients, a weekly meal planner, recipes with cooking steps, a digital chef, a cooking timer and even tips on what to do with the leftovers you still have.

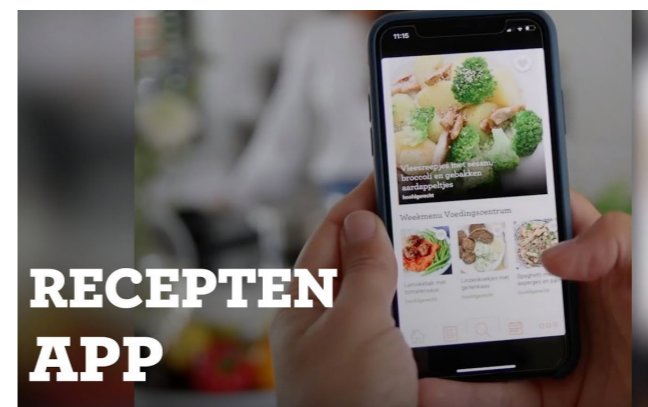


Figure 11: The 'Slim Koken' app. Source: Voedingscentrum.

02.5.2 Samen Tegen Voedselverspilling

Samen Tegen Voedselverspilling is a foundation set up in December 2018 that has set the goal of 'making the Netherlands the first country that has been able to reduce its food waste by 50% by 2030.' (Samen Tegen Voedselverspilling, 2020). They can be seen as the overarching organization and are built up by a collaboration between various organizations and businesses such as NNC, Too good to Go, Verspillingsfabriek, Zero Food Waste and the Rabobank. On the website of Samen Tegen Voedselverspilling many of the existing initiatives are shown (see figure 12). Next to the sharing existing ones, Samen Tegen Voedselverspilling also has several of their own initiatives.



Figure 12: An overview of all initiatives. Source: Samen Tegen Voedselverspilling.

#VERSPIJLINGSVRIJEWEEK

They are best known for their nationwide #Verspillingsvrijeweek campaign for which they in June introduced their new Becky mascot (Samen Tegen Voedselverspilling, 2020). During this period, Samen Tegen Voedselverspilling launched several TV commercials that tried to educate consumers on the difference between the 'best before' and 'use by' dates on products (see figure 13).



Figure 13: Mascot Becky, educating consumers on different date labels. Source: Samen Tegen Voedselverspilling.

EDUCATION

Samen Tegen Voedselverspilling also has several of their own teaching packages that focus on educating students of all ages on food. They believe 'school is the place to make children aware of healthy and sustainable food' and try to put this believe into practice through their 'Smaaklessen'. Smaaklessen is essentially a teaching package for primary schools that throughout several lessons teaches children about different food products, flavor and healthy and sustainable eating and cooking. Smaaklessen is only one example of various initiatives they have around education, but all address food and food waste, among various age groups.

02.5.3 Love Food Hate Waste (UK)

Possibly the most influential foreign organization is Love Food Hate Waste. They work together with various UK governments, UK Businesses, chefs, and community organizations and can be seen as the UK variant of Samen Tegen Voedselverspilling. They have several initiatives that based on how they are designed are much more focused on the user. Apart from the four initiatives that will be discussed next, Love Food Hate Waste has several other smaller tips and hacks they share on their social media channels. Some of these also focused on more psychological and behavioral aspects such as using smaller plates, competitions on who eats the most fruit and games that teach you about healthy eating.

THE PORTION PLANNER

This planner tool provides consumers information on the right portion per household member as well as nutritional information for many different food products (see figure 14). It also explains consumers how they can best store the leftovers. Although the tool mainly focuses on raising awareness, the application is simple in use and clear in communication. They have paid attention to how consumers deal with portions, and made the process more intuitive by listing the number of tablespoons for some ingredients, something everyone understands. This means consumers do not need to measure the quantity every time they want to consume the product, making the process easier.

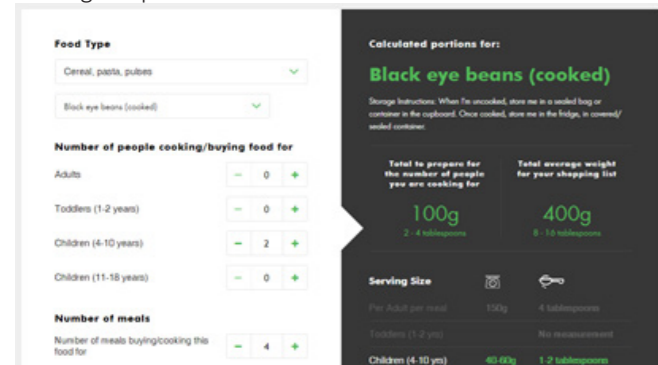




Figure 14: Love Food Hate Waste portion planner tool. Source: Love Food Hate Waste.

THE COMPLEAT FOOD GUIDE


This initiative, or revolution as they call it, assists consumers to go one-step further towards food waste reduction. It promotes eating ingredients as a whole. Consumers throw away peels, skins, leaves, stalks and crusts while these parts can easily be consumed and are often very healthy. Their website has a food guide showing you how to use these parts (see figure 15).



HACKS AND TIPS
Find out how to make the most of your ingredients.



COMPLEATING 101
Discover the top 8 foods you never knew you could compleat.



COMPLEAT LEGENDS
See who else is adopting the compleating philosophy.

Figure 15: Compleating food guide. Source: Love Food Hate Waste.

THE A TO Z FOOD STORAGE TOOL

This application provides practical information on produce and other food products. It shows consumers how to best store them, if and how it can be frozen, how to keep them fresh longer and what to make from it once they are not 'fresh' anymore (see figure 16).

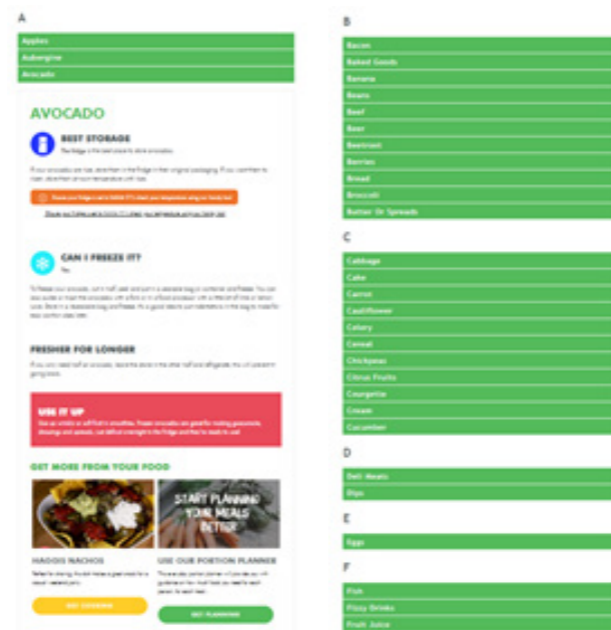


Figure 16: A to Z storage tool. Source: Love Food Hate Waste.

LET'S MAKE FOOD MATTER CAMPAIGN

This campaign is focused on children, teaching them about the value of food at a young age. The process requires the assistance of an adult but is very much focused on engaging the child (see figure 17).

The two-week campaign helps consumers to map out their food usage and waste. The campaign consists of three steps: 1) work out your waste, 2) learn how to save, 3) become a food saver superhero. The entire kit includes several documents including a food diary instruction, explaining you the process. The weekly dairy tables in which consumers need to fill in the main questions: how much, when, why, who. In week two the why question changes to 'how did you save it'. Lastly, a recipe card with various recipes that use the most common leftover ingredients can be downloaded as well as an activity sheet that consists of extra tips and facts. It uses many of the tips that are also present in their other initiatives, but is purely focused on the children.

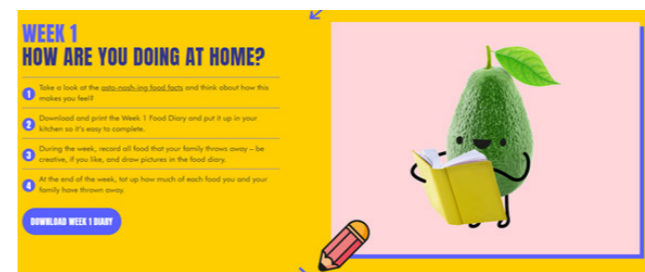


Figure 17: The let's make food matter campaign. Source: Love Food Hate Waste.

02.5.4 Too Good To Go

Too good to go is a great example of a successful business that is working towards food waste reduction. In their core focus, they are an app that links food retailers to consumers. Retailers, each day, are left with many food products that cannot be sold in their stores anymore. These products are shared using the Too Good To Go app. Consumers can order a box full of close to expiry products for a small price and pick up the box at the shop at the end of the day. With over 22 million app users and a presence in fifteen countries, they are doing very well (see figure 18). A study conducted by Wageningen University (2019) has found that the biggest motivation for consumers to use the app is the fact that they reduce food waste, furthermore consumers are intrigued by the element of surprise (not knowing what you are going to get) and the relatively low price. According to the same study, it does in fact reduce food waste quite a bit. Only 8% of the participants threw something away if it remained unconsumed and products were often shared with family and friends.

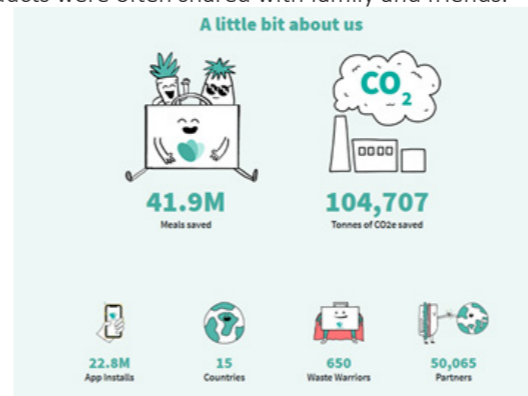


Figure 18: The impact of Too Good To Go. Source: Too Good To Go.

Although this solution is more focused on reducing retail food waste, too good to go has used this success to grow their plans for household food waste reduction. During an interview with Robin Hoyer, Customer Success Specialist at Too good to go their plans regarding consumer food waste were discussed. The entire interview can be found in Appendix A of this report.

Hoyer mentioned that regarding consumer food waste, they are working on the issues surrounding date labels. As was mentioned in the section on Samen Tegen Voedselverspilling the misunderstandings lead to an unnecessary increase in food waste.

On the question, what do you see as the biggest obstacles

or challenges to achieve more food waste reduction? Hoyer mentioned: 'The biggest challenge is really for people to change their schedule: If they still have food at home, they need to ask themselves, is it still good to eat the day after tomorrow? If not, let us eat it today and not go out for dinner as we planned.'

Saving food is still not a common thought for everyone. Many people choose for the convenience option. Saving food waste is secondary. Hoyer believes all different initiatives and partners combined can start a movement that changes that mindset. This is something Too Good To Go is actively pursuing.

02.5.5 Jamie Oliver #KeepCookingAndCarryOn

Lastly, this chapter will address an example of a role model to reduce consumer food waste. What started as a small home cooking show during the Covid-19 pandemic, turned into quite the successful initiative that helped consumers to start cooking. The show showed people how simple ingredients that every household has at home, and leftovers can still lead to some creative cooking (see figure 19).

Every Week Jamie cooked and shared easy and quick dishes that were healthy and had swappable ingredients. Swappable meaning that you could easily replace some ingredients for others, still achieving a tasty dish. The show was tailored to the things you had left in the house, and used the additional time consumers and the reluctance consumers had towards going grocery shopping as success factors. With this show, Jamie gave consumers the right example. His commitment to the good cause (good nutritious food for everyone) and his impressive media influence has already changed quite a bit in the UK, including the recently announced regulations against obesity in the UK (NOS, 2020).



KEEP COOKING AND CARRY ON

You've told me what you need, and I've listened. In my new show, I'm sharing my easy-to-follow, super-flexible recipes with lots of useful swaps and tips to help you feed yourself and your loved ones in these unique times. Let's celebrate freezer faves, big up the store cupboard and get creative with whatever we have to hand. Let's keep cooking and carry on!

Figure 19: Jamie Oliver's newest cooking show, during the Covid-19 pandemic. Source: Jamie Oliver.

02.5.6 The Success / Lack Of Success Of These Initiatives

Of all the discussed initiatives, the success or lack of success was investigated. This was done based on insights from the previous chapters as well as through interviews and reviews on the success of the initiatives. The reasons for this is because several experts from the European research Centre, REFRESH have expressed their doubt about the effectiveness of several Dutch government led initiatives. *‘What policy makers often do, which is raising awareness, is actually the least successful instrument you can use’* (Wunder et al., 2019). Emphasizing on the negative effects of food waste and confronting consumers with those, in order to create awareness, in many cases even has the opposite effect. This leads to an increase of food being wasted. According to Wunder et al. (2019), instead the focus should go towards encouraging the positive behavior through designs that trigger consumers to perform in the desired way.

