Design for reducing the food waste of the TUDelft banquet service

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MSC Integrated Product Design

CIRFOOD | Food & Eating Design Lab | TUDelft Delft University of Technology

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Preface

Welcome to my graduation report. This project is the final thesis of my master's study at the faculty of industrial engineering at Tudelft. It has been a challenging and enjoyable project that I accomplished at the last stage of my master's study life.

Rick, Thank you for all the support during the meeting and for being my chair. Your suggestion is not only about how to do a good design and also how to do a good designer. Moreover, it will hugely influence my future career, and I will remember it.

Pinar, Thank you for encouraging me, believing me at each meeting, and being my mentor. I learned from you how important the details are as a designer. I will hold it all the time.

Thanks to the staff from the secretaries: Rafaela, Jessica, Selina, and Denise. Thank you for always welcoming me to answer questions at any time. I felt motivated to do the project when I talked with you every time.

Thanks to the staff from Cirfood: Mark, Karian, Manou, and Yumi. Thank you for sharing your experience and discussing the project with me. You provide a new perspective to review the project.

Mom and dad, thank you for teaching me to grow up to be optimistic and supporting me with any decisions.

Thank you to my friends.You are always shining my life when I am in trouble.

Thank you to the participants joining my research, co-creation, and evaluation session. You give me valuable suggestions to achieve the design.

Finally, Never give up and love life. Enjoy the report!

2022.12.15

Xiaonan Yang

Executive summary

In the past decade, food waste has accepted intensive attention from society. It is increasingly acknowledged that approximately one-quarter of the food for human consumption is wasted throughout the food supply chain (Papargyropoulou , 2014). At the Delft University of Technology, It organizes a vast meeting every day in different facilities. The banquet service with the company of Cirfood would be the food sup- plier to provide the lunch for the guests during the meeting. Typically, the orderer needs to book the food from the "Banque" website, the official and only platform that merely offers the food for the Delft Uni- versity of Technology.

In contrast, it must go through a long journey from booking the food to disposing of the food with confer- ence organizers, the secretariat who is also the order- er, and the Cirfood caterer in a different stage. The project figures out the workflow of the banquet service and understands the problems of different stakeholders that meet during the process that cause food waste. The design solution achieved the vision: I envision a seamless banquet service aiming to help the organizers, orderers and audience collaborate to reduce food waste.

The project ends with the holistic banquet service concept, which integrates with the website, APP, and packages to apply numerous design interventions for multiple stakeholders to meet their value towards collaborating to reduce food waste. In addition, validation has proven that the new service concept could achieve the goal of the design vision.

Table of Content

Introduction

This chapter contains all the essential information to contextualize this thesis project. It presents an introduction to the project, context, and design approach. This is where the project starts.

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1.Introduction

1.1 Background research

Food waste has been a serious issue worldwide. The UN FAO estimated that about 1.3 million tonnes are produced annually from the edible parts of food produced globally for human consumption that is lost or wasted. Even at the delft university of technology, food waste produces every day in each facility. The caterer said that they have to throw away the food every day. The university has a booking platform called the Banque system, which provides the banqueting service to book the food for the lunch meeting. The Banque system includes four companies to provide food for the whole university: Cirfood, Rode Rozen Tortilla's, Deplattelander, and Zuppanini. The orderer could choose one of the companies to make the order. This project only focuses on Cirfood as the research direction.

Furthermore, most of the orders in the university are delivered from the Aula kitchen to different faculties. The order amount ranges from 50 at the end of the semester to 1000 at the start. From booking the food to dealing with food waste, each stage has the influence factors to cause the final result of the food waste.
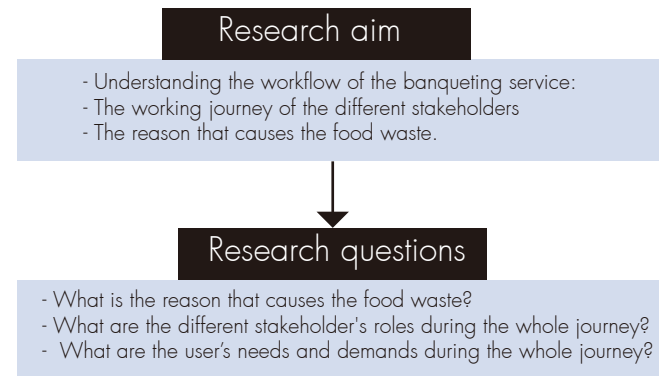
Overall, the banqueting service of the TUD has already been facing an intensive problem of food waste.

1.2 Problem statement

The project starts from one specific problem, which is reducing the food waste in the banquet service of the Delft University of Technology. The banquet service aims to provide and deliver the meal for the meeting in different faculties. Different departments in the university have weekly or monthly meetings in the facilities. At the same time, it will also organize various types of meetings and activities. For example, the academic meeting with the staff in the university, the business meeting with the companies, etc. While before the meeting, the orderer must book food from the Banque website. The website is the official website that books the meal for the lunch of the meeting. It did not have a specific number of how much food waste it produces one day or one year, while according to the interview with the Cirfood caterer, they said that it would be 1000 orders in the busy time. So if I assume the calculation of food waste, if there is 2 sandwich that will be wasted for each order, it will be left 2000 sandwich per day, which is a massive amount of waste.

So the project would specify how to reducing the food waste of the banque service from the design perspective.

Research aim
- Understanding the workflow of the banqueting service: - The working journey of the different stakeholders   - The reason that causes the food waste.

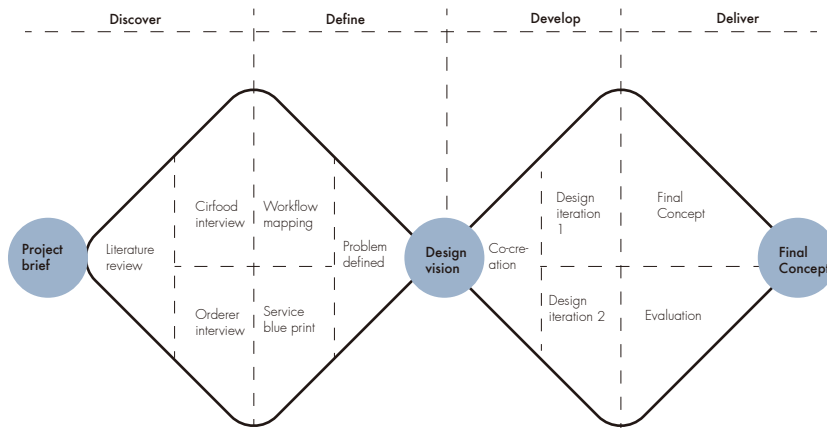| Research questions |
|---|
| - What is the reason that causes the food waste?
 - What are the different stakeholder's roles during the whole journey?
 - What are the user's needs and demands during the whole journey? |

1.3 Design approach

Figure 1. Design approach

The whole project has used the Double Diamond design framework (British Design Council, 2015) as the design approach and report structure guideline. The project's journey is to understand the behaviour that causes food waste and the current workflow of the banquet service and then generate insights into the design solutions. Through these four phases, different tools were used to perform the objective of the stage.

Discover:
The discover phase aims to understand how the current system works and the causes of food waste. I got the key findings from the interview by analysing the consumer journey map, which provides the essential argument for the define phase.

Define:
The define phase analyses the research data gained from the discover phase. I reframed the problem and formulated the essential findings, and translated it into design opportunities for the development phase.

Develop:
The development phase aimed to explore the design solutions to achieve the design goal. After three rounds of co-creation ideation and self-ideation, I developed the preliminary concept and improved the delivery stage.

Delivery:
The delivery stage aims to present the final concept, formulated by the service blueprint, using scenarios and touchpoints to describe it in the macro and microcosmic way.

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Discover

This chapter introduces the process of translating the research information into insights. I interviewed orderers, caterers, and students to understand the food waste problem from different people's views. I am using the journey map to understand how the current journey works and analyze the problem behind the system. In the end, by engaging the journey map of different stakeholders, I map the current service blueprint to figure out how the system works. All the information helps me to understand the reason cause food waste, and I transfer the valuable information to the design opportunities.

02

2. Disvover

2.1 Literature review

Recently, food waste has received attention from local, national, and international organizations. In the European Union , there is around 88 million tonnes (Mt) of food are wasted every year. An estimated 17.7 to 2.55 million tonnes of food is wasted in the Netherlands annually(Soethoudt & Burgh，2017) .Even goal 12.3 of the United Nations Sustainable Development Goals (SDGs) is to halve food waste by 2030.

Food waste has been brought a bad influence on the environment. Such as resource depletion and greenhouse gas emissions attributed to food waste (Schanes,Dobernig，&   Gözet，2018).Even though some people realize that food waste is an issue for the environment, they do not pay much attention to changing their behaviours or do not know how to make the change. At the same time, some people are trying to figure out how to engage more people to protect the environment. Such as intervening in people's motivations, opportunities and abilities(MOA framework) can help reduce food waste(Soma, , Li, & Maclaren, 2021).

Alternatively, they use Information campaigns to reduce food waste by up to 28%(Reynolds,2019). At the same time, these campaigns are also an excellent way to change people's behaviour. For example, The information can deliver messages in multiple ways, such as through advertisements (Septianto et al.,2020), leaflets (Shaw et al., 2018) and online platforms (Schmidt, 2016) etc., by reminding people to take care of the earth. In society, the expert is also trying to find the optimal way to solve this question. One of the prevention paradigms is preventing surplus food from becoming waste. On the hand, society provides multiple ways to deal with food waste. Food banks, food donations, and social supermarkets could be a way to deal with waste food. On the other hand, if society is over-reliant on this method, it might encourage producing more surplus(Messner, Richards, , & Johnson. ,2020). Therefore, it needs to explore innovative methods to deal with food waste flexibly depending on different situations.

2.2 Research method

Some studies also show that the critical factors of most food hierarchies, Reducing food surplus and avoidable food waste at source, is the first priority. This is followed by reuse to provide edible food for human consumption and recycling, which recovers energy through combustion and processing (Huang et al., 2021). In the meantime, there are two stages of reducing the food waste model: awareness and knowledge could prevent food waste (Graham-Rowe et al., 2014). When people's awareness of food waste increases, their willingness to reduce it increases (Quested et al., 2011). Furthermore, food waste is not an isolated behaviour. It results from the interaction of food-related activities Purchasing, storing, preparing and consuming (Pearson, Mirosa, Andrews, & Kerr, 2017).

In the context of the Delft university of technology, the caterer said that food waste happens daily in different faculties. They almost have to throw away a lot of sandwiches every day. So it's a big challenge for the banqueting service and a big problem for helping the sustainable development of universities.