In order to gain insight on the effectiveness of the products from NNC, data on use and impact of these products and services was gained during an interview with Joost Knüppe, knowledge specialist on behavior change at NNC. He was able to share evaluation reports of these products and services and share additional information, which gave the following insights.

EETMAATJE

According to van Dooren et al., (2020) 85% of the consumers that were part of the test panel mentioned they believed the product was handy and found it useful. Around 50% of them mentioned they used the product when measuring their pasta or rice. Of all consumers, 80% believes the product has helped them reduce the amount of pasta and rice they wasted. A critical side note to this however is that this report addresses cases in which the product was handed out for free. Consumers now need to pay a delivery fee of €6.95. Something that many consumers might not feel comfortable with or see added benefit in, just to save a maximum of 6% on pasta waste and 21% of rice waste (van Dooren et al., 2020).

Interestingly, after a quick search, quite a lot of negative reviews were found (Willems, 2014).

The most mentioned feedback by users was:

It is annoying to measure it again for every household member
Even when using the product, we still have to deal with a lot of leftover pasta/rice.

This product just creates more trash

Based on the insights from chapters where and why it is likely to think that consumers experience this product as inconvenient, mainly because it adds an extra step in the cooking process. Measuring quantities is not something consumers are actively willing to do. As found in chapter 02.2, households have the goal of making sure there is enough for everyone, Eetmaatje essentially interferes with this.

Perhaps the biggest downside to eetmaatje is the fact that it purely addresses the waste of rice and pasta products. The problem with this is that these products are not actually wasted that much. According to Ooijendijk et al., (2019) only 3% of all consumer food waste consists of pasta products and 2% of rice. This means that the product is only looking at a potential waste reduction of 5% on the overall waste. In order to achieve this reduction, the consumer also has to be willing to pay €6.95 for delivery, which is likely to be too much of a threshold for consumers to engage.

THE FRIDGE AND FREEZER STICKERS

Based on the data provided by Joost Knüppe, the Ja-Nee Koelkaststicker scored a 7.0 on general appreciation. Around 60% of the consumers use/look at the sticker when storing products and 50% of consumers feel that using the product has led to an increase in shelf life of products.

Based on the insights of the previous research chapters, it is likely to believe that consumers will see the product as rather convenient. The product does not add any extra steps in the process and is present where food waste occurs.

A potential downside to the product might be the fact that consumers are unwilling to actually place the product on their fridge or freezer. This is something that came forward during the concept-testing phase of one of the concepts. Consumers prefer to design their fridge door to their own liking.

A second, bigger, problem with this product might be the fact that it is rather simple and incomplete. The sticker only shows consumers how to store 12 common food products, ignoring any other product. It also does not tell consumers how to store the products properly. It matters quite a bit how the product is stored inside your fridge as well as next to which other products it is stored. Some products influence each other in such a way that the ripening process is sped up or they contaminate each other. Furthermore again cost plays a part. A €2.45 delivery fee might be too much for many consumers, keeping them from engaging. Instead, another promotion action, as was done in 2015 with the stickers, would lower the threshold, triggering more consumers to get and perhaps use the product.

THE SLIM KOKEN APPLICATION

In 2019, NNC conducted an evaluation study to understand the motives for consumers to use the app, as well as determine the success of the Slim Koken application, to find room for improvement (Lek, 2019).

The study concluded that consumers mainly used the app to find healthy recipes and find meal inspirations, and not necessarily to reduce food waste. The study concludes that, when it comes to usability, there is a lot to gain. Only 49.1% of the users consider the app to be user friendly and just a bit more (50.3%) find the app easy to use.

Several functions of the app were also individually tested based on several characteristics. The most important conclusions were that 38.9% of the users described the digital shopping list as ‘inconvenient’. The meal planner (33.5%) and the digital fridge (37.1%) were functions that scored the highest on ‘not needed’. As final recommendations from the study, NNC concludes user friendliness as one of the main focus points for improvement.

The app also requires active engagement from the consumer to achieve food waste reduction. The app does have some interesting challenges for consumers to commit themselves to, but again these require quite some effort and in general apps seem to be less effective to achieve behavior change, mainly because the way apps ask you to change is not part of your normal daily routines (Eyal, 2013).

SAMEN TEGEN VOEDSELVERSPILLING

The #Verspillingsvrijeweek campaign addressing the different product dates is likely to be quite effective. As was also mentioned in chapter 02.1, there is a general lack of knowledge when it comes to how to interpret date labels. This national campaign, which included several TV commercials over a period of weeks, had a huge potential audience reach. Whether or not the campaign has also positively influenced consumer food waste is too early to conclude.

LOVE FOOD HATE WASTE

For the four initiatives from Love Food Hate Waste it was already mentioned that they were more focused on user friendliness and user needs. A few potential downsides to some of their initiatives might be the fact that they are purely digital products. The problem with this is that, as mentioned with the smart cooking app, they seem to be less effective in achieving behavior change. Furthermore, they require active engagement from the consumer, meaning that in moments where these routine behaviors are desired, the initiatives rely on the consumer initiating engagement, something that might not always happen at the moment unwanted behavior occurs.

For the Let’s Make Food Matter campaign, this is not the case. This ‘product’ is physical but, in case this is not something the children for example get at school, it does require the consumers to print it themselves. Furthermore, since it is a two-week assignment it requires quite some active engagement, which might be asking too much from the consumer, considering the convenience they are after.

TOO GOOD TO GO

The biggest ‘problem’ with Too Good To Go in the scope of this project, might be the fact that their business can be seen as mainly addressing retail food waste and not so much consumer food waste. The positive elements of Too Good To Go however are the fact that they understand how to tap into the user’s needs and desires, to make it fun to engage in food waste reducing initiatives. Even if you are not a consumer that cares too much about food waste reduction, the app is still fun to use. They also proved that dealing with food waste could result in a viable business, possibly paving the way for other initiatives to do the same. Secondly, they have mentioned

wanting to do more towards consumer food waste. Assuming they will use the same principles as in their app, this might be a promising development.

#KEEPCOOKINGANDCARRYON

Finally, the role model cooking show. The use of a role model (ambassador) for a good cause has proven to be an extremely powerful tool, simply look at the power influencers hold over their users and how greedy sponsors are to work with them. Using a Dutch role model would be a useful tool to achieve food waste reduction however finding the perfect candidate might be the most difficult.



02.5.7 Key Takeaways Existing Initiatives

- Although the **reach** of the discussed **government** led **initiatives** is often **broad** they generally **do not focus** on the **real needs** of the consumer. They might therefore lack impact and engagement.
- In order to be interesting for the consumer, the **solution needs** to be a **low investment**.
- The solution has to be **user friendly** and **present at the right moment** wasteful routines occur.
- The product should be focused towards **product groups** that have a **significantly impact** on the amount of **food waste**.
- The product should **not add** any **additional steps to the daily routines** of consumers.
- **Digital solutions** seem to be **less effective** in the **changing behavioral routines** of consumers.
- Including **kids** into **food waste reduction products** seems like a **common method** for some initiatives.
- The final outcome of this project should have a **follow up option** for consumers that want to take a **next step** towards **further food waste reduction**.
- The solution should also be **interesting** for **consumer** that **do not** necessarily **look** for solutions to **reduce** their **food waste**.

02.6 Customer Journey

The customer journey is essentially an overview of the different elements that were discussed in the previous chapter and it is used to gain a deeper understanding of how all the different elements influence each other. The figure shows the six different stages that were identified in Chapter 02.1. The goals consumers have and the actions they take to achieve these are based on the results from chapter 02.2 and 02.3.

The feelings, which are also based on these chapters, are used to get a deeper understanding about how consumers may experience each of the household stages.

These feelings basically portrait the possible conflicts consumers experience in their daily routines.

The figure also included the existing solutions that were discussed in chapter 02.5 that play a role in each stage. These are added to see where initiatives are present in order to find opportunities.

Next the customer journey identifies some main touchpoints, these are the products within the household of the consumers that consumers interact with during their main routines.

The opportunities that are provided are some of the key take aways that were concluded. These opportunities were used as input the ideas during the design phase.

The figure does not discuss any touchpoints or opportunities for the consuming and disposal stage because this project does not focus on finding a solution within these stages. They are discussed because the goals, actions and feelings of consumers in these stages are valuable.

STAGES <small>(CHAPTER 02.1)</small>	PLANNING	PROVISIONING	STORING	PREPARING	CONSUMING	DISPOSING
CONSUMER'S GOALS <small>(CHAPTER 02.2)</small>	Being efficient with (free) time. Being prepared for any unexpected events. Being a good provider.	Making sure to buy plenty of good/fresh but also enjoyable food. Sticking to a budget.	Knowing what I still have in stock.	Making sure there is more than enough for everyone.	Making sure everyone in the households eats healthy and fresh. Eating food I enjoy.	Don't unnecessarily throw away food.
MAIN ACTIONS <small>(CHAPTERS 02.2/02.3)</small>	Planning to buy plenty of fresh produce. Improvise.	Improvise getting groceries Buying plenty. Buying things I don't actually need.	Storing food products where I think they belong.	Using their existing skill and knowledge to prepare meals.	Use senses when determining a product's shelf life.	Throwing away food that is not fresh anymore or past its due date.
FEELINGS <small>(CHAPTERS 02.2/02.3)</small>	<i>'I don't know what to get.. I'll just improvise again.'</i> <i>'It is too much effort to plan everything, I don't have time for that.'</i> <i>'I don't know what I still have in stock, I should have checked.'</i>	<i>'I'll just buy this in bulk, it's cheaper that way.'</i> <i>'I am not sure if we still have this, let's buy it just in case.'</i> <i>'I need to make sure I buy plenty of (fresh and healthy) food.'</i>	<i>'I forgot I still had that.'</i> <i>'Where did I put ...? I can't seem to find anything.'</i> <i>'I don't like to keep leftovers.'</i>	<i>'I'll cook plenty just to be sure everyone has enough.'</i> <i>'I don't feel completely comfortable making this dish.'</i>	<i>'I feel responsible for making sure my household has plenty of healthy food to eat.'</i> <i>'This product can't be eaten anymore, it's past its due date.'</i> <i>'I don't like eating leftovers.'</i> <i>'I hope there is enough for everyone's liking.'</i>	<i>'I am willing to do something but I don't know how.'</i> <i>'I need to throw this away because it is spoiled and I don't want to get sick.'</i> <i>'It is wrong to throw away food.'</i> <i>'I feel guilty / ashamed throwing away this food.'</i>
EXISTING SOLUTIONS <small>(CHAPTER 02.5)</small>	The 'Slim Koken' app	Too Good To Go	The Fridge and Freezer Sticker #Verspillingsvrijeweek A to Z Storage	Eetmaatje The Portion Planner #KeepCookingAndCarryOn	The Compleat Food Guide #Verspillingsvrijeweek Let's Make Food Matter	
TOUCHPOINTS <small>(CHAPTERS 02.1/02.2)</small>	Fridge, Freezer, Cupboards	Grocery Bag.	Fridge, Freezer, Cupboard, Tupperware.			
OPPORTUNITIES	Providing a solution when consumers are interacting with the fridge, freezer of cupboards. Making consumers aware the consequences of food waste that occurs due to a lack of proper planning. Providing consumers with a convenient and easy implementable options that help them plan.	Showing consumers how to save money by wasting less food. Changing consumer's shopping routines to address impulse purchasing.	Providing consumers with a solution that makes leftovers more visible. Providing consumers with knowledge on where and how to store products. Helping consumers to become organized.	Teaching/ showing consumers what they can do with leftovers. Providing consumers with something that helps them cook.		

03. Define

This chapter tries to define the design challenge for this project on how to prevent consumer food waste. The chapter does this based on the key takeaways that came from each of the sub questions and the opportunities that were identified in the customer journey. Furthermore the chapter discusses a list of requirements and wishes for the outcome of this project, based on the key takeaways.

03.1 The Design Challenge

Based on the key insights from the different chapters and the opportunities found in the customer journey the design challenge has been formulated as:

'Making food waste prevention in the planning routines of high-wasting households convenient.'

In this design challenge three elements are underlined which are key. The planning routines are key because, as was found, the upstream routines have a significant influence on food waste that occurs at later stages. Furthermore proper planning routines are said to have a significant potential impact (up to 50%) on food waste reduction. The focus on high-wasting households is based on the fact that this target group lacks many of the 'good food habits' which allow for food waste reduction. Convenient is underlined because it refers to the main cited reason consumers waste food. By developing a solution that provides this same feeling of convenience, food waste can be prevented.

03.2 A List Of Requirements & Wishes

Based on the key takeaways from each of the sub questions in the discover phase, a list of requirements and wishes was set up which should be taken into account for the development of the concepts.

REQUIREMENTS

The outcome of this project should ..

- address the food wasting behaviors within the consumer's household.
- address routines in the crucial upstream stages such as planning and storing.
- be convenient in use, meaning it should not add any additional steps to the existing routines of consumers regarding food management.
- increase consumer awareness on their food waste.
- be useful for consumers that lack 'good food habits'.
- increase consumer awareness on common misunderstandings regarding food (e.g.: where to store which food products and how to interpret date labels).
- facilitate a significant reduction of consumers' food waste.
- be physically present at the crucial touchpoint consumers have with food.
- be a low economic investment for the consumers, meaning it should not cost more than a couple of euro's.

- be economically viable for I Change.
- enable I Change to reach a bigger target audience.
- be easy and accessible, meaning it should fit within the busy lifestyle consumers experience.
- comply with the found motives consumers have for reducing their food waste.
- complicate the manipulative behavior of consumers when dealing with leftovers.
- be framed encouragingly and positively.
- be easy and accessible for consumers, meaning that it should not require any additional abilities or opportunities to use.
- focus on improving the routines of high wasting consumers that they identified as 'willing to adopt' in order to reduce food waste.

WISHES

The outcome of this project should ..

- prevent food waste as much as possible.
- be suitable to as many consumers as possible.
- The product should be as low be as cheap as possible in order to have consumers invest in it.
- The product should be as convenient as possible, meaning it should require as little effort and time as possible while still having a significant result.

04. Design

This chapter takes on the design challenge formulated in the last chapter. Through two creative sessions ideas were formulated to tackle consumer food waste. After clustering four concepts were created. These most promising concepts moved into the concept testing phase, during which each concept was tested. The chapter end by discussing the results from this testing phase.

04.1 The Ideation Process

As mentioned in the previous chapter, the design challenge was used on two separate creative sessions (see figure 20 and 21). Both these sessions looked at the entire household process (from planning to disposing), not solely the planning routines. The reason for this was to get an elaborate overview of ideas and solutions spread over the entire process. The goal of these sessions was to get as many ideas as possible without being restricted to the specific phase in which the idea should eventually be implemented.

The first creative session was done with a group of four design master students, who have much experience with brainstorm sessions. The second session was done at I Change with four of its employees, which can all be considered experts in the context of food waste.



Figure 20 and 21: Creative session one with several design master students. Session two with I Change employees.

04.1.1 Ideation

Within each session several different design methods were tested/ used that helped to spark friendly competition and get the creativity flowing, with the goal of getting more (unique) ideas. The tips for developing these design methods within the session came from the book 'Road map for creative problem solving techniques' (Heijne and Meer, 2019). The method in figure 22 uses several of their principles.

Having two 'teams' compete, helps to boost energy and an interactive playground on which the ideas are placed, should boost creativity.

Apart from these two sessions, several other ideas that came from a continuous brainstorm session throughout the entirety of this project, that seemed interesting or unique, were added into the clustering mix. These ideas were gained through reading papers, watching interesting documentaries and sudden inspiration.

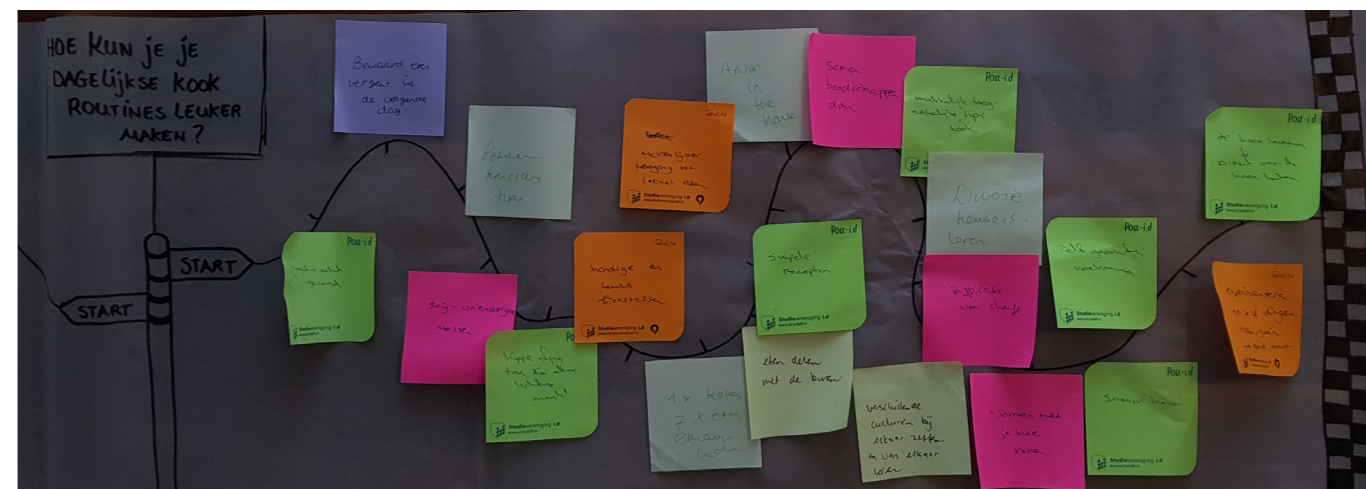


Figure 22: An 'idea race' to trigger friendly competition, aimed at increasing the energy and creativity levels.

04.1.2 Clustering

After both sessions were held, a clustering session was done to match all the ideas back into the different stages in which the ideas were present: Planning, Provisioning, Storing, Preparing and Consuming (see figure 23). Disposing was deliberately left out because, as mentioned in chapter 02.1, interventions at this stage are not contributing to food waste prevention.

As concluded in the previous chapter, the biggest potential for food waste reduction was found to be in the upstream stages and routines. For this reason ideas that linked well to this stage or the routines that followed them were further into the selection process. This selection was done based on personal expertise and intuition. The eleven ideas that were chosen can be seen on the next page. Each idea is briefly explained and together with this explanation the stage(s) in which the concept mainly operates is added.

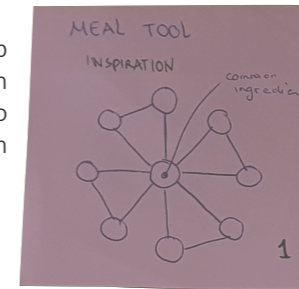


Figure 23: Work in progress, clustering the ideas into the specific stages in which they best fit.

1. Meal assistance tool

this idea would help consumers get inspiration for meals by helping them to choose a product from each food group.

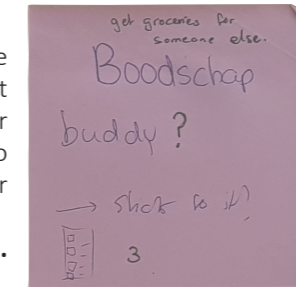
Planning stage.



3. Grocery buddy

This idea would have consumers to also get groceries for a neighbour or friend, triggering them to use a shopping list (also for themselves).

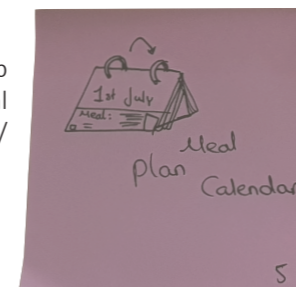
Planning / Provisioning stage.



5. Plan calendar

This idea would help consumers plan a meal according to which day/season it is.

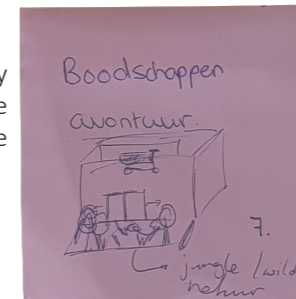
Planning stage.



7. Grocery adventure

This idea would make grocery shopping into a unique adventure, to increase the value of food.

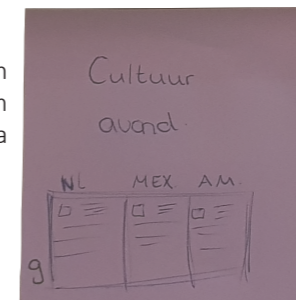
Provisioning stage.



9. Culture night

This idea would interact with consumers to inspire them to make meals belonging to a specific culture.

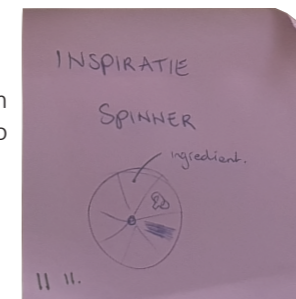
Planning stage.



11. Inspiration spinner

This idea would interact with consumers to inspire them to make a certain meal.

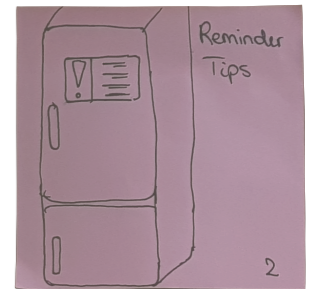
Planning stage.



2. Fridge reminder tips

this idea would provide simple tips that consumers are reminded to each time they interact with their fridge.

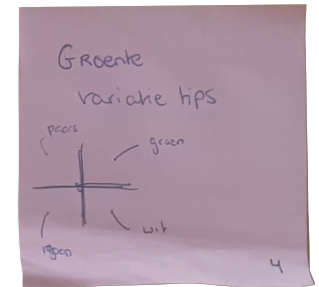
Storing stage.



4. Vegetable variation tool

This idea would interact with consumers, to inspire them to use a different color vegetable every time.

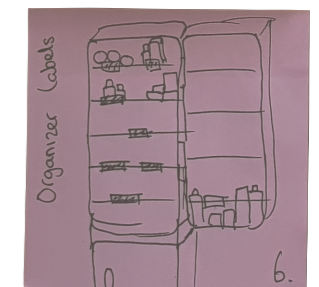
Preparing stage.



6. Organization labels

This idea would help consumers to get a clearer overview in their fridge, assisting them to plan more effectively.

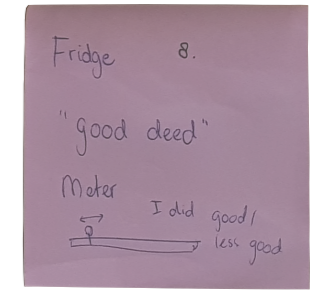
Planning / Storing stage.



8. Good deed meter

This idea would have consumers reflect on their good/bad deeds, to help them do differently.

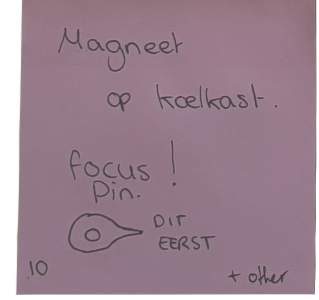
Planning stage.



10. Priority pin

This idea would have consumers make a commitment and get a better overview of what is still in their fridge.

Storing / Consuming stage.



04.1.3 Idea Selection

In order to choose the most promising ideas a selection process was done using the C-box method (Boeijen, Daalhuizen and Zijlstra, 2020). The C-box method is essentially a 2 x 2 Matrix, where on the two axes criteria are written down that are used to score each idea. The criteria that were chosen were the ones that based on the key takeaways from each sub question and the list of requirements were found to be crucial. These were: 'How convenient it is for the consumer to use' and 'How big the potential impact on how waste reduction' was. Both criteria ranking from low and high.

After placing all eleven ideas in the C-box, see figure 24, each idea was again reviewed based on how well they complied with the requirements of chapter 03.2. Ideas that, based on personal intuition, did not meet one or multiple of these requirements received a '-'. The four ideas that scored the highest on convenience and potential impact (numbers 1,2,6 and 10) were taken further, to be developed into concepts.

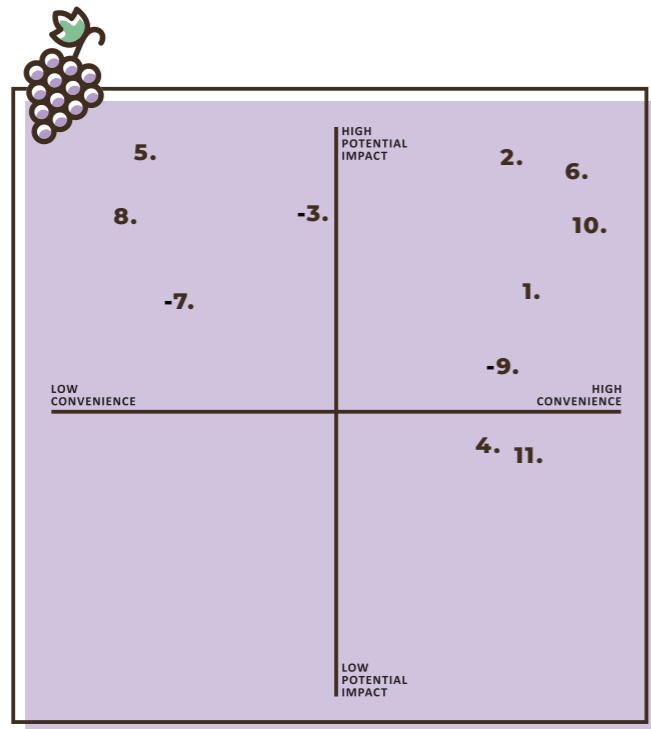


Figure 24: C-Box method to rank the different ideas. The numbers match with the post-it on the previous page.