This project involves multiple stakeholders, shown in figure 2. I conduct 11 interviews which include the Cirfood caterers and staff from different departments, orderers who take charge of the order for the conference organizers in the university, and students, who help me to understand how the current system works and what kind of behaviour causes food waste. Before the interview, I set the research aim and questions from the initial problem statement. I divided the different problems among these three groups of people based on the guide of the research aim, and the main goal is to find out which session of the whole banqueting journey causes food waste. In the meantime, the interview also follows the guide, divided into five categories what, how, why, who, and where.

According to the description from the orderers and caterers, I gradually mapped the process of the banqueting service and also understood how different stakeholders collaborate in their daily time.
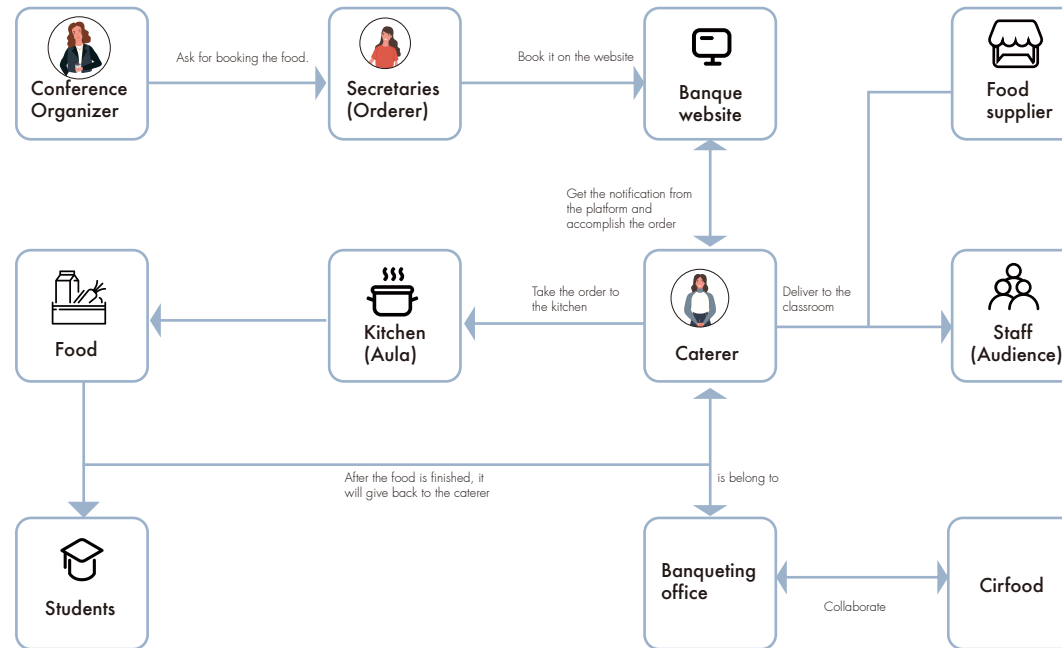
Figure2. Stakeholders map

I use the journey map to map the working process of orderers and caterers and analyze the data based on the stages of the process, which helps me to get insights for further steps.

Finally, after I figured out how the whole banqueting service works and the problems, I summarised and clustered the problems and translated them to the design opportunities for building the design vision, which shows in chapter xxx.

What:
- The reason that caused the food waste

- Different perspectives of the reason that causes the food waste

How:
- The process of providing the banqueting service to TUD.

-How do the different stakeholders corporate with each other? How many people will be involved in finishing this whole process?

- What happens if the food is left in the room after the meeting

Why:
- The problem they meet during the process
- The reason causes the food waste

Who
- What type of group will people book the food, and what problems do they meet?
- The needs of the different stakeholders.

Where
- The place to deliver the food is the faculty
- The place to deal with the wasted food in the TUD
- The problems with the current website system

2.3 Understand the stakeholder's behaviour

This section aims to explore all the research questions by gaining stakeholders' perceptions and behaviours towards understanding their working journey by building the overview of the whole banqueting service and finding the challenge they meet in solving food waste. The interviews were conducted in a semi-structured way to gain broader insights. The interviews were conducted flexibly based on different stakeholders' experiences.

2.3.1 depth interview

Orderers research interview :

Research aim:
It aims to figure out how the orderer's actions, from booking the food to dealing with the food waste, and understand the reason that causes the food waste.

Participants:
The secretary is mainly responsible for ordering the food for the meeting and has the central authority to enrol the "Banque" website, which is the ordering system in Tudelft. According to this, I interviewed four secretaries to attend the interview. Two partiioants are from the HCD department of IDE faculty, and the others are from the SCD department of IDE faculty. All of them have the experience to order the food for the meeting. The interview was all finished at the university with the participants offline.

Method:

The interview was conducted using a semi-structured interview with the identified questions following the research aim. The interview was processed for 30 mins per person. After the interview, the content was analyzed by transcribing the interviews.

The journey map of the orderer:

Usually, The conference organizer will tell the general information of the request for meeting information to the orderer, and the orderer sometimes will notify the audience to ask whether they want the food during the meeting. While normally, less of the audience replies to the notification from the orderer. It causes a lack of food or ordering too much food at the meeting. And then, the orderer will book the food from the website because Cirfood has a rule to make the order before 12:00 P.M. the day before the conference date for the small event. So they also have the rule to adjust the order before 12:00 P.M on the delivery day. After the meeting, the orderer will take the left sandwich outside the office table and let the people passing by take it. In the meantime, some of the orderers will put the left juice in the refrigerator.

Stage

Before the meeting

After the meeting

| Before booking the food | During booking the food | Booking the food | Before the meeting starts | After the meeting |

Process

The fixed meeting (Every week/ Every month)

Send the notification to the people whether they attend the meeting.

Accepted

Declined

None

Check how many people would come to the meeting

Book the food from the website

Finish booking the food

Audience-will/won't talk to secretary that they won't come

Conference organizer wants to adjust or cancel the order

Adjust the order

Before 12:00 P.M

Cancel the order

Secretary

Take the fresh food back to the office and let people take it.

If the drink left a lot, They will put it back into the refrigerator.

Problem

① The people who make the order don't have specific overview of how many people will join in the meeting

② The less diversity of the food will make people tried of eating it.

③ The orderers don't know the preference of the food of the people

④ The orderers don't know the preference of the food of the people

⑤ The orderer will book the food based on their feeling and past experience

⑥ The covid situation make the variability situation of the booking process

⑦ The audience doesn't have the sustainable awarenesses that they need to value the food

⑧ The blur responsibility of the stakeholders causes the "free" food doesn't treat as normal

⑨ The audience will not show up at the meeting day

⑩ The people who book the food only responsible for booking the book

⑪ The variability number of the audience increase the amount of the food waste

⑫ There is a gap between the people who book the food and the conference organizer

⑬ When the food left at the faculty ,people lack the sensitivity to think about how to deal with it

⑭ People don't think it's there responsibility to take care of the food

⑮ Sometimes the students are not sure whether they can take the food at the outside of the office.
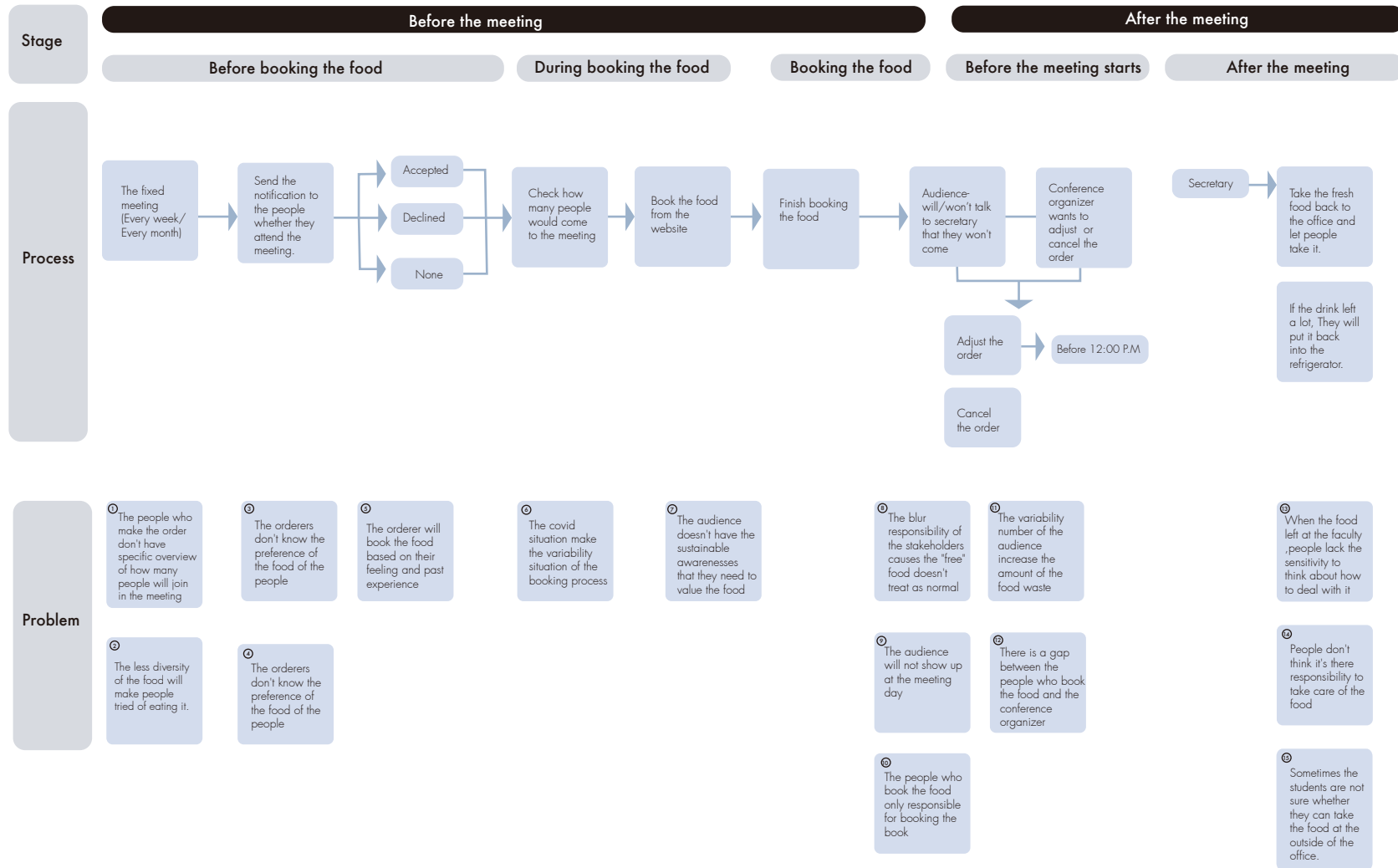
Figure 3. The journey map of the orderer

I divided the problems into different stages of the journey map by analyzing the problems they meet and also have an overview of the journey from the orderer's side. Finally, I took the key findings from the interview.