04.2 The Concepts

Eventually the choice was made to only develop three of the four concepts. During an evaluation meeting with I Change to discuss the four ideas, the choice was made to discontinue one of the ideas (number 1 in figure 24). The decision was made because this idea would be the least suitable for both I Change and the problem it was trying to solve. The choice was made to instead focus on the three more promising ideas. Additional feedback on the remaining three ideas was taken along in the development of the concepts.

The choice was made to create low-fidelity concepts. In this case, it meant concepts made from accessible materials such as cardboard and paper.

The reason for this was because the main focus for each of the concepts was put towards making them accessible and simple in use and implementation. The purpose of the testing phase was purely to find out of the concepts facilitated a change towards the desired behavior by addressing the main motivations consumers have to change their food waste. The idea behind this was that, if they facilitated this change, the desired behavior would, on the longer-term, hopefully become embedded into the new routines of the consumer.

The concept designs and the different print-outs used for the testing phase can be found in Appendix B of this report.

04.2.1 The Design with Intent Toolkit

In order to develop the concepts and make sure the design choices in them lead towards the desired result, the design with Intent toolkit, developed by Lockton, Harrison and Stanton (2010) was used.

Although the toolkit was intended to be used as a tool for ideation, at this stage it enables to support several design choices for the different concepts which motivate consumers towards performing desired behavioral routines. For this reason, the focus was put on the cards that were classified as 'thoughtful'. These thoughtful cards, according to Lockton, Harrison and Stanton (2010), provide the consumers with reasons why some behavior is better than others, aimed at motivating a change in their attitudes towards what is desired. This focus was found most suitable because it directly addresses the conflicting motivations that are present in the decision of consumers to waste food, as discussed in chapter 02.2.

Because these so-called 'patterns for influencing behavior through design' help to address the intrinsic motivation of consumers, the assumption is made that by using these patterns the desired behavior eventually becomes embedded into the existing routines of the consumer, changing their behavior.

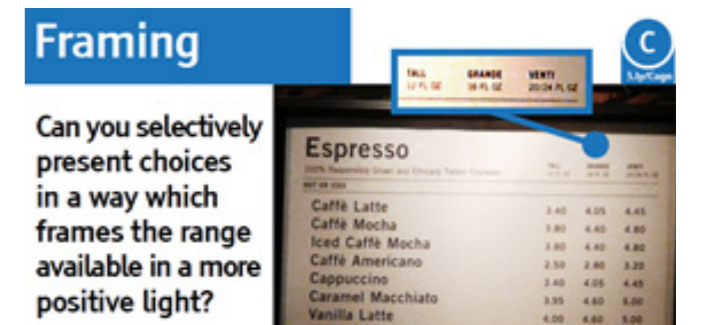
Some patterns addressed in the toolkit were already concluded based on key takeaways from the various chapters in the discover phase of this project, which only proves their effectiveness. The four patterns, which can be seen in figure 25, are implemented in all three of the developed concepts.



1. As found in the discover phase, consumers need to be confronted with a desired option at moments where undesired routines would occur. For this project, these moments are when consumers interact food items in their fridge, freezer and/or kitchen cupboards.



2. The moment this undesired behavior occurs, they need to be provided with a better option. These better options are the various concepts that are developed. Each of them motivates the consumers by addressing the motives that were found to be effective to reduce consumer food waste.



3. By framing the better options in an encouraging/positive manner, consumers are presumably more willing to change their routine towards what is desired, especially considering it takes little effort.



4. The motivations used to change the consumer can be seen as the rewards. By highlighting the fact that the concept saves them money, helps them to do the right thing and/or takes away the feeling of guilt and shame when wasting, the consumers are rewarding themselves by making the right choice.

Figure 25: Four Design with Intent patterns that were implemented in each of the chosen concepts.

Source: Lockton, Harrison and Stanton (2010)

04.2.2 Concept I: The Fridge Flyer

This concept is essentially a flyer designed as a fridge that consumers place on their fridge, the place at which many of the wasteful behavior starts. The concept provides the consumer with simple tips, which aim to help improve storing routines. The concept does this by focusing on increasing awareness by for example explaining to consumers how and where to store several product categories and how to determine edibility.

On the front of the concept, a short message (see figure 26) is written that aims to encourage consumers to reduce their waste. It tries to do this by tapping into the main motives consumers have to reduce their food waste: doing the right thing and avoiding an unnecessary loss of money. When consumers interact with the product and open the door they find the ten easy tips that help them achieve this desired result.



Figure 26: The message on the front side of the concept, aimed at triggering the consumer by addressing the main motivators

These ten tips are based on the most common tips provided by the Netherlands Nutrition Centre and Love Food Hate Waste on how to reduce your food waste. Showing consumers where and how to store food products and how to extend a product's shelf life (see next page).

The fridge flyer concept in its essence is not unique, several other initiatives also focus on raising awareness using similar tips. The problem however, as was concluded in chapter 02.5, is that these existing initiatives are often not engaging with the consumer at moments where consumer food waste actually occurs. These solutions also rarely focus on the (real) user needs (intrinsic motivations) or are designed in a way that is discouraging unwanted behavior, trying to prevent consumers from behaving in a certain way, instead of encouraging desired behavior. This concept tries to engage consumers in an encouraging way that fits with their intrinsic motivation. The concept aims to be playful in design and is simple in use, which should trigger interaction.

THE DESIGN WITH INTENT PATTERNS

The concept uses Design with Intent patterns that were found to be the most applicable and useful based on how well they fitted with the goal the concept is trying to achieve. This selection was done based on personal intuition.

Feedback through form

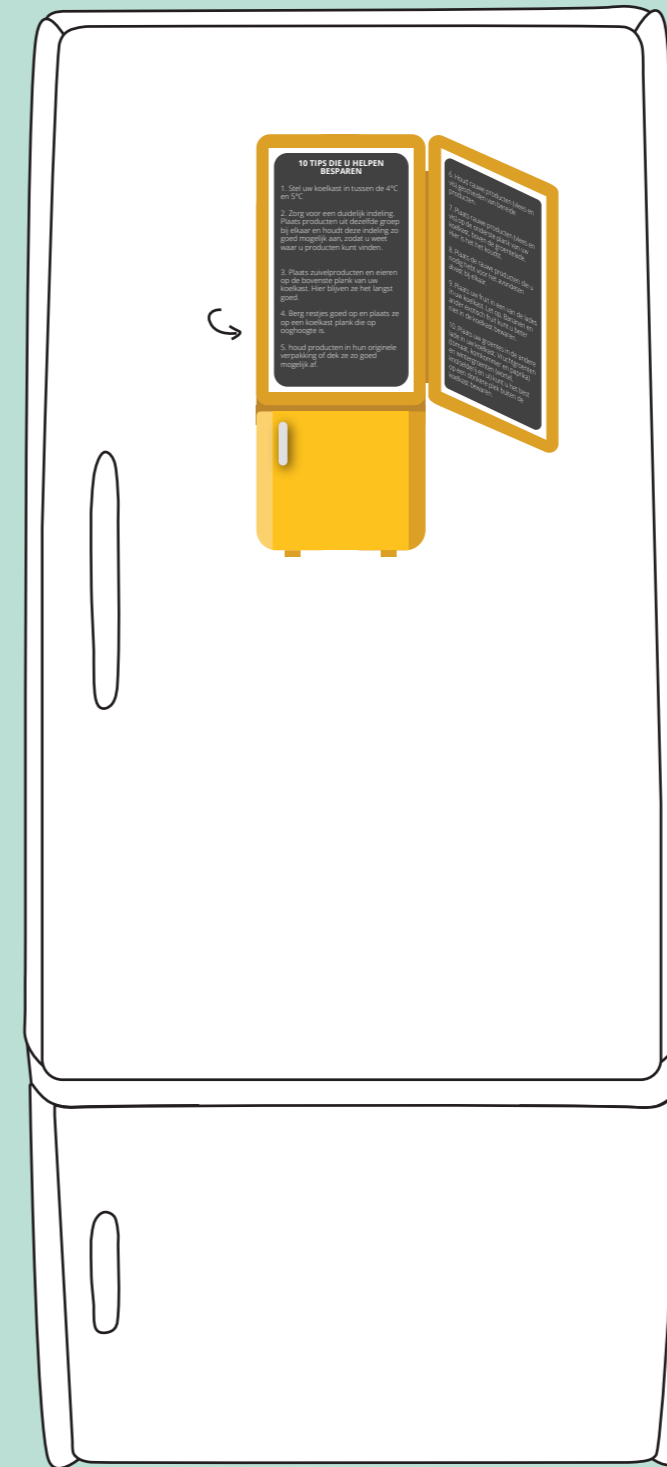
Can you use the form of your object itself as a kind of interface, giving feedback or suggestive cues?

The concept is designed in the shape of a fridge. When opening the fridge, consumers can read tips on how to improve their routines and reduce their waste. The rationale behind this is that consumers can do the same with their actual fridge. When they open it, they can apply the same tips. The concept in its form and interaction, tries to suggest consumers what they can do better.

Peer feedback

Can you give users feedback on their behaviour from other users of the system, equal in status to themselves?

Another strong motivator to help consumers to do better is using peer feedback. The concept tries to tell the consumer that households that have better routines can reduce up to 50% of their waste. This aims to motivate the consumers to also waste less.



THE TEN TIPS

1. Set your fridge between 4° C and 5° C.
2. Create a clear layout. Put products from the same category together and try to stick to this layout so you know where to find certain products.
3. Place dairy products and eggs on the top shelf of your fridge, this shelf is generally the coldest.
4. Store leftovers in airtight containers and store them on a shelf in the fridge that is at eye level.
5. Keep products in their original packaging as much as possible, otherwise cover them.
6. Keep raw products (meat and fish) separated from prepared food products.
7. Place raw products (meat and fish) on the bottom shelf of your fridge, above the crisper drawer.
8. Place your fruit in one of the drawers in your fridge. Please note, bananas and other exotic fruit should not be stored in the fridge.
9. Place your vegetables in the other drawer in your refrigerator. Fruiting vegetables (tomatoes, cucumbers and bell peppers) and winter vegetables (carrots, celeriac and onions) should not be kept in the fridge.
10. When checking whether a product is safe to eat, use your senses: Look, Smell and Taste instead of solely relying on date labels.

04.2.3 Concept II: The Organization Labels

This product is a set of six different product category labels and a few empty labels together with a description where each of the products in the category are best kept (see figure 27). Consumers are asked to place the labels on the shelves of their fridge, freezer and/or cupboards that correspond with the best location each category should be kept. The labels help consumers organize the different products they have and to place them in the best location, extending their shelf life as much as possible.



Figure 27: An example of a product category label including the description of where to best store it.

The six product categories are bread, dairy, vegetables, fruits, meat and leftovers. The first five categories were found to be the most wasted product groups in the Netherlands (Chapter 01.1.2). The sixth label: leftovers, addresses the increasing amount of prepared food waste that is occurring. This label also aims to make leftovers more present, by having them grouped together on a shelf at eye level, it is less likely that consumers ‘forget’ about them, manipulate them and eventually throw them away.

This concept originated from the combined problems consumers experience with being and staying organized, knowing what they still have at home (to not over purchase) and how to store different food products. This concept not only increases awareness on how to store the product, it aims to engage the consumer into organizing it themselves, directly applying their gained awareness.

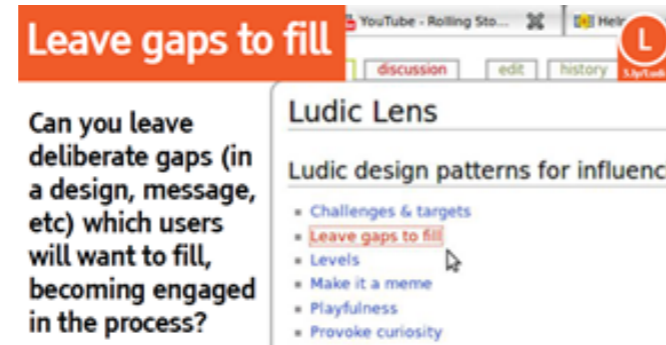
The advice for storing is again based on a set of tips from Netherlands Nutrition Centre and the Love Food Hate Waste organization.

After consumers have placed the labels into their fridge, freezer or cupboard, and the consumer has reorganized, the labels serve as a constant reminder every time they interact with these appliances.

The step of getting used to the new layout however may be the most difficult, because it requires some effort from the consumer. However, once installed, it should provide a more convenient system that is easy to keep using.

According to a study conducted by Farr-Wharton et al., (2012) a similar system that used a color-coding scheme reduced the effort of having to make conscious decisions on where to store newly bought products, which reduced overall food waste. The study also found that using color coding to class products found that ‘consumers became more conscious about the food they still had and could eat, and when particular products would expire.’ (Farr-Wharton et al., 2012).

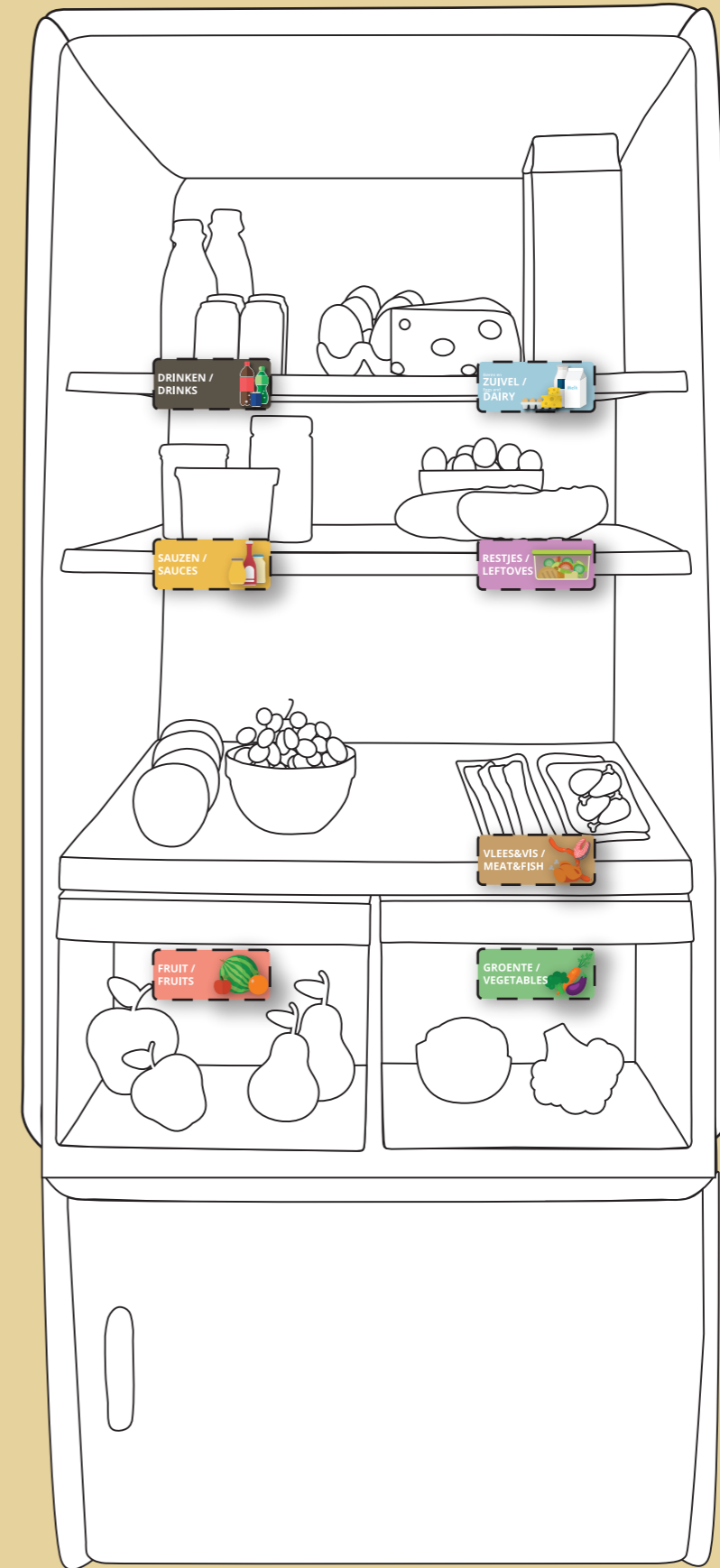
THE DESIGN WITH INTENT PATTERNS



This pattern applies to two aspects of the concept. Firstly it refers to the descriptions the consumer read about where to place the products category labels. After reading it, it is up to the consumer to decide where it is most convenient for them to place the label and food products. Secondly, there are the four empty labels. These provide the consumer with an option to make their own product categories, based on what they feel like they need to become better organized.



These empty labels and the fact that the consumers have to fill them in makes use of the ‘Watermarking’ pattern. By filling in the labels, the consumers increase their feeling of responsibility and ownership towards the concept, which increases the chance of using them and thus to reduce their food waste.



04.2.4 Concept III: The Product Priority Pin

The third concept is a sign that contains a personal commitment written down by the consumer, linked to the consumption of their leftovers (see figure 28). The sign is placed in the consumer's fridge next to leftover ingredients or meals, pointing at them. As soon as the product is eaten, the sign can be placed elsewhere. The fact that the sign can be moved after the specific ingredient is finished, keeps it that every time the consumer opens the fridge, it attracts attention, reminding consumers of the leftover they still have.



Figure 28: The sign including a personal commitment, helping consumer to commit to consuming their leftovers.

This concept derived from the planning issues consumers have concerning leftovers. As was concluded during the analysis phase, leftovers ingredients or meals are rarely used and often discarded while still safe to eat. Some consumers are generally unwilling to eat leftovers, but many of them store leftovers suboptimally, decreasing the shelf life or forgetting about their existence entirely. This concept is meant to help consumers get a better overview of which leftovers they have and provide consumers with a reminder to where leftovers are stored, triggering them to use-consume them.

Just as with the other concept this concept tries to seduce the consumer into using it by communicating what motivates them: saving money, doing the right thing, not feeling ashamed or guilty anymore.

THE DESIGN WITH INTENT PATTERNS

Similar to concept II, this concept uses the 'Fill the gap' and 'Watermarking' patterns. Consumers are asked to write something down themselves which increases their feeling of responsibility.



For this concept however, the consumers write down their personal commitment. Doing such a thing increases the success rate of the commitment. A simple clear goal, such as the one in figure 28, 'Include a leftover ingredient into every meal I prepare.' is easy to commit too and reminds consumers every time they open the fridge.



04.3 Testing

In order to determine how each concept influences the consumer in their food wasting behavior, how motivated they were to use it and how convenient they experienced the concept, the three concepts were tested.

In total 18 participants, six participants per concept, were asked to take part in a one week test. Each participant received an envelope that consisted of a workbook and the concept that had to be tested. The workbook started with a few general questions to gain insight into the current awareness of and thoughts on food waste and which routines the participant already had.

After participants were shown how to install the product, they were asked to fill in a few questions each day after dinner about their interactions with the concept that day and how motivated they were (see figure 29).

DAG 2

Hoe gemotiveerd was u vandaag om het product te gebruiken en waarom?

Heeft u vandaag interactie(s) gehad met het product (heeft u het bekeken/gebruikt)?

Zo ja, wat voor interactie en waarom?

Zo nee, waarom niet?

Hoe blij bent u met het product (en waarom)?

Heeft u vandaag iets anders gedaan in uw keuken routines dan u normaal zou doen (door het product)?

NOG EEN PAAR LAATSTE VRAGEN

Hoe gebruiksvriendelijk heeft u het product ervaren en waarom?

Hoe gemotiveerd was u om het product dagelijks te gebruiken?

Denkt u dat u deze week minder voedsel heeft verspilt dan in een normale week (door dit product)? En hoe denkt u dat dit komt?

Zou u het product willen blijven gebruiken? Waarom wel/niet?

Denkt u dat u op langere termijn minder voedsel zult verspillen?

Dit is het einde van dit werkboekje.

Figure 29: Daily questions aiming at understanding the interaction and motivation of consumers regarding the concept.

Repeating the same questions each day was done to determine how these factors might change throughout the week. At the end of the one week test, participants were asked to answer a few last questions to have them reflect on this week and the impact the concept has made on their food wasting behavior (see figure 30). Lastly participants were asked whether or not they wanted to keep using the product and why. This was done to receive input on how the design could be improved. The entire workbook lay-out can be found in Appendix B of this report.

Of the 18 participants that were asked to participate, a few things were observed that provided interesting insight which need to be taken into account for further development.

04.3.1 Feedback Before Testing

One participant quit before starting. This participant was asked to test concept two: The fridge labels, but stopped after reading what the first step was. The reason this participant quit was because she felt too stressed and overwhelmed having to completely re-organize her fridge according to how the booklet said it could be best labelled. She mentioned being a chaotic person, which was reflected by her chaotic fridge organization. Her chaotic method of organizing however made her feel comfortable. She mentioned that, although she had to throw away food because she often forgot it, this was fine with her.

In hindsight, asking her to test one of the two other concepts that require less effort to install, could have been more useful. This could perhaps have helped her to take a step towards food waste reduction, which she felt more comfortable with and motivated for. This was however not tested.

Secondly it is useful to realize that these solutions, that try to conveniently help consumers to reduce food waste, are still not suitable for everyone. Some consumers might just not be willing to change their current routines. Perhaps because it is still too much effort or because they don't see the need to do so.

04.3.2 Feedback During Testing

During the tests, some participants mentioned having trouble sticking to the daily scheduled questions. This was mainly because the tests were being conducted during the summer holiday period, where participants went on holiday and because many of them spent half their time at their spouse's place. These factors resulted in some participants either skipping some days or spreading the test over a two week period instead of one. Participants mentioned they believed it did not necessarily have direct consequences to the results of the tests, but it is something that is good to keep in mind.

04.4 The Results

Irrespective of which concept some interesting results were found.

- All participants wrote down that they were against wasting food but admitted sometimes throwing away food. Participants either felt ashamed when doing it, mentioned it was not right or found it a waste of money.
- Participants generally did not put much effort into doing something about their food waste. The reasons were often linked to the effort it took. Participants mentioned it was difficult to correctly plan everything, difficult to eat everything or necessary to throw away food because it had gotten spoiled. These reasons match well with the found reason consumers waste food in several literature papers.
- For each concept there was a participant that mentioned they did not necessarily think the concepts helped them further reduce their food waste that week. Interestingly within the booklets of these participants, there could be read that in that week they all made a different choice or plan which was closely linked to the concept. One participant, after reorganizing the fridge according to what the concept proposed, made a dish using a few leftover ingredients that were identified. Another participant planned on doing groceries more often instead of just once a week and the third participant lowered the fridge temperature as a result of the concept. Although these actions may not have led to a direct reduction in their food waste that week, in the long term they can make a difference.
- The participants that mentioned the product did not really reduce their food waste were also all involved in different practices that might have increased their overall value for food and desire to reduce food waste. Two of them mentioned growing their own vegetables and all rated themselves high on reusing leftovers into new dishes and planning portions. This might make the concepts less suitable for them since these participants are already motivated enough and do not necessarily require something that is convenient. This group also belonged to the oldest demographic age group that participated in this study (between age 50-69) which, as was concluded in chapter 02.3 WHO, generally is a group that already wastes significantly less than others.
- The other participants mentioned they believed the concepts did lead to a reduction in their food wasting behavior. Overall the concepts helped them to become more aware of what they had and helped to structure and get a better overview.

04.4.2 Concept I: The Fridge Flyer

Several participants mentioned they believed the product did positively influence their food wasting behavior. The main cited reason was that the concept provided them with a simple constant reminder, every time they interacted with their fridge. This constant reminder led to different decisions being made, which positively influenced their behavior and routines. They also mentioned the tips helped them to get better organized, providing a clear overview of what they still had and what should be eaten first without too much effort. One participant wrote down: *'The concept is easy to use and close to where the problem of food waste occurs. Because the product is placed on your fridge, you are constantly reminded.'*

Several participants mentioned having conversations with friends about the tips, sharing them with others. One participant wrote down that she had a conversation with a friend where they discussed the layout of their fridges. That same participant mentioned that, although she already does a lot to reduce her food waste she learned something new about the temperature of her fridge. It turned out the temperature of her fridge was too warm and that she was happy to learn this. One of the participants, that was living with a partner and child, mentioned the concept initiated conversation on how they should rely more on their senses to determine edibility instead of purely on date labels. This participant also mentioned the child to be a fan of the design of the product.