Key findings from the orderers:

■ Orderers are used to ordering food based on their personal experience.

From the interview, all the secretaries have different ordering styles created by their past ordering experience, including the successful and unsuccessful book history. This behaviour sometimes indirectly causes them to order too much food and produce food waste without the clear guideline of the booking session.

"Now I know the balance. If there is a big meeting for 50 people and if there are five or 10 sandwiches left. It's okay for me. For the first time, there are 30 sandwiches left, and I think it's too short for me. And the next time that there are 30 sandwiches more."

■ Orderers lack communication with the conference organizer and audience.

Most of the time, the orderer does not organize the meeting. They are only responsible for booking the food as the intermediate person who could not timely know whether the participant will come. The audience did not reply to their email about whether they will come. In the meantime, if the participant's amount was changed and the conference organizer needed to tell the orderer, then the orderer needed to change the order in time. Furthermore, the orderer will not see the food previously before the meeting, So they do not have an overview of what the food looks like and how the audience reacts to it.

> "I think the people who organized the meeting have the awareness of dealing with the food. Because sometimes people are busy with work and they just go to another meeting. But if they inform us that we could take care of the food and inform the other Secretariat that they are food left over."

■ Orderers have been dealing with the food waste without support

If there is still wasted food after the meeting, all of the orderers from the interview will put it outside the office to let the people passing by take the food. While they take this action spontaneously and still lack support to activate the students in the faculty to take the food. For example, sometimes, the students do not know whether they can pick the sandwich, which might cause no one to take it. So even though orderers make efforts to reduce food waste, they still have a gap between students and them.

■ The blur awareness of taking responsibility of taking charge of the food

Even though multiple stakeholders try their best independently to reduce food waste, the orderers think the main reason cause the food waste is the audience. They have a blurred consciousness of the importance of their role in the system and that eating the sandwich every time will reduce considerable waste. All the stakeholders' actions will influence each other.

> "People don't see it as their responsibility or job to care for the food"

■ The less human-centred website to book the food

The decision-making of the booking session is quite important for the final delivery of the food and will influence the amount of food waste. At the same time, the unclear information will cause the orderer to order more food than they imagined. For example, the orderer does not know the sandwich size on the website, and they order it from their assumption. However, the sandwich is bigger than they imagined which causes a big amount of waste every day.

"I couldn't imagine how does the food looks like in the meeting"

■ The multiple elements would influence the orderer to decide the order

Two participants said they would consider the meeting category and the attendance people to decide the food category. All the participants said that if it is a fixed meeting every week for the same group of the audience, they will adjust the variety of the food to attract more food to eat it. One participant said they also wanted to know whether foreign people were attending the meeting and would like to order suitable food for them. Overall, there are multiple elements to influence the decision of the order.

🪪 Cirfood staff research interview :

Research aim:
Cirfood is the supplier to provide the food to the faculty, and they are responsible for cooking the food and delivering the order to the different faculties. All the research activities still follow the main research aim and aim to identify the overall workflow of the banqueting service and get their perspective of the current system from Cirfood's view.

Participants:
The Cirfood caterer is responsible for preparing, delivering the food and dealing with the waste food. According to this, I interviewed the staff who are from different departments. Two participants are the carters from Cirfood, two are the staff from the food office of Tudelft, and one is from the IDE faculty canteen. The interview was all finished at the university of the participants.

Method:
The interview was conducted using a semi-structured interview with the identified questions following the research aim. The interview was processed for almost 30 mins per person. After the interview, the content was analyzed by transcribing the interviews.

Journey map:
For the small event, the caterer will get the order review from the Banque system, and they will check whether they can cook it. After checking it, they will send the notification email to the orderer. After 2:00 P.M, the caterer will buy the fresh ingredients from their food supplier and some of the frozen food they have bought a considerable amount and save it in the refrigerator. On the delivery day at 7:00 A.M., they will cook the food for the meeting and deliver it to different faculties. When the meeting is finished, they will return to the faculty, take the left sandwich back to the Aula kitchen, and throw it away into different containers.
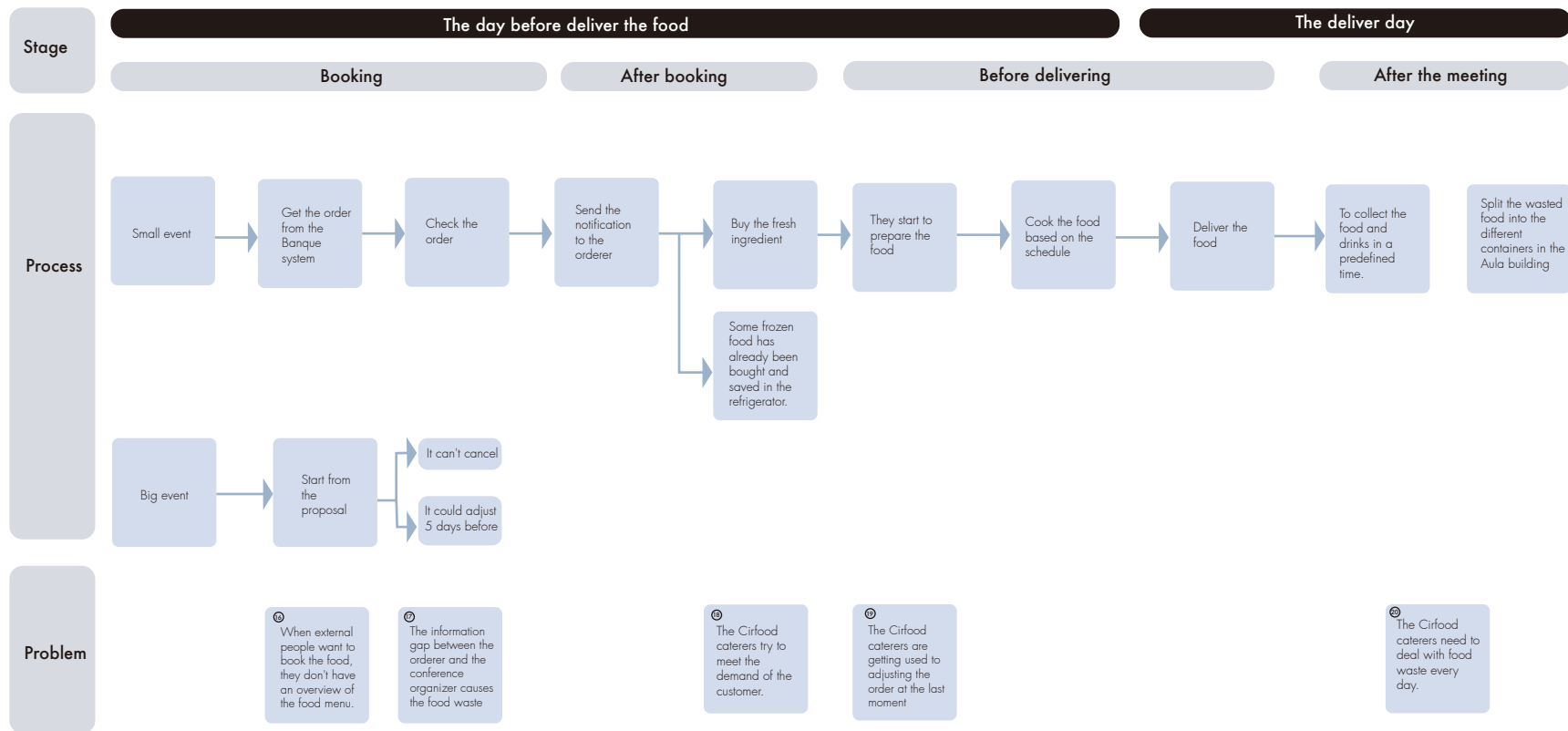
Stage		The day before deliver the food			The deliver day
		Booking	After booking	Before delivering	After the meeting

Process

Small event → Get the order from the Banque system → Check the order → Send the notification to the orderer → Buy the fresh ingredient → They start to prepare the food → Cook the food based on the schedule → Deliver the food → To collect the food and drinks in a predefined time. → Split the wasted food into the different containers in the Aula building

Some frozen food has already been bought and saved in the refrigerator.

Big event → Start from the proposal → It can't cancel / It could adjust 5 days before

Problem

⑯ When external people want to book the food, they don't have an overview of the food menu.

⑰ The information gap between the orderer and the conference organizer causes the food waste

⑱ The Cirfood caterers try to meet the demand of the customer.

⑲ The Cirfood caterers are getting used to adjusting the order at the last moment

⑳ The Cirfood caterers need to deal with food waste every day.

Figure4. The journey map of the orderer

I divided the problems into different stages of the journey map by analysing the problems they meet and also have an overview of the journey from the caterer's side. Finally, I took the key findings from the interview.

Key findings from the Cirfood:

"We've also got a lot of last minutes. For example, the bread was frozen, and we had to bake it in the kitchen. So when the lunch is cancelled. And, for example, 12 around and it's a throwback in the freezer, and then we use it for another time. So the bakery brings it to the frozen, and we bake it in the oven in the kitchen. So we work with little waste."

■ **The Cirfood caterer is getting used to adjusting the order at the last moment**

Cirfood caterer sets the deadline to adjust the order at 12:00 A.M. If the orderer wants to adjust the order, they must take action before 12:00 A.M. While most of the time, the orderer calls Cirfood caterer to adjust the order after 12:00 A.M. The Cirfood staff said that they constantly adjust the order at the last minute. While sometimes, if the kitchen gets a massive amount of orders, they cannot adjust it. So it would always have food waste, even if they tried their best to save this situation.

■ **The Cirfood caterer does not have an overview of the food in the Banque system.**

The Cirfood caterer knows what people have ordered for each order, but they do not have an overview of the amount of food in the Banque system. For example, one of the participants said that it is nice to see how many cookies we need in one month, and if we could see it, it would be nice to move the order to another one if the orderer wants to change the order.

"We don't have an overview of the food in the banque system. It's not possible in the banque system. And if we could see it, that would be very easier to adjust the order"

"That's a pity. Almost daily, also the tea or coffee or the food. We delivered it, and then we picked it up two hours later. And nothing is used or touched. Then we have to throw it away. It's a shame. It's not their own money"

■ The Cirfood staff needs to deal with food waste every day.

After the meeting, the Cirfood staff must go back to the meeting room and return the food to the Aula kitchen. If the drink does not open, it could still be used. For the food, they must throw it away to the container in a specific container based on the law in the Netherlands. Two participants said that sometimes the food was fully wasted after the meeting, and they must throw it away, which made them feel shame.