On one of the last questions of the experiment asked participants: *'Would you like to keep using the product?'* Most participants answered that they would not need to keep using the product. They stated that they had memorized and applied the tips, which changed their behavior and therefore did not need the product anymore. More than half of the participants did mention keeping the product as a reminder or showing it to friends.

One participant stated: she was *'very motivated, also because I deliberately made the decision I wanted to change my food wasting habit, I was intrinsically motivated to change.'*

One month after the experiment, one participant initiated contact and mentioned they still used the same fridge layout based on the tips from the concept. She stated, *'I have become the queen of fridge organization. I even bought all kinds of proper tupperware to keep my leftover meals and ingredients.'*

POINTS FOR IMPROVEMENTS

- Several participants stated that after just a few days in the test, they were aware of the tips and did not need to look at the booklet anymore. One Participant mentioned: *'I have not looked at the tips in the booklet, instead when making a decision I acted with the tips in the back of my mind.'* One participant during the experiment already mentioned they did not feel like they needed to keep the product on their fridge since they were now familiar with the tips. Although it is positive that participants quickly became aware of the tips, removing the product could mean that participants won't be reminded anymore and possibly forget the tips and fall back into their old routines.
- The concept was quite text heavy. Participants mentioned perhaps less text would provide a quick glance at the tips as a reminder instead of having to read the text.
- Something that was not tested with the booklet, but raised a personal question due to the discussed points for improvement, was the willingness of consumers to have the product on their fridge. In order to answer this question a small experiment was conducted, asking consumers whether they would place the product on their fridge (see figure 31). 65% of consumers (n=20) mentioned to be willing. This means that around one out of three consumers might not be willing, which is good to realize. Although this is a useful insight, it does not answer whether or not consumers would keep it in their fridge for a longer time. Consumer's unwillingness to do so, might decrease the effect even more.



Figure 31: Testing consumer willingness regarding having this product on their fridge.

04.4.5 Concept II: The Product Category Labels

In general participants mentioned the concept to be very user friendly and easy to implement and several of them stated that they liked to reorganize the products in their fridge.

All participants mentioned the labels were helped to get an overview and that this overview helped them to more easily plan. They stated that it was easier to see what they still had, where things were and to make a shopping list. It was mentioned that *'The product has taken much of the active thinking of how to store food products away.'*

It furthermore helped to identify leftovers and some participants mentioned this led to more leftovers being used and eaten. One participant mentioned *'It helped me to do some more forward thinking which resulted in me wasting less.'*

Another participant mentioned that she used the different product categories labels to organize her shopping list. She mentioned: *'Removed the labels and added them directly to the shopping list'*. This makes it seem as if she added the labels to her physical shopping list to organize the products she had to buy. Another interesting result was that one of the participants decided to use the additional labels that were added, in his cupboards. He used one side of a free shelf for additional vegetables, which did not have to go in the fridge and the other side for fruits.

Two participants also wrote down that the product proved to them that they were already using a good fridge layout.

One month after the end of the tests one participant mentioned to still have the labels installed. *'I still use the same layout but that is also easy to do with my small fridge.'* The participant mentioned that the concept in general gave him a bit more awareness which he now still uses to reduce his food waste.

POINTS FOR IMPROVEMENTS

- One household stated a difficulty dealing with height. She stated that the proposed labelling system did not work for them. She mentioned not being able to reach the top shelf, where dairy products and eggs are best kept because it is the coldest location. This is why they instead normally use this shelf for the beers of her husband, who is tall enough and now has his own personal beer shelf. This problem can be solved by making the descriptions of each product category more intuitive, to make sure that consumers can adapt the concept to how they find it most convenient to use in their fridges. Making sure both the overview is created and consumers experience it as more convenient.
- Some participants mentioned having to get used to the new lay-out. Although this does not have to be something negative it does take some time for the new behavior to be implemented into the existing routines, during which consumers need to stay motivated. If not as convenient as the normal layout some consumers may be reluctant towards sticking to this new change and go back to doing it in their particular way.
- Several of the participants mentioned the labels did not stick that well. Some participants stated that their shelves were too small or that the damp environment made it difficult to stick the labels onto them. Although not specifically mentioned, the damp environment will in the long term probably also have a negative impact on the cardboard material the concept is made off.
- One participants furthermore mentioned that it might be better to integrate the tips for each of the product categories with the label. He mentioned *'To be honest, I haven't looked much at the tips list with information, single flyers always quickly disappears into a pile. Maybe think of something to connect this more with the stickers. Something of QR or something on your phone.'*

04.4.6 Concept III: The Food Priority Pin

Participants mainly mentioned that the concept was simple to use and helpful to identify which products should be eaten. Several participants mentioned that it helped to get a better overview, which prevented overlooking products. One participant mentioned *'I saw I still had half a bag of onions that I almost forgot. I placed the product next to them came up with a dish for tonight which used the onions as a base ingredient.'*

Some participants even mentioned that during their grocery shopping, they were reminded of the concept and leftovers they still had.

It was also commonly mentioned that less food waste is always better good, and several participants mentioned that because this concept takes little space and provides a constant reminder they wanted to keep using it. *'I liked using it because a original and easy to use product.'*

Some participants did mention that after a few days they started getting more used to the product. Although not specifically mentioned in the booklet, this could have a negative effect of the motivation of consumers to use it and eat their leftover products.

Various participants mentioned moving the concept several times throughout the week, to place them next to an ingredient or meal that had to be eaten. Some participants also mentioned that they based their meals on these leftover ingredients.

Interestingly several participants mentioned that instead of placing the concepts somewhere different every time a product was finished, they instead moved the products that had to be eaten to the pin. They essentially created a place in their fridge where all leftovers were located. This prevents leftovers ending up somewhere in the back of the fridge and being forgotten.

POINTS FOR IMPROVEMENTS

- Some participants mentioned they would have liked to be able to change their commitment. Some mentioned that when they wrote the commitment down it was for a specific product or product category. After the product was finished they would have liked to write down a new commitment.
- Regarding the design, participants mentioned the product was a bit too weak and that the suction cups, used to stick the concept to a shelf in the fridge, often came loose.
- Some participants mentioned that although the product helps to get a better overview it can still happen the product itself is overlooked when the fridge is too full. *'The product should be more sturdy or bigger because now it is sometimes hidden behind food product.'*

05. Decide

This chapter draws a conclusion on which concept is most promising based on the results of the testing phase. It furthermore covers a design iteration for this chosen concept, incorporating the feedback. The final part of this chapter discusses the showcase of the product to the general public, and some feedback of consumers.

05.1 The Chosen Concept

From the testing phase there can be concluded that all concepts had aspects that have the potential to contribute to a reduction in the amount of food waste consumers generate. However, looking back at the set requirements and wishes, a more deliberate choice can be made. Proper planning routines such as making shopping lists and checking stock are found to be crucial routines in the upstream phases. Looking into the findings of how the different concepts improved these routines, there can be concluded, based on participant feedback, that concept II did this the most. This concept, according to various consumers, helped to get a better overview which allowed them to know what they still had and to set up a shopping list. Based on these first results, this makes concept II the most interesting option.

During a meeting with I Change, the results from each of the concepts were discussed and the personal preference towards concept II was mentioned. After an evaluation session the decision was made that concept II would indeed be most interesting. This decision was partially based on the results of the tests and partially on the potential the concept has to reach the set aim in chapter 01.4. This aim was to develop a concept that would be economically viable and would allow I Change to reach a bigger target audience.

It was furthermore discussed that it would be interesting to integrate some sort of follow up step in the design, that would allow consumers to take additional action to reduce food waste if they are willing to do so.

The concept now solely helps consumers to become more organized, it would be interesting to also have the concept propose a next step, for example what the consumer can do with the products they still have.

Interest was also shown for the third concept, the product priority pin. During the meeting it was discussed that the concept could also be formed into a marketing campaign where I Change would for example initiate a 'Leftover commitment week'. During this week consumers would for example write down their own commitment, regarding consuming their leftovers, on a post-it and place it in their fridge. Implementing the product in this way would probably reach a similar result.

After this session the choice was made to do an iteration on the chosen concept to incorporate the feedback found in the testing phase and discussed during this meeting.

05.2 A Design Iteration

During the testing phase and evaluation meeting with I Change, various points for improvement were identified for the product category label concept. A design iteration was done to incorporate these elements into the chosen concept, which eventually led to the following final design (see figure 32). During this iteration the product was also given a name, Eetkaartjes.



Figure 32: The final iterated design of Eetkaartjes.

05.2.1 The Booklet

A small booklet was designed to accompany the product and replace the workbook that was used during the testing phase. The booklet explains what the product does, how to 'install' it and where to best keep the various product categories. Trying to solve the height problem that was identified as a point for improvement, the product category descriptions have been rewritten. Instead of telling the user where to best keep the products, it now tries to advise them which location is best, more intuitively and therefore more convenient for the consumer. For dairy products for example the booklet now talks about 'the highest accessible shelf' (see figure 33).

The booklet also explains the empty labels. Four additional empty labels are added that allow consumers to create their own product categories and thus encourage further food waste reduction. Consumers can use these labels for example in their cupboards or pantry, increasing the overview even more. This aspect also ties in well with the design with intent pattern 'Watermarking' which was discussed in chapter 04.2.4.



Figure 33: The booklet design to accompany the labels, explaining consumer where and how to best store food products.

05.2.2 The Labels

An iteration was done to the labels based on the feedback of consumers and a meeting with I Change. The decision was made to add a follow up option for consumers. The labels as they were might help consumers to identify which products they still have, but actually using these products might require an extra step. The addition of the QR code to each of the product category labels, together with the sentence: what can I do with my last piece?' aims to encourage the consumer to take the next step in their food waste reduction. Each QR code redirects the consumer to a (different) web page with additional information about what to do with products from that particular product category (see figure 34). For example the QR code for the fruit and vegetable labels redirects the consumer to the A to Z Food storage tool provided by Love Food Hate Waste (as discussed in chapter 02.5). Here consumers can read tips on how to prolong the shelf life and what to make from the last remaining piece of produce in one clear overview.

Although the QR codes are now redirecting to different well known parties involved in the food wasting domain such as the Netherlands Nutrition Centre and LoveFoodHateWaste, it would be more interesting for I Change to eventually take this on themselves. If the QR code would redirect consumers to I Change's web page, where they would see similar tips and tricks in a, it would not only boost traffic on their website but also involve more consumers into their practices, potentially convincing them to join the community.



Figure 34: The new label designs, including QR to help consumer take the next step.

05.2.3 A Product Wrapper

A crucial aspect that was addressed during one of the feedback sessions was how to hook and motivate the customer to buy/use the product. During the testing phase, participants were personally asked to partake in the experiment, which assumably already increased their motivation to reduce their food waste, however for the final product this interaction will not be as strong. In order to engage consumers into using the product, this product wrapper was designed (see figure 35). The wrapper sits around the product package and is the first interaction consumers have with the product. The wrapper uses several of the design with intent patterns as discussed in chapter 04.2.1, trying to engage the consumer. The text on the wrapper explains consumers how much grocery bags of food are wasted and what the social and personal consequences of this are, tying in with the found motives in chapter 02.2. It furthermore explains consumers how a significant percentage of this waste can simply be prevented and that this is where the product can help. After consumers read this they are shown a commitment statement which says: 'I am ready to change my food waste'.



Figure 35: The product wrapper, aimed at motivating consumers to start reducing their food waste.

05.3 Showcasing The Final Design

During the 'waste-free week' I joined I Change at their stand at the market in Delft and displayed the Eetkaartjes product and hand it out to consumers that were interested (see figure 36). During this day, I Change had a stand and was handing out merchandise products of the Netherlands Nutrition Centre as a promotion event for the waste free week.

During this day a few things stood out that need to be addressed.

- It was observed that in general consumers were reluctant to take the free merchandise items I Change was handing out.
- personally I was not well prepared for the event. firstly I am not a sales person therefore I lacked the skill to actively engage conversation with consumers that walked by. Secondly I only had made ten of the products and did not just want to give the product away to anyone that walked by. I preferred to have some control over who got the product and explain what my project was about and how the product helped to reduce food waste.
- a small handful of consumers initiated conversations about the product and topic of my graduation. Although most of them expressed interest in the product, and mentioned they liked the design, they did not feel like taking it home. The reason for this, according to the consumers themselves was that they already had quite some good planning and organizing routines and wasted little food. Whether this is actually the case can of course not be tested. However in general I personally think that people that visit the market and actively engage in conversation about food waste, might already be somewhat more conscious about their food waste, which means this product might not be suitable for them.



Figure 36: Me showcasing the final product on the market in Delft during the waste-free week.

06. Develop

This chapter proposes a production plan, and implementation strategies for the product to allow I Change to bring the product into full realization once this graduation project ends. The chapter is meant to serve as a stepping-stone on which I Change can build further. For each of the strategies benefits and limitations are stated and additional steps that should be taken are discussed.