When I finished the interview with the orderes and caterers, I knew how the system works. In the meantime, I found that website is the only touchpoint which connects with the orderes and caterers. To get a depth understanding of the usage of the website and also explore the food waste problem from the student's perspective in the university. I conducted the testing and the interview with the students.

Student research interview :

Research aim:
The research aims to test the usability of the Banque website from the view of people who never use it and understand the student's thoughts on food waste in the university.

Participants:
I interviewed four participants in total. All of them are from the delft university of technology and have the experience of joining in the session of the banqueting service at lunchtime. The interview was all finished with the participants online.

Method:
The interview was conducted using a semi-structured interview with one task, which is to Imagine you need to book the food for the 10 people meeting. And you receive the request that there are 3 people who are vegetarian and 1 person is allergic to the egg. How will you book the food?

I will observe the process of the booking session and interview them about the website's usability and their opinion about how they will deal with the food waste in the past meeting. The interview was processed for almost 30 mins per person. After the interview, the content was analyzed by transcribing the interviews.

The introduction of the website:
The website is an essential touchpoint during the whole journey, and it is also where the orderers get information about the food. Only the people who make the order have permission to open the website and place an order. As you can see from the Cirfood booking page, it has two categories of meals: the normal lunch and the reception meal. Orderers could book different kinds of sandwiches, sweets, salads, coffee, or tea from the system. If the orderer makes an appointment, and the order successfully finishes, they will get a confirmation email from the Cirfood carter.
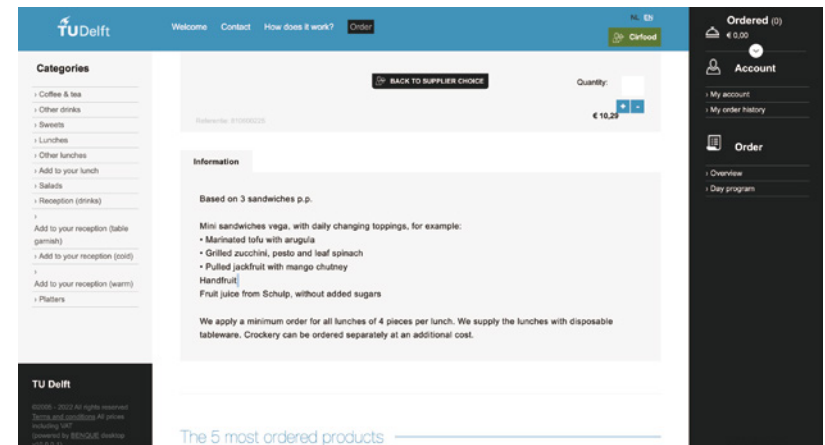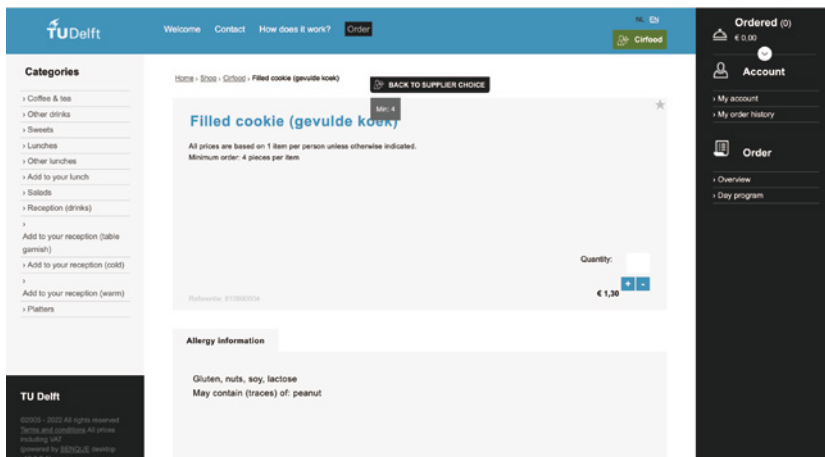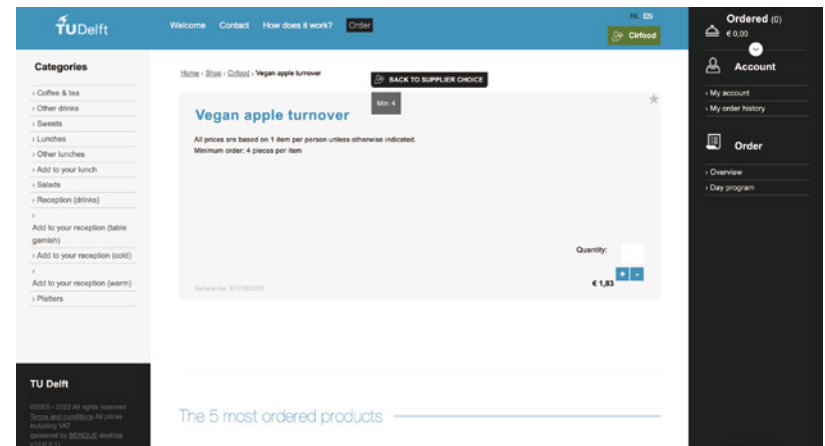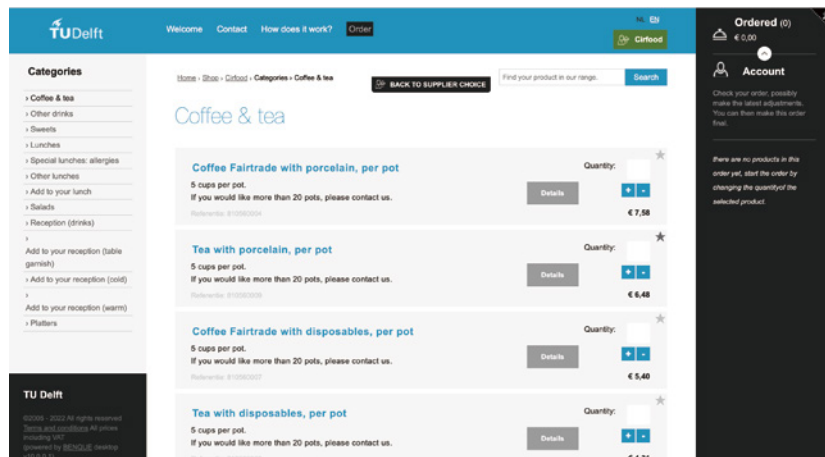
Figure 5. The current Banque website

■ **The unclear information on the website will cause them to make the wrong order**

The website doesn't have obvious information about the specific size or picture of the food. And there is also some hide information on the website. Such as the description of the ingredients of the food, how the sandwich will deliver on the meeting day etc. It improves the possibility of ordering unsuitable food for the meeting.

■ **Lack of motivation and guidance to engage in food waste reduction**

Two of the participants said that they don't notice how the food will go and normally would leave the room after the meeting is over. In the meantime, sometimes they don't know where they can take the food or whether find free food in the faculty.

Conclusion:
This section deeply analyses the interview result by combining them with the journey map to understand how the stakeholder's action causes food waste. In conclusion, the caterers and orderes will experience the challenge in different stages throughout the journey. Each stage have multiple influencing factors that cause food waste happens.

2.4 Understanding the current service

From the depth interview, I analyze how the orders and caterers work separately. The service blueprint aims to show how the whole service works by integrating multiple stakeholders, which help build the foundation of designing the whole service in the next step.

2.4.1 Service blueprint:

I divided the whole service into three sessions: Booking the food, before delivering the food and after delivering the food.

Booking the food:

Normally the conference organizer will ask for help from the secretary to make the lunch order from the Banque website. Some conference organizers would tell the secretary the meeting information, such as the number of participants, the meeting location, whether the people would eat vegan, etc. The secretary would decide what kind of food they would order by themselves. In the meantime, Cirfood sets the rules that the orderer needs to make the order before 12:00 P.M for the meal of the day before the meeting, and they could adjust or cancel the meal before 12:00 P.M.Some time they could adjust the order after 12:00 P.M for small size meetings, while It does not allow to cancel the order after 12:00 P.M.

Before delivering the food:

After the orderer makes the order from the Banque website, the caterer receives a notification from the system. The orderer will receive the final notification email from the caterer after they check whether they can achieve the order So when the caterer checked all the orders after 12:00 P.M. and sent the notification email to the orderer, they would order all fresh food ingredients from their food supplier from 2:00 P.M. to 3:00 P.M. to make sure they could get the fresh food.

At the same time, the frozen food has already been prepared in the refrigerator. The kitchen will start to prepare for cooking the food at 7:00 A.M. on the delivery day. After cooking, they will deliver the food with the trolley to different facilities.

After delivery:

When the meeting finished, the caterer needs to take the food back to the Aula kitchen. On the one hand, the caterer will throw away all the waste food in the container in the Aula building. If the drink box is open, they also have to throw it away. However, they can reuse the unopened drink for the next meeting. On the other hand, some secretaries will leave the leftover food outside the office for passers-by to pick up or on the first floor of the faculty for students to pick up on.
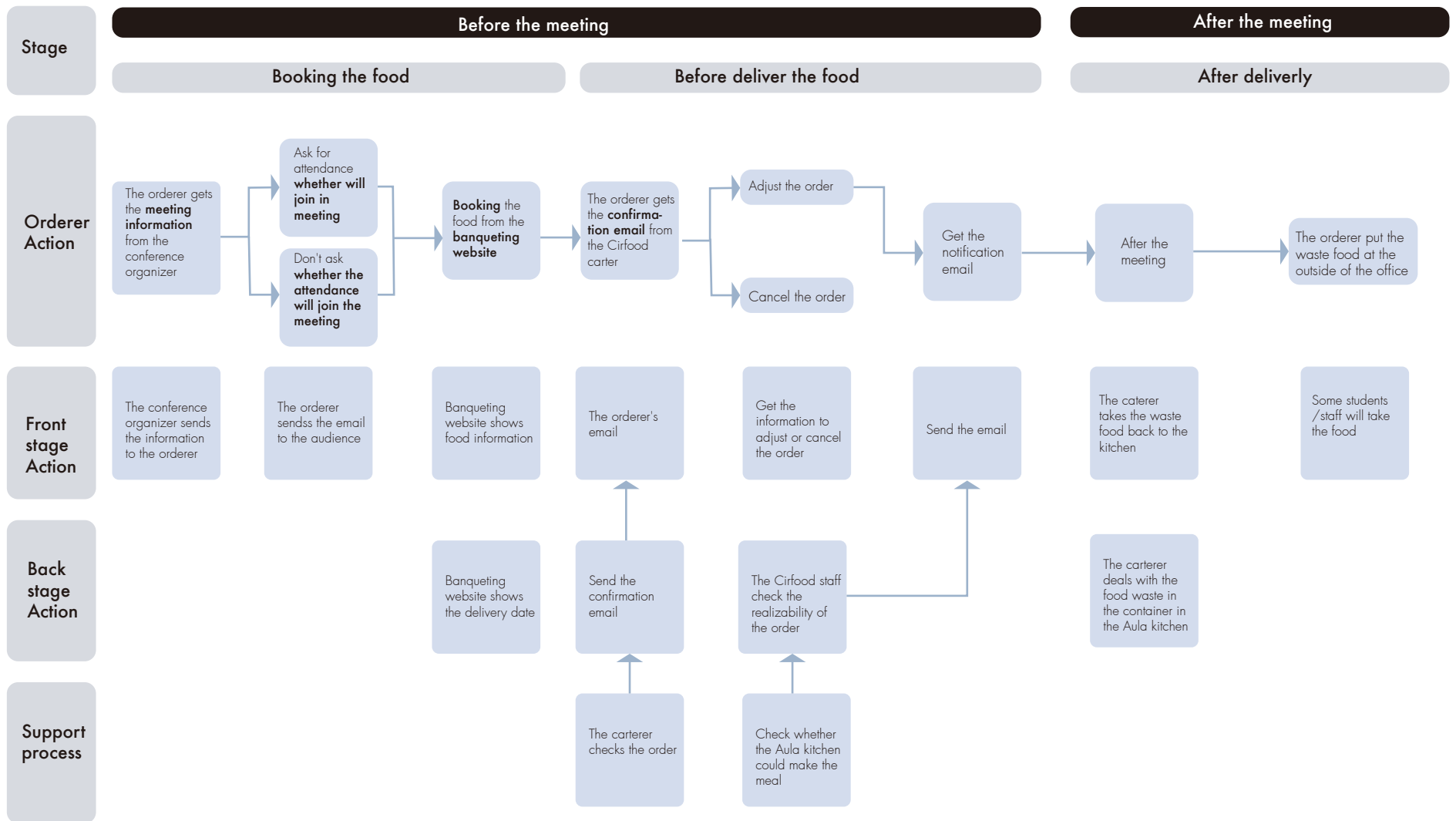
Figure 6. Service blueprint

2.4.2 The workflow map

	Booking the food	Prepare the food	During the meeting	After the meeting
Conference organizers	**Organize a meeting** Give the meeting informationto to the orderer			
The orderer	**Receive the meeting information** -Ask for attendance **whether will join in meeting** -Don't ask **whether the attendance will join the meeting** **Book the food** **Booking** the food from the **banqueting website** **Extra situation** -Adjust the order -Cancel the order			
The caterer		**Check the order** Send the **confirmation email** from to the orderer **Prepare the food** -The Cirfood caterer book the food ingredients from the food supplier -Cook the meal at the delivery day	**Deliver the meal** Deliver to the specific room	**Reuse the food** The orderer puts the left food at the outside of the office
Audience	**Get the notification** -Reply the message - Do not reply the message		**Attend the meeting** - Eat the meal - Don't Eat the meal	**Deal with the food** The cateer takes the waste food back to the kitchen to throw away

Figure 7. Workflow map

According to the service blueprint, I summarise each stakeholder's tasks during the journey. The orderer, who is the secretary, plays a central role in deciding on booking the lunch appointment of food for the meeting lunch from the banqueting website. In the meantime, it is a complex process from booking to getting the food which makes all the stakeholders must cooperate to finish the process. For example, The caterer needs to communicate with the kitchen to ensure that the order could complete on time. And If the orderer wants to adjust the food for the appointment, they also need to talk with carterer, who belongs to the banqueting office from Cirfood. While we could find that each stakeholder works independently without much support and communication with each other, which improves the effects of food waste.

Conclusion:
This section draws the overview of the working journey of the whole service by engaging multiple stakeholders and figuring out how the stakeholders work together to achieve the current banqueting service.

Define

In this chapter, the main insights were clustered as a conclusion from previous research. After that, the challenge and design vision was defined. Based on that, the design goal was confirmed as the starting point of the following design part.

03

3. Define

The key findings have been summarised from chapter 2; this section aims to translate the insights to design opportunities towards building the design vision for the innovation of design solution.

3.1 Main insights

After understanding how the current system works and what problem they meet causes the food waste. According to the key finding, I summarise the main challenges that they meet, which is

- Each stakeholder focuses on their job; they know that food waste happens in the faculty but do not know how to make the change.
- The stakeholders have multiple orders they must deal with daily and do not have enough time to reduce food waste.
- The stakeholders all deal with food waste in their way and lack help from each other.
- Each person's decision in this system will influence the final result of the food waste; they are isolated from each other while they stick to one model.

I translated the insights potential design opportunities and aimed to aggregate the insights into different themes to uncover potential design directions. It can be summarized into these seven themes, which are reflected in figure 8 . These themes help me do another ideation by using the "how might we" questions to think about the design opportunities I can design for it (figure 9).

Insight statement

Enhance the sense of responsibility ⑧ ⑩ ──── The number is the problems that presented in the figure 2 & 3

The audience, orderer and Cirfood's staff don't think it's their responsibility to value the food.

Behavior guideline ① ②

| The unclear information on the website. | Order the food based on the orderer's personal experience. | Most of the orderer prefer to order a little bit more food. |

Increase communication ③ ④ ⑰

| The weak connection between the orderer and the audience. | Lack the feedback of the food from the audience | The weak connection between the orderer and conference organizer. |

Reduce uncertainty ⑤ ⑥ ⑨

| If someone adjusts the order after the deadline, it's not easier for Cirfood to arrange the ingredients | If someone adjusts the order after the deadline, it's not easier for Cirfood to arrange the ingredients |

Decision making ⑤

| Order too much food. | The meeting categories will influence the food choices of the orderer. | The meeting categories might also influence the participation rate |

Create the appreciate atmosphere ⑦

| Some audience doesn't care about the food becasue it's for free. | The meeting categories will influence the food choices of the orderer. | People have no awareness that they could help with reducing the food waste |

Build clear instructions ⑮ ⑯

| Sometimes the students are not sure whether they can take the food at the outside of the office. | Some of the audience doesn't know how to deal with the food when it was left in the classroom. |

Figure 8. Theme

Insight statement

Enhance the sense of responsibility

Behavior guideline

Increase communication

Reduce uncertainty

Decision making

Create the appreciate atmosphere

Build clear instructions

How might we(Design opportunity)

How might we **increase the responsibility** of the **audience and orderer** to treat the food more seriously?

How might we **help the orderer to make the order the food easily and without confusion** towards **ordering the proper food for a different audience**?

How might we **give the orderer more clear and rich information** to make the order?

How might we naturally **engage the conference organize**r to join in the booking session?

How might we **help the orderer feel motivated** to make the order?

How might we **help the audience realize their decision** is important for food ordering?

How might we **make the order session more human-centred** like you order the food in the restaurant with the waitress?

How might we help **people in the faculty could feel inspired** to make efforts to reduce food waste?

How might we **help people could clearly** to know what they can do with the wasted food?

Picture 8. Design opportunities

28

3. Define

3.2 Problem reframing

When I look back at the research aim of the project, I listed three priorities for reducing the food waste of the banqueting service. The first priority aims to provide early intervention of food waste in the journey, and the second priority aims to motivate people to deal with food waste spontaneously. The third priority aims to increase sustainability awareness in the long-term goal. I could focus on the first two priorities from the current stage by engaging with these How might we questions. On the one hand, the design will improve the current banquet experience; on the other hand, the design will also increase the connection between the stakeholders to reduce food waste jointly.

1.

How might we help the orderer to make the **order the food easily and without confusion** towards ordering the proper food for different audience

How might we give the **orderer more clear and rich information** to make the order?

How might we help orderer **feel motivated** to make the order ?

How might we make the **order session more human centered like you order the food in the restaurant with the waitress** ?

2.

How might we help people in the faculty **could feel inspired to make efforts** to reduce the food waste ?

How might we help people **could clearly to know what they can do with the wasted food** ?

How might we **increase the responsibility** of the audience and orderer to treat the food more seriously ?

3.

How might we naturally engage the conference organizer to join in the booking session?

How might we help the audience realize their decision is important for the food ordering ?

Figure 9. Design priority

3.3 Design vision

I envision a seamless banqueting service aiming to help the organizers, orderers and audience collaborate to reduce food waste.

3.3.1 Design goal

There are three goals according to the design vision. The design solution should follow the design goal to achieve the design vision.

• **Seamless banqueting experience**
The concept should be enjoyable and not burden the stakeholders. From the booking process to the final food handling process, it is important that multiple stakeholders will be involved in the process and that every touchpoint can be well connected.

• **Support each other**
The design could be a bridge to connect all the stakeholders and develop new working habits to reduce food waste. The whole experience should promote collaboration with each other.

• **Reducing food waste**
From the previous analysis, the banqueting service consumes a long journey to causes food waste. So it should be prevented from two perspectives; one is to use the design to provide early intervention to reduce food waste as much as possible. The other one is to use the design to save the food before it is thrown away in the waste container.

Develop

This chapter describes the iteration process, and I gained inspiration from the co-ideation session. After that, two round self iteration was achieved. I will introduce the final concept in the next chapter.

04

4. Develop

After defining the design vision and goal, I try to use the insights to think about the ideas for the design solution. I start with the ideation session to get inspiration and make the foundation for the final design.

4.1 Co-creation Ideation session

4.1.1 Iteration process

The ideation comes up with the co-creation session, and the steps are aligned with the self-ideation. The brainstorming sessions aim to get as much inspiration without limitation and start the first step of the design development.

Before starting the ideation session, I summarised the challenge questions for different stakeholders based on the stakeholders' needs. The aim of defining these questions is to give the participants a scope to brainstorm, and problems can be dug from a different perspective.

The challenge 1: How might we help the orderer feel motivated to continuously reduce food waste from booking to disposing of the food?

Challenge 2: How might we naturally engage conference organizers to join in the journey to reduce food waste?