06.1 Production Proposal

Although the concepts, which were made of mainly cardboard, paper and tape, were able to withstand the damp fridge environment for the short testing period, this is surely not the most ideal long-term design solution. The advice would be to laminate the printed labels. Laminating them ensures they will be able to sustain in the fridge environment over a longer time period. Instead of the double-sided tape to stick them to the shelves, a better system using clamps is advised. For this simple plastic tube clamps (see figure 37) can be used.



Figure 37: Tube clamps instead of double sided tape to attach the labels.

The clamps can be attached to the backside of each label and can then be slid over the fridge shelf (see figure 38). In case the consumer wants to clean their fridge or change their layout, the clamps can still easily be removed.

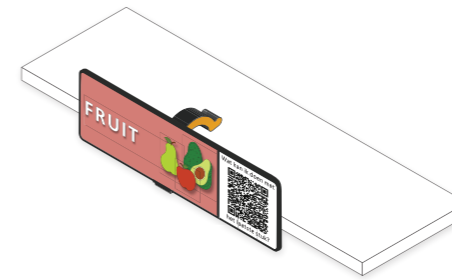


Figure 38: Sliding the Clamps over the fridge shelf.

06.1.1 A Cost Estimation

Now that each part of the design is determined, a first cost estimation can be made. Based on the advice from the previous section, the production costs for one set were found to be € 1.53 (see table 1)

This table merely gives an estimation of which costs can be expected when bringing this product into production. Several things are not taken into account.

- The table does not take any costs for assembling into account. In this cost scenario, the clamps still need to be attached to each of the labels and the product wrapper needs to be glued and slid around the box after all parts are in it. Although these actions are not costly in terms of materials, they do require quite some time.
- This table addresses all the parts separately, meaning all from different suppliers. It is likely that outsourcing the entire production to one party would significantly reduce the production costs.
- The table is based on a rather small batch of 1000 sets. A larger batch size would significantly reduce the production price per product.

Production cost estimate for Eetkaartjes.		
1000 sets		
Item	Quote (exl. TAX) per 1000	Supplier
The Labels (laminated)	€ 327,38	https://www.pixartprinting.nl
The clamps	€901,55	https://www.amevo.nl/
The Booklet	€ 27,68	https://www.printenbind.nl/flyer
The Product Wrapper	€ 68,59	https://www.printenbind.nl/poster/a3
The Box	€ 200,00	https://webshop.viv.nl/
Total Production Cost for 1000 sets	€ 1.525,20	
Production Cost per Product	€ 1,53	

Table 1: Production cost estimation for Eetkaartjes.

06.2 Implementation Strategy Proposals

In order to bring the developed product to the market and find a way via which the product can be viable for I Change, several implementation strategies are proposed. These strategies are primarily based on those of the existing initiatives discussed in chapter 02.5 and personal intuition.

06.2.1 Implementation Proposal 1: Give-away

A strategy frequently used by NNC is giving the product away for free. Something they can do because they are an organization that is 100% funded by the Dutch government. They have used this strategy in 2015 for their fridge and freezer stickers, where they handed over 1 million products out to various supermarkets in the Netherlands, the location where consumers deal with food. This strategy is rather effective to reach a big target audience and it is likely that a percentage of the consumers will actually use the product. However it is good to realize that handing them out at a supermarket is somewhat odd considering the fact supermarkets play a significant role in the amount of food waste consumers generate. As can be read in chapter 05.3, handing them out at the market in Delft might also not be ideal because of the audience mismatch. Although too early to draw a conclusion from, initial results do not look promising.

An interesting option for I Change would be to give away the product at their breeding ground. Consumers could for example get it with a specific deal, when ordering something to eat/drink. This strategy is something I Change is already using on the social channels to attract customers (see figure 39). An example of how I Change could use the product in combination with a drink and bite to eat can be seen in figure 40. This strategy allows I Change to test on a relatively small scale whether consumers would be interested in it, and how they experience the product.

The potential problem with scaling up this strategy could be that unlike NNC, I Change is not completely government funded. I Change would have to get funding or partnerships to be able to bring the product into (mass) production. For the small scale test at their breeding ground this funding may not be needed, based on the production costs (see table 1). However in order for I Change to hand-out this product on a nationwide scale, they surely do.



Figure 39: The current marketing strategy of I Change to promote their products.

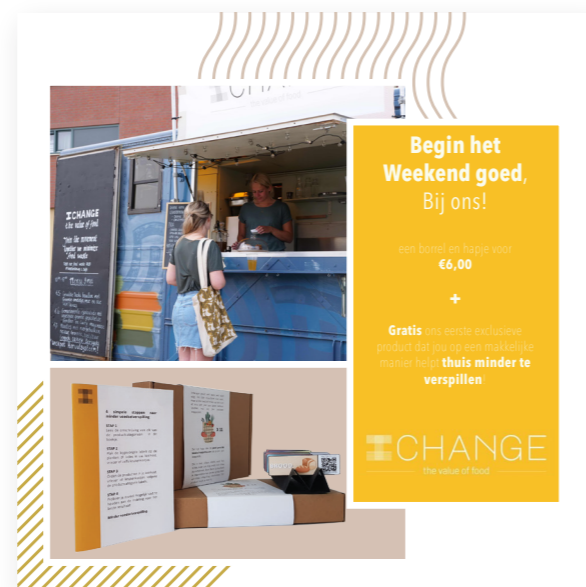


Figure 40: The possible strategy for I Change to promote Eetkaartjes.

Another option would be for I Change to make a simple free downloadable file available on their website. By placing a digital version of the product on their website they would be able to reach a larger audience. This digital product could look something like figure 41. The figure combines all key elements of the physical product and shapes it into two A4 flyers. The first page explains the benefits, aimed at motivating the consumer, the second is the do-it-yourself kit to make and install the product.

Although this direction would be beneficial for I Change, since it saves them the production cost, there are a few potential downsides.

The main downside is the required additional effort from the consumer. With this option consumers are asked to print out the product, cut out the labels, paste them on something sturdy and durable in a damp environment and place them on the shelves of their fridge, freezer and/or cupboards. It is likely that consumers will be less motivated and willing to take all these steps since this project concluded that convenience is key when it comes to consumers reducing their food waste. Whether this would be a fruitful direction at all has to be tested.



Figure 41: The possible strategy for I Change to promote Eetkaartjes.

06.2.2 Implementation Proposal 2: Merchandise Item

Closely related to the first strategy but more viable for I Change would of course be to just sell the product. If I Change were to sell the product for the symbolic value of €3.49 (the value of 1kg of food waste in the Netherlands), they could potentially still earn a small profit on each of the products, based on the estimated €1.53 production cost per product. Whether consumers would actually purchase the product for this price is something that needs to be validated. It might be interesting to start with the first implementation strategy and as soon as interest in the product has increased, start selling the product as is.

I Change could also give the product as a welcome gift when consumers sign up to be part of the I Change community, something they are trying to grow. This was in fact one of the first ideas that was discussed, even before the product was designed. Consumers can sign up to become a member of the community by paying the same symbolic contribution of €3.49 per month. In exchange for this contribution consumers currently get their name on the community wall, receive discounts on events and get regular tips and tricks to reduce their own food waste at home.

The Eetkaartjes product can be seen as a manifestation of these tips and tricks, essentially helping the consumer to earn back their investment. Just as with the previously mentioned strategy, this can also be tested on a small scale, to see whether consumers are interested in receiving and using this product. I Change could for example promote that the first 20 new members get the product for free. This strategy would not directly earn I Change any profit, but indirectly it might trigger people into joining their community which increases profit.

I Change could also make a deal with several of their partner companies that they have already collaborated with during a give-away promotion using the Netherland Nutrition Centre products (see figure 42). They could repeat this initiative using the Eetkaartjes product. The assumption is made that these partners would again be interested because they also commit to reducing food waste in Delft. However in order to implement this strategy they would again need to get enough funding to get the product into production.



Figure 42: A social media post of I Change. Partner companies posing for an initiative using the product by NNC.

06.2.3 Implementation Proposal 3: Education

A strategy used by both Samen Tegen Voedselverspilling as well as Love Food Hate Waste is implementing food waste solutions into education. According to Samen Tegen Voedselverspilling (2020) 'School is the place to make children aware of healthy and sustainable food. Many schools also want to pay attention to preventing food waste.' This strategy, of making children more aware of the topic of food and food waste and teaching them how to prevent it has a positive effect on parents (Samen Tegen Voedselverspilling, 2020). In order to make the product fit for this implementation strategy it should be re-designed, to fit the interests of children. Although no additional research was done into how to design for children, a small proposal was made, aimed at making the product more interesting for children.

The product could be made in a simple exercise to teach children how to store different food products and afterwards let them design the label for these products. This approach is also what both Samen Tegen Voedselverspilling and Love Food Hate Waste use. The re-design could for example look something like figure 43.

The 'exercise' here is to match the right description with the right type of, in this case, fruit and vegetables. The descriptions refer to the tips that were already provided in the booklet of the product. Using them in this way would be an interesting exercise for the child but also informative for the parent, providing them with knowledge on how and where to store what. After the parent places their child's designed label in the fridge on the corresponding shelf, they are constantly reminded, and can start becoming more organized in their fridge.

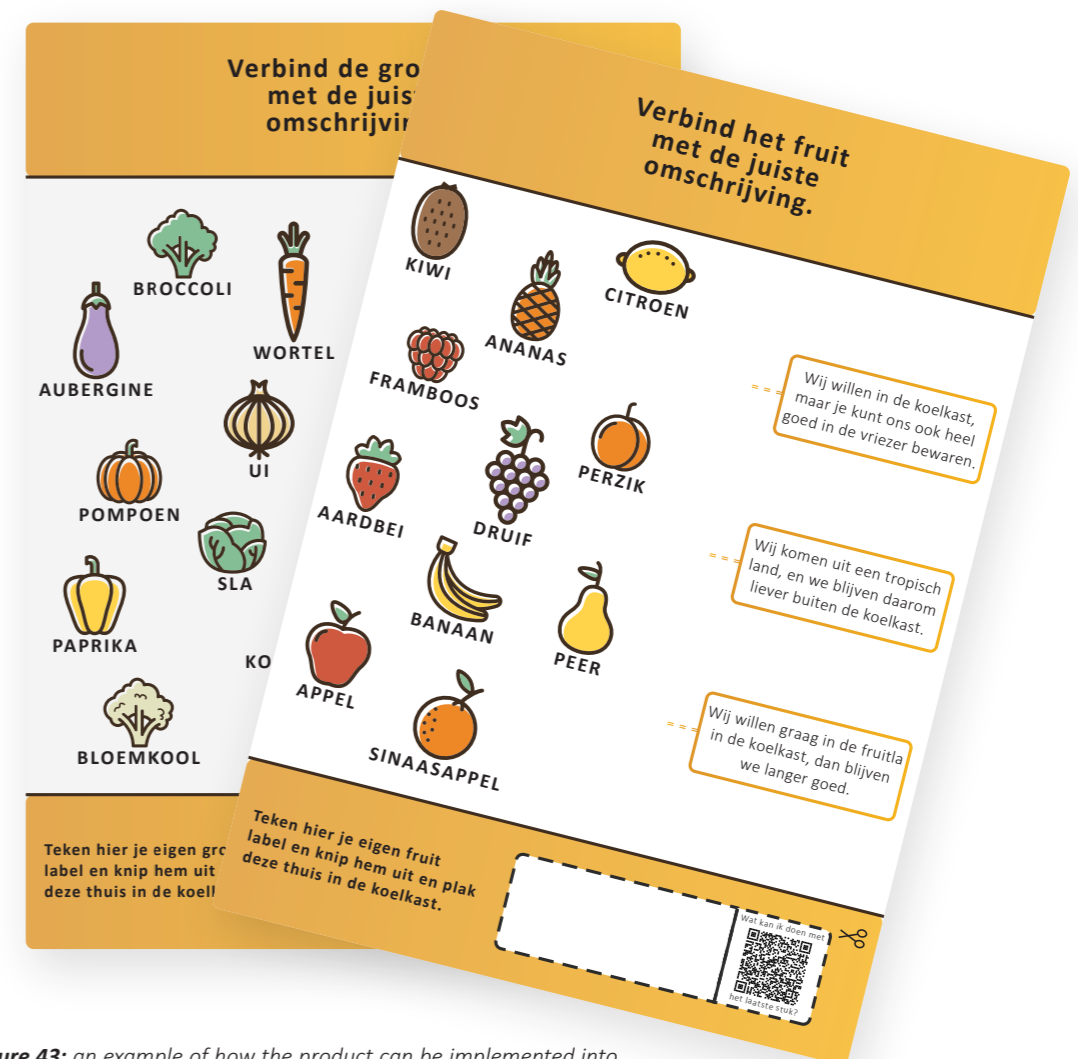


Figure 43: an example of how the product can be implemented into the primary education system of school children.