Challenge 3: How might we help the audience increase awareness of reducing food waste?
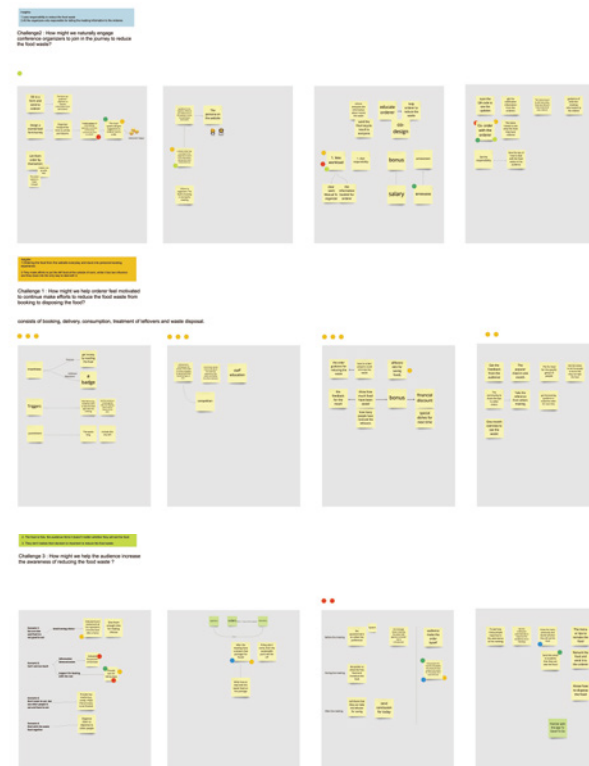
Figure 10. Co-creation session

Participants:

The co-creation session was composed of four design students from the IDE faculty of TUD. They all have experience in doing the design project and have joined the co-creation session before.

Methods:

The co-creation started with introducing the project, the current banqueting service and the design goal. Then the participants were joined into the brainstorming session from the How might we questions in 5 minutes and roughly described the ideas to each other. In the meantime, every participant will vote for their favourite ideas after they listen which shows on figure10 . After the co-cocreation session, I clustered similar ideas and transfered them to one idea. Finally, I conducted the idea based on a two-dimensional axis which is collaboration and reducing food waste. The matrix helps me build the preliminary concept.

High collaboration

Co- order with the orderer

The community to share the tips to other orders

The menu or tips to remake the food

Organize them to dispense to other people

After the meeting have a session that package the food

The feedback for the result

After the meeting have a session that package the food

Low impact on reducing the food waste

High impact on reducing the food waste

Send the email to students that they can take the food

a badge

get money by reselling the food

Know the menu previously and decide whether they will eat the food

the poster to show the free food and introduce the food

Let them order by themselves

Only prepare the food for the people who book the food ,prepare the snacks for the people don't book the food

After the meeting have a session that package the food

Low collaboration

Figure 11. Matrix to choose the idea

4.2 Design iteration round 1

I took inspiration from my last ideation session and visualized the concept by guiding the design goals. Additionally, to map this concept to an ongoing journey, I rethought the journey through touchpoints throughout banquet service and the factors that influence food waste outcomes. With these two points in mind, I propose the three concepts described in this chapter.

Preliminary Design Concept 1:

A tool composed of the conference information card, participant card and the package for packing the left sandwich after the meeting. The conference organizer will fill in the meeting information, and they can also see the menu from this form link. And then they will send it to the orderer. In the meantime, the orderer will also send the participant form to the audience to know whether they will come and also what is their food preference. After the orderer collects the information, they will book the food from the website. People could use the package to pack the food when the meeting is done.

The package is printed with the route map of feeding the animals in delft and also the tips on how to remake one meal by using the current ingredients.
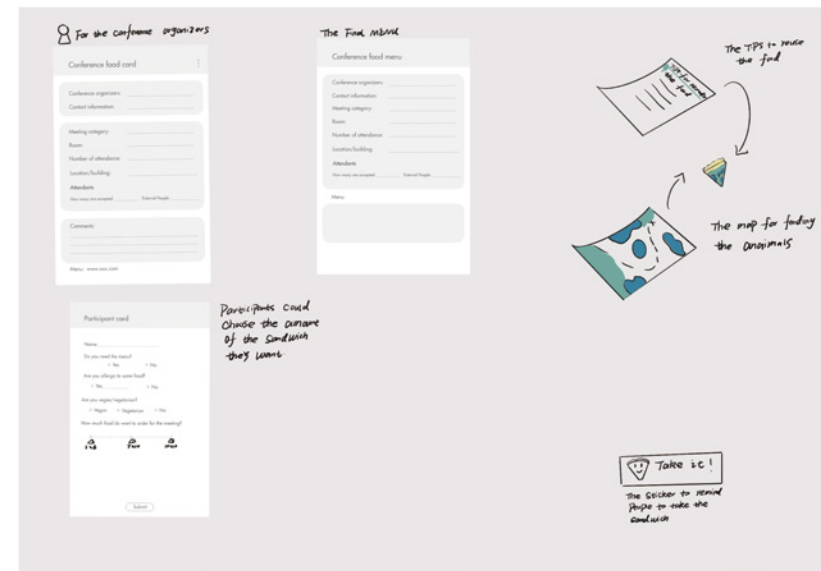
The benefit:
1. It provides the tool to deal with food waste at the last minute
2. The orderer could get rich information to make the proper order.

Preliminary Design Concept 2:

A community which aims to build a platform for conference organizers, orderers and students to work together to reduce food waste. The orderer could upload the left food information on the App, and the students from different faculties could see the message and pick up the food at the relevant position. And the orderers could communicate the ordering tips for reducing the food with other orderers on the App. Furthermore, the students could also share tips on how to remake the sandwich.
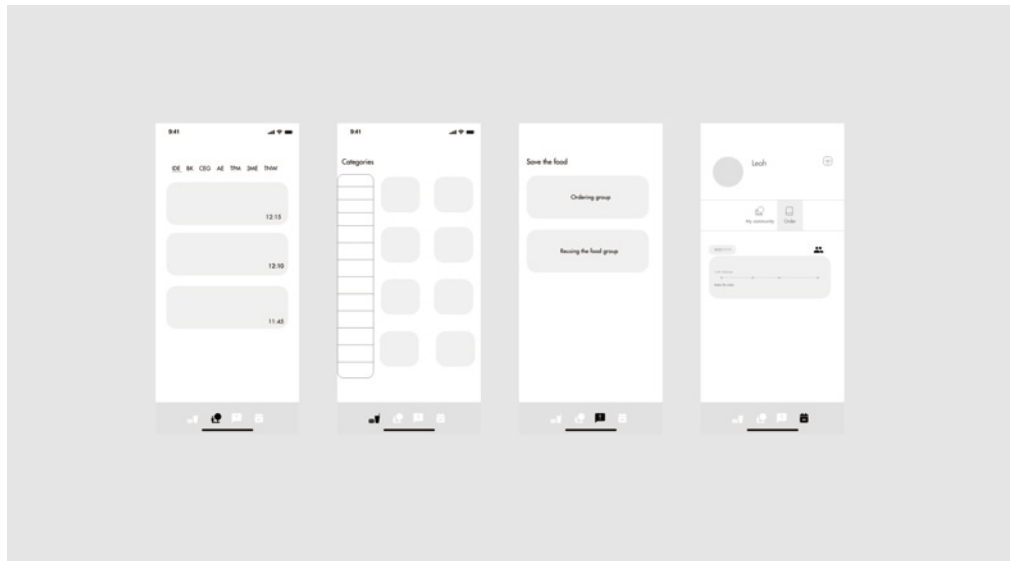
The benefit:
1. It Provides a platform to make people notice the importance of reducing food waste.
2. Engage multiple stakeholders to join the session on reducing food waste.

Preliminary Design Concept 3:

Redesign the website that provides the advantage of food for various group meetings and add the co-order session to engage the conference organizers to order the meal. The website will also provide tips to guide the orderer to order the lunch. After the meeting is finished, the left food will be provided in a removable box and attract the students in the faculty to take it.

The benefit:

1. Engage the conference organizers to join in the ordering session

2. Use the website guidelines to guide the orderer to make the order towards reducing food waste in the early intervention.
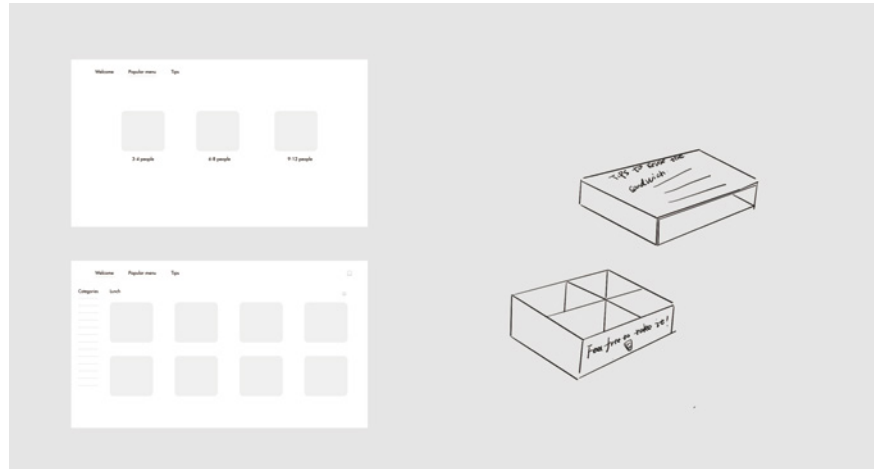
4.3 Design iteration round 2

In design iteration round 1, I came up with three concepts distributed in the different stages of the journey. The three concepts help reduce food waste but do not align with a seamless experience. Finally, I took advantage of each concept and integrated the three concepts into one concept by following the design goal.

4.3.1 Concept description:

The whole journey will be divided into three stages which are booking the food, before delivering the food and after delivering the food. The workflow map (figure 12) and service blueprint (figure 13) present the concept to describe how different elements were engaged in a systematic view.

The whole service needs collaboration with multiple stakeholders to achieve the goal of reducing food waste. When the conference organizer organizes a meeting, they will fill in the conference meeting form and send it to the orderer. Based on the conference form information, the orderer will send the participant form to the audience to check their food preference and whether they will come to the meeting. In the meantime, they will check the tips on the app to see the article other orderers published on the platform. After they get the recommendation, they will book the food on the website. When the order is done, they will communicate it with the conference organizer on the app to see whether they need to adjust the order. After the meeting, there is still some sandwich left in the classroom, and the orderer will publish the food information on the app to inform the students in the faculty to take it. After the students see the information, they will use the package to pack the food.

Booking the food

Before deliver

After deliver

Participant form

Fill the form

Communicate the order

Book the food

Platform to publish the left food

Communication platform

Publish the left food information

Pick up the food

Take the reference of the tips

Conference organizer

Orderer

Audience

Figure 12. Workflow map

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User journey	Booking the food				Before deliver	After deliver the food			
Evidence	Digital conference meeting card	Participant card	Website, APP	APP	Email	Claassroom	Package	APP	Package
Banquet journey	The orderer get the conference meeting information from the organizer	The orderer collectss the food choices from the audience	The orderer makes an appointment of the food	The orderer checks the order with the conference organizer	Get the confirmation email of the order	Have the meeting	Audience packagess the left food	Upload the food information in the faculty	Take away the food

Line of interaction

| **Front stage Action** | The conference organizer gets the conference information card from Cirfood | The orderer sends the participant form to the audience | The orderer gets the conference information and take the reference of the tips on the app to make the order | Invite the conference organizers to see the final version of the order | The caterer sends the email to cofirm the orderer | The caterer delivers the food to the classroom | The audience could use the package to take away the food | The App can see the food condition of different faculties | Students in the faculty will recevice the food information and take away the food |

Line of Visibility

| **Back stage Action** | The caterer sends the conference card to all the staff in the University | The caterer sends the participants card to the orderer | | | The Caterer check the order and make sure it could be cooked | The cirfood kitchen cook the food based on the order | When caterer delivers the food they will also provide the package | The conference organizer will check the food and upload the information to the app | |

Line of Internal interaction

| **Support process** | Make the standard digital form by google drive | Make the standard digital form by google drive | IOT system that collects the data and shows the final result to the orderer | | | The cirfood book the ingredients from their food suppliers | Print the food package | IOT system support the work of the APP | |

Legend:
- Conference organizer
- Orderer
- Audience
- Caterer

Figure 13. Service blueprint

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4.3.2 Evaluation:

1. Improve the seamless experience of the service

The current service has too many touchpoints, requiring users to use multiple platforms to achieve one goal. For example, when the orderer needs to book the food, they need to see the tips on the app and book the food on the website. The switch of the two platforms increases the complexity of their work. So I need to integrate the design to provide a seamless experience to the user.

2. The blur information in the design

Some design touchpoints deliver the wrong message to the user, giving unclear guidelines for using the card. For example, the conference food form and participant form seem like the paper version instead of the digital version, which is not the original design I aim to provide. So I need to improve the design to show clear information to the user.

Conclusion:

After three round iterations, I defined the final design direction by engaging the valuable insights from each iteration rounds and confirming the basic working of the final design, which mainly included four touchpoints: The conference form and participant form, the Banque website, the App and the package. The next chapter will describe the final design with a detailed introduction and evaluation.

Deliverable

This chapter mainly describes the final service concept with the website, App and package by presenting in detail. At the same time, the storyboard helps us better understand the working process. After that, I organize a validation session to evaluate the design solution.

05

5. Deliverable

5.1 Final concept

The final concept provides a holistic new banqueting service to engage orderers, conference organizers, and students to collaborate towards reducing food waste. To achieve this goal, the three stages are divided into the whole journey: before booking the food, after booking the food and after delivering the food. The improvement of the booking system created an early intervention to reduce food waste. The communication system with the app and the package promotes the motivation to encourage the students, orderers and conference organizers to take action to reduce food waste.

The service blueprint has created an overview of the journey and specific details of each stage. The storyboard that presents the usage of design through storytelling shows the context of the whole service. Finally, the touchpoints will describe the usage and details of the design.

User journey	Before booking the food			After booking		After deliver the food			
Evidence	Digital conference meeting card	Digital Participant card	Website	Website	Email	Claassroom	Package	APP	Package
Banquet journey	The orderer get the conference meeting information from the organizer	The orderer sends the participant form to the audience	The orderer books the food on the website	The orderer checks the order with the conference organizer	Get the confirmation email from the orderer	Have the meeting	Audience packagess the left food	Upload the left food information on the App	Take away the food

Line of interaction

| **Front stage Action** | The conference organizer download the participant form from the website | The orderer gets the audience response from the website | The orderer gets the conference information and takes the reference of the tips on website to make the order. | After the orderer made the order on the website, the system will automatically shows the information on their account. | The caterer sends confirmation email to the orderer. | The caterer delivers the food to the classroom | The audience could use the package to take away the food or just take the food. | The App can see the food condition in different faculties | Students in the faculty will see information on the App and package food |

Line of Visibility

| **Back stage Action** | Upload the standard digital form to the website | Upload the standard digital participant form to the website | | | The Carterer check the order and make sure it could be cooked by the kitchen. | The cirfood kitchen cooks the food in the Aula kitchen at the delivery day of 7:00 A.M | When carterer delivers the food they will also provide the package | The conference organizer will check the food and upload the information to the app | |

Line of Internal interaction

| **Support process** | IOT system makes the standard digital form by google drive | IOT system makes the standard digital form by google drive | IOT system collects the data and shows the collection of the audience response | | | The cirfood caterer book the ingredients from their food suppliers | Print the food package with recipe of remake the food | IOT system support the operation of the APP | |

Conference organizer

Orderer

Audience

Caterer

Figure 14. Service blueprint

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Before booking the food | After booking | After deliver

Send the
participant form to
the audience

Fill the form

Communicate the
order

Platform to publish the left food

After the meeting

Publish the left
food information
on the app

Book the food

Take the reference of the tips

Pick up the food

Conference
organizer

Orderer

Audience

Caterer

Figure 15. Workflow map

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The scenarios

1. When the conference organizers organize a meeting, they will arrange the lunch for the meeting.

2. When the conference organizer opens the website, they could download the conference food form to write the meeting information and send it to the orderer. (Touchpoint 1)

3. When the orderer gets the conference information from the organizer, they will download the participant card and send it to the audience to fill it in. (Touchpoint 1)

4. After the orderer gets the amount of feedback from the audience, they will book the food from the website. In the meantime, they will see the tips for booking the food on the website written by other orderers to take the reference of it. (Touchpoint 2)

5. After the meeting, the orderer or the conference organizer will send the left food information to the App at different faculties. (Touchpoint 3)
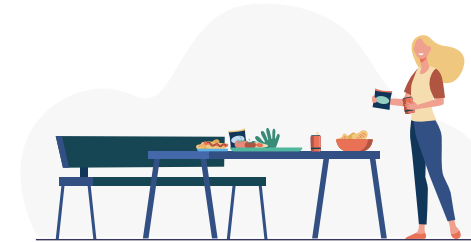
6. The students will receive the notification of the food message from the App and go to the specific position to take the food. (Touchpoint 3)

7. Students could pack the food with the provided package or take it to eat. (Touchpoint 4)

45
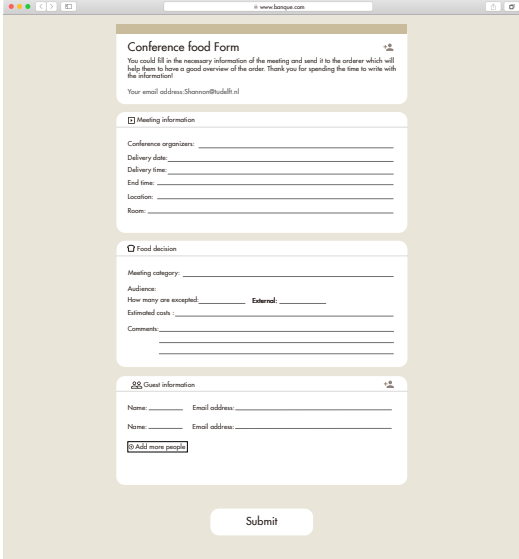
5.2 Touchpoint

Touchpoint1: The conference food form and participant form

The conference food form provides the aligned meeting information with the conference organizers. The rich information on the conference food form helps the orderer to have an overview of the meeting according to the meeting category and the audience information towards reducing food waste as much as possible.
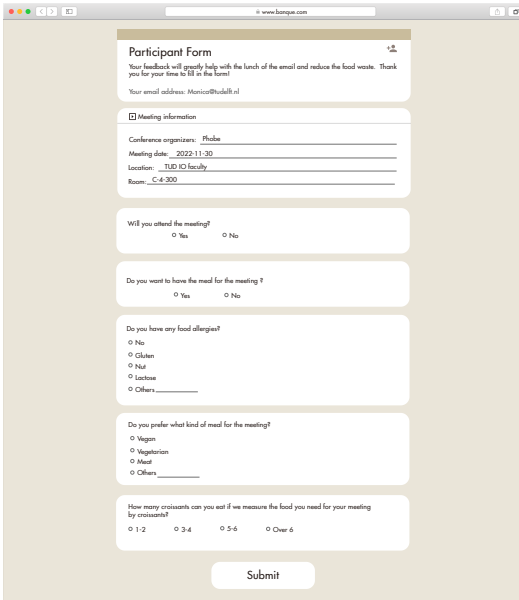
The participant form aims to collect the audience's food preferences and whether they will come to the meeting to check it previously. At the same time, the official invitation to the audience will encourage their audience to realize they should pay attention to the free food provided during the meeting. When the orderer receives the participant response from the website, they can consider the information to decide to book the food.

Furthermore, the information on the participant form provides a clue for the orderer to calculate the amount of food they should order.For example, the website calcu- lates the energy by replacing the energy Croissant. When the audience fills in the participant card form, they will also write down how many croissants they can eat for the assumption. So the orderer will have the clew to make the proper order.

Conference food form

Participant form

Conference food form

When the conference organizer wants to organize a meeting, they could get the form from the website

Add the orderer's email towards let them receive the information.

Touchpoint 2: The Website

The website aims to help the orderer to decide the order of the food with concise and precise information.