06.3 Implementation Feedback

In order to discuss the proposals and see which directions would have the most potential for the product, two meetings were held. The first meeting was initiated with Marjolijn Schrijnen, manager consumer activation at Samen Tegen Voedselverspilling and project manager at Voedingscentrum.

The purpose of this meeting was twofold, first of all it was to get an external expert opinion on the product to see whether they believed it had potential. The second goal, based on their expertise, was to find out and discuss potential implementation strategies.

The meeting was fruitful. Sincere interest was expressed in Eetkaartjes. It was mentioned that the product captures the essence of what consumers need, convenience. Because, as they have learned at the Netherland Nutrition Centre throughout the years, consumers are willing to do something but other motivations are suppressing this willingness.

Secondly, as it turned out, several years back the Netherlands Nutrition Centre had a similar product called 'Koelkastklem'. The product was essentially a label that specifically helped consumers group their leftovers. The reasons why the product was discontinued back then were as follows.

- According to a focus study conducted by the Netherlands Nutrition Centre, the KoelkastKlem was not suitable for all consumers. Some consumers were not interested in using the product because they had no intention to re-organize their fridge.
- Secondly back then, the product was made from silicon rubber which is clamped onto the fridge shelves. This material however which it quite expensive to produce.
- It was at the same time Eetmaatje was in production, this product seemed more suitable for everyone and therefore the choice was made to continue with this product.

It was mentioned that the Koelkastklem product was dusting away on the shelf, waiting to be picked-up again. Marjolijn believed Eetkaartjes could help with that. She mentioned, the Netherlands Nutrition Centre already has the right knowledge and resources at hand which would allow them to take Eetkaartjes into production.

Marjolijn furthermore shared her view on interesting implementation strategies. She shared two interesting options.

- Fridge manufacturers such as Samsung are an interesting party because they are often looking for interesting extra give-aways for their customers. This is something they have seen with the BCC store as well. BCC contacted them because they were interested in having a giveaway

product for the waste-free week.

- Education would indeed be an interesting fit for the product because it would not only be something that the children will engage with at school, but they eventually take the labels home, triggering the parent. This cross-pollination, as Marjolijn called it, made the product interesting. However in order to implement this product into education it should fit within the education packages provided by an organization called Smaaklessen. They are responsible for what ends up in these education packages. Marjolijn believed this product would fit quite well and provide extra depth to the topic of food and food waste.

Marjolijn mentioned she would get in contact with Samsung and Smaaklessen and bring them in contact with me or I Change. Unfortunately the contact with Samen Tegen Voedselverspilling was initiated quite late in the process of this report. This means the outcome of these next steps have not made it into this report. The progress however will continue beyond this report.

During the second meeting, with I Change, interest was expressed in the first and second strategies, having the product as a give-away or merchandise item. Mirte mentioned having a real physical product that you can give or sell to consumers just feels more luxurious and elegant than a simple flyer. Consumers are triggered by this. It was furthermore discussed that having this physical product would also be more convenient for the consumer, having the option to easily move and remove the product, instead of having it be stuck in your fridge.

It was however discussed that it could be valuable to have a simple flyer version of the product that is cheap to produce and could become the new give-away items for next years #Verspillingsvrijeweek. This is something Mirte was very enthusiastic about and might be a great opportunity to further explore in collaboration with the Netherlands Nutrition Centre.

Secondly, interest was expressed in the Education proposal. As it turns out I Change was already looking at possible collaborations with an external party called Flower Factor. Flower Factor has developed an education package called 'Groen doen in de Klas'. According to Mirte Flower Factor has already taught many primary school classes about nature and plants and is looking towards expanding to food and nutrition as well. According to Mirte, the implementation strategy proposal would fit well with their wishes.

I Change and Samen Tegen Voedselverspilling have been brought into contact with one another to discuss potential next steps and decide which implementation strategy would be most suitable for them and the product.

07. Deliver

In order to determine how the final Eetkaartjes prevents consumer food waste, this chapter looks back both at the initial aim of the project and how well the product ties in with the formulated criteria of chapter 03.2. The chapter furthermore critically discusses the shortcoming and uncertainties that are still present in this project.



07.1 Conclusion

The initial aim of this project was *‘to provide I Change with a product/service that facilitates consumer food waste prevention by addressing the household routines, which is economically viable and allows I Change to reach a bigger target audience.’*

To safely conclude whether or not this aim has been achieved at this stage, is too early. The project essentially aims to change the consumers their behavior, something that is already difficult to achieve and even harder to validate within the relative short time span of this project.

However, based on the first results of this project, some first careful conclusion can be drawn.

- Looking back at the results and comments from participants in the testing phase and the feedback given by several external parties involved in the food waste domain, it can be concluded that Eetkaartjes has potential to facilitate consumer food waste prevention. Based on the testing results, the product addresses the lack of ‘good food habits’ and improves them. Consumers mentioned it helped them to get a better overview, since products were organized. This helped several of them to plan more easily. It furthermore made it more convenient to see what they still had in stock, which helped to make shopping lists. Lastly it identified leftovers and led to more often using and consuming those leftovers.
- Comparing Eetkaartjes to the existing products currently produced by the Netherland Nutrition Centre, I believe that Eetkaartjes can have similar success. Compared to the fridge and freezer stickers Eetkaartjes is more elaborately since it explains how and where to best store several product groups. Compared to Eetmaatje, using Eetkaartjes within consumers their daily routines requires less effort and furthermore addresses the most wasted product groups.
- The fact that the product is intentionally kept simple and does not add any additional steps in the existing routines of the consumer, allows for a broad target audience. However, as was found during in the testing phase and study of the Netherlands Nutrition Centre, the product seemed less helpful for naturally un-organized consumers.

Being able to reach this broad target audience highly depends on the chosen implementation strategy. The give-away strategy, especially with a digital version of the product, would certainly allow I Change to reach them using their social media reach and network. However since this version requires additional effort from the consumer, the actual implementation rate might be low.

The education strategy together with Flower Factor or Smaaklessen would be an interesting direction because it would furthermore reach an target audience that is generally considered to be high-food wasters, namely families.

The biggest opportunity might lie within a collaboration with the Netherlands Nutrition Centre. They have expressed interest in the product and have the right knowledge and resources in-house to get the product into production. They furthermore have the right partners in place to get the product implemented.

Whether the product can be viable for I Change is still hard to conclude. Based on the fact the product is simple and a low investment for the consumer makes it questionable if the product can directly be profitable for I Change. Indirectly there are some opportunities for I Change. Using the product as a merchandise item that consumers get when they sign up to the I Change community or take part in an event might still be the most promising option.

Whether this is something consumer are interested in should be tested at I Change’s breeding ground as soon as the hospitality industry can open it doors again. For this a small batch of products is made.

07.2 Discussions & Recommendations

This project aimed to address one small part of a big food waste system. This ultimately meant some potentially interesting aspects were neglected because they were beyond the scope of this project. Furthermore there are still some uncertainties about the project and product which should be acknowledged. This chapter discusses both.

07.2.1 The Food System

In order to successfully change the entire food waste system much more is needed than just a good product or service intervention that reduces consumer food waste. There are several stakeholders in the system that have to take their responsibility. This is most likely not going to happen unless the rules change and governments step in. Something which has happened in France. In France laws changed, which meant supermarkets were now obligated to sign donation deals with charity organizations such as food banks and donate them their leftover produce (Chrisafis, 2016). The law has also made it easier for production companies to directly donate their excess products. This is just one example of a law that currently does not exist in the Netherlands, but could make a huge difference to the amount of food that is being wasted.

07.2.2 The Consumer

Although the project tried to develop a solution that would be easy and convenient, and therefore suitable for all different types of consumers, the solution is still not for everyone. Something that was concluded during the testing phase, is that some consumers are simply unwilling to use the product. Consumers that think they do not waste much food, are happy with their current household management or are just reluctant towards becoming more organized in their household. Some consumers will not see any added value in using this product. Although this is not unique, it is good to realize some consumers are simply not interested.

07.2.3 Motivating Consumers

The project addresses the motives consumers have to waste food and has tried to implement those reasons in a solution that would prevented food from being wasted. Although the final product tap into these motives, motivating the consumers to purchase and implement the product into their existing routines is something that has not been exclusively tested.

The product uses several of the motives which consumers have to prevent food waste such as it not being ethically right, the fact it is a waste of money and that consumers generally experience a feeling of guilt and shame when doing it. Whether these are enough to trigger consumers into purchasing and/or implement the product into their existing household routines was not tested. This however could be tested during a new test with the final product.

07.2.4 The Testing Phase

The qualitative testing phase was done with a relatively small group, that was mainly based on 1st and 2nd degree connections. Although the tests showed promising results in the food waste reduction, it is unclear if this is purely due to the concepts. Some participants that took part in the test might have had biased motivation because of wanting to help this project. This is something two participants even mentioned in their booklet. These biased motivations might have interfered with the results and provided an unrealistic success rate. This however is not certain. It was communicated to each participant beforehand that this testing phase was done to gain insight about the effect of the concepts (not prove their success) and some 3rd degree connections still showed similar results.

Even if motivations would have been biased, the consequence of this is assumably low. In general, based on personal belief, the product is rather harmless. The product specifically focuses on changing food waste behavior and routines consumers exhibit using a simple and accessible product. It is therefore unlikely to think that the product might have the opposite effect on the amount of food being wasted. Despite this, I would personally recommend to first run a larger scale test using 3rd degree connections. During this specific test it would furthermore be interesting to ask these participants whether or not they would be willing to purchase the product and why.

07.2.5 The Final Product

As concluded in the concept testing phase, several participants mentioned that after just a few days they were familiar with the product or tips, which sometimes lowered their interaction and motivation. It can be assumed that consumers are more likely to remove the product if they feel they are familiar with it, although no participants directly mentioned this in the booklets. The problem when consumers remove the product if they feel familiar is that it could cause their constant reminder to fade away, leading to them falling back into their old behaviors and routines.

Although the final product aimed to tackle this, by the implementation of the QR code, whether it helped was never tested. It can be assumed that this additional QR code option might keep consumers engaged longer because it provides a simple step they can fall back to every time they have to deal with a leftover ingredient or meal. Because this step can be applied to numerous ingredients, it is something that should feel different every time. The advice would be to also implement this aspect into the proposed new test, to validate whether this is actually the case.

07.2.6 Production

The short production proposal including a cost estimation that is made for the product is based on the current design. The question that still remains is whether this is the optimal form for the product. Based on the meeting with Marjolijn, who mentioned the Koelkastklem was also clamped on, it can be assumed it is a useful system, however it has not been tested. Whether or not they fit well within each type of fridge and are sturdy and convenient enough to use was not verified. Another option that could be explored is using price tags (see figure 44). These are similar in price but would perhaps be more sturdy.



Figure 44: Price tags as an alternative to the clamps.

07.2.7 Implementation

Although already addressed in chapter 06.3 there are several implementation strategies proposed. Making a digital version of the product would take away all production costs, but requires additional effort from the consumer. During the meeting with Marjolijn Schrijnen it was also proposed that the product could perhaps also be made into a sticker format, just like their existing fridge and freezer stickers. This direction would be interesting since it would be cheap to produce and therefore easy to realize on a large scale. This makes it ideal for the give-away product for next years ‘waste free week’. Again, whether or not consumers would implement the product into their routines needs to be investigated.

Which direction eventually turns out to be most suitable is something that will be apparent from the continued contact, and eventually hopefully, collaboration between Samen Tegen Voedselverspilling and I Change. This however continues after this project.

07.3 A Final Note

Throughout the entirety of this project, I had to deal with the consequences of the Covid-19 pandemic. It has had a significant impact on me personally, but also my work. This strange homebound period meant dealing with quite some restrictions. Companies had other priorities than setting up meetings during the analysis phase of my project and during the design phase, it was difficult to reach with consumers and involve them into the design process. Although the first restriction only meant a bit more patience, the second restriction meant not being able to engage with consumers as much as intended and test as much as I had hoped beforehand. Whether this has had an impact on the concepts and final product is hard to say, it however has definitely led to the project ending us less far than I had hoped. With more time, I would have liked to bring the concept into further realization by implementing some of the strategies that are proposed and test them out. This is something that might still happen, since I plan on still being somewhat involved with the product whilst looking for a full-time job.



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'Imagine walking out of a grocery store with four bags of groceries, dropping one in the parking lot, and just not bothering to pick it up. That's essentially what we're doing.'

- Dan Gunders