Provide the guidelines to order the food:

On the one hand, the orderer could publish tips on the successful example of ordering food on the website. They can also see the tips created by other people from there. On the other hand, the website created more visualisation improvements to guide the orderer to order the food properly. For example, when the orderer chooses the food from the website, they can see what the food looks like through the picture. In the meantime, They could know the size of the sandwich and how much energy a sandwich is. So the orderer could directly know what kind of food they need to make an order when the audience has a specific demand for the food. Such as some audience is allergic to gluten, the orderer could search the keywords to find food without gluten.
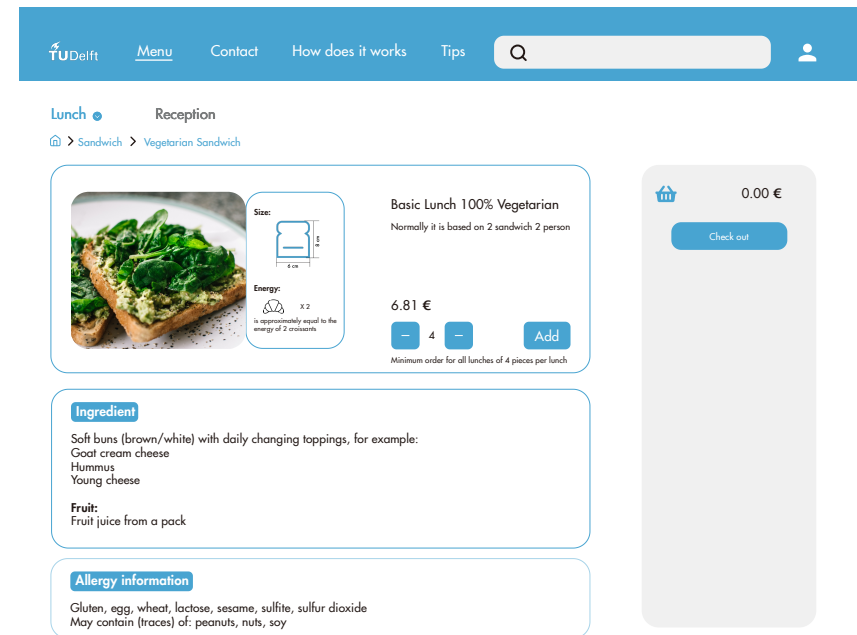
Open the website to order the meal
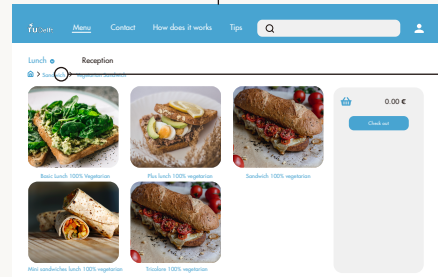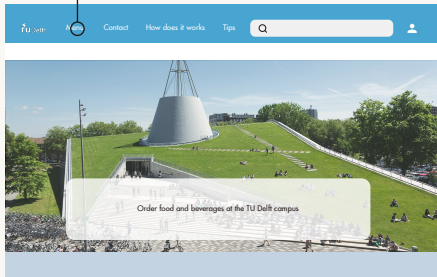
Choose the food category
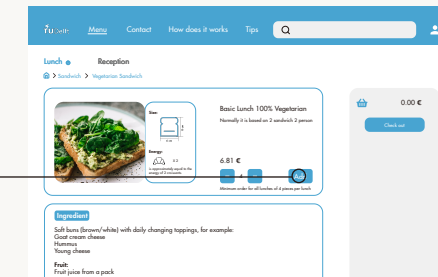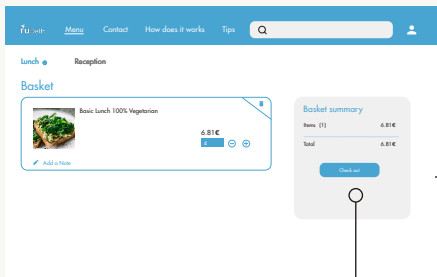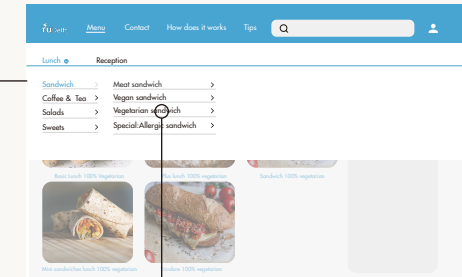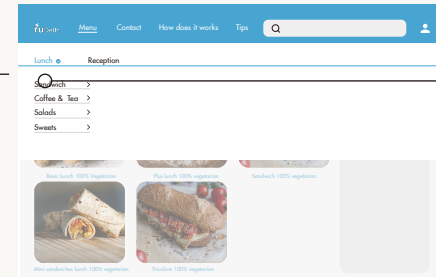
Choose the food
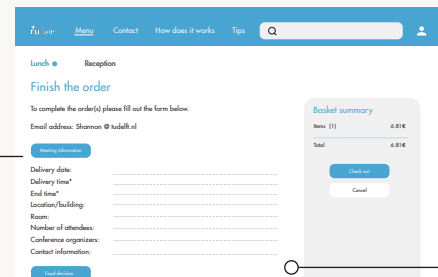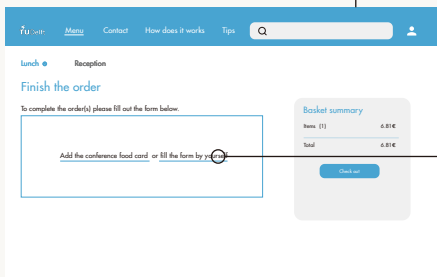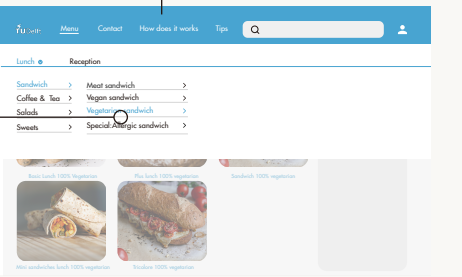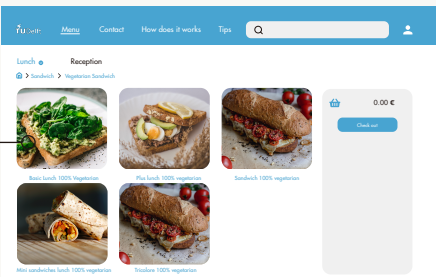
The orderer could drop the conference form to here or write the information by themselves
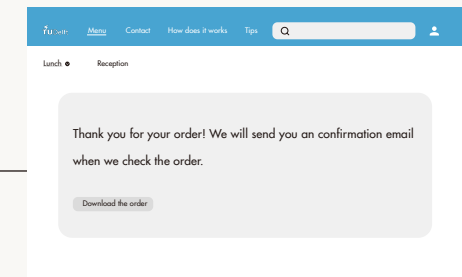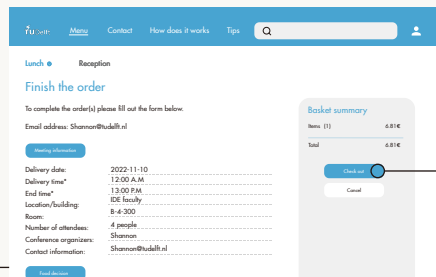
Enhance the communication between stakeholders:

The website created a platform to promote communication with the conference organizers and orderers towards double-checking the order and adjusting the order in time to reduce food waste in the early stage. From the personal stage, the conference organizer could download the food form to start a new meeting. After they launch a new meeting, they could open the button of the upcoming meeting, which could check the order when the orderer finishes ordering the food. In the meantime, when the orderer sends the participant form to the audience, the orderer and conference organizer can check the audience response to the participant form from the website. The website could quickly help conference organizers and orderers check the order's status and adjust the order in time, preventing food waste in the early stage.

Organize a new meeting

Review the old order

Cheack the audience response and order

See the tips
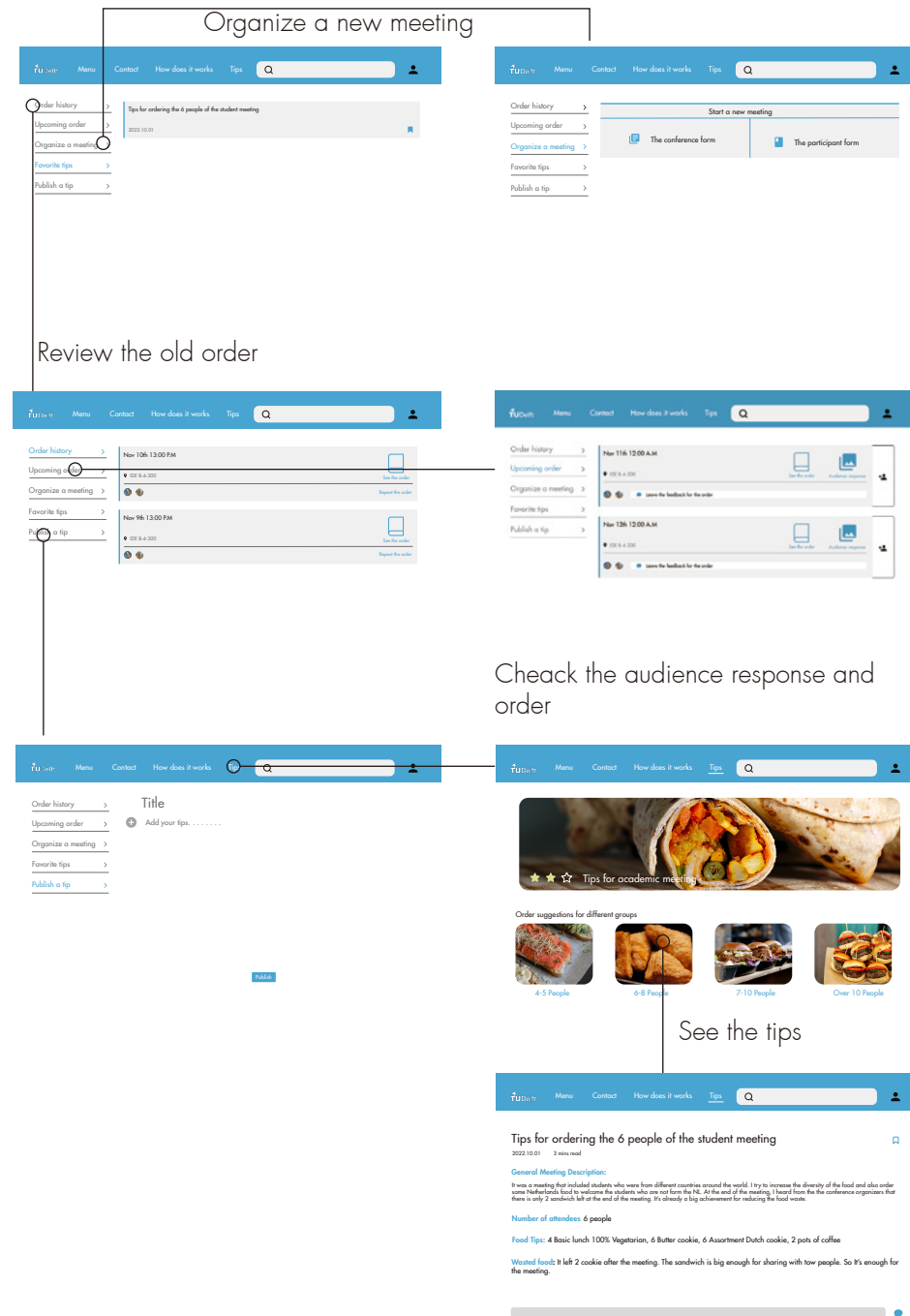
Touchpoint 3: The App

The App aims to engage multiple stakeholders to collaborate towards reducing food waste.

Before the meeting

Before the meeting, conference organizers and students could see the calendar to check which meeting they would participate in and what kind of food they would provide during the meeting. If the participant forgets to fill in the participant food form, they will also receive a notification to fill out the form.

My schedule

Choose the calendar date

If the participant forget to fill the form ,they can check it from here

Check the food menu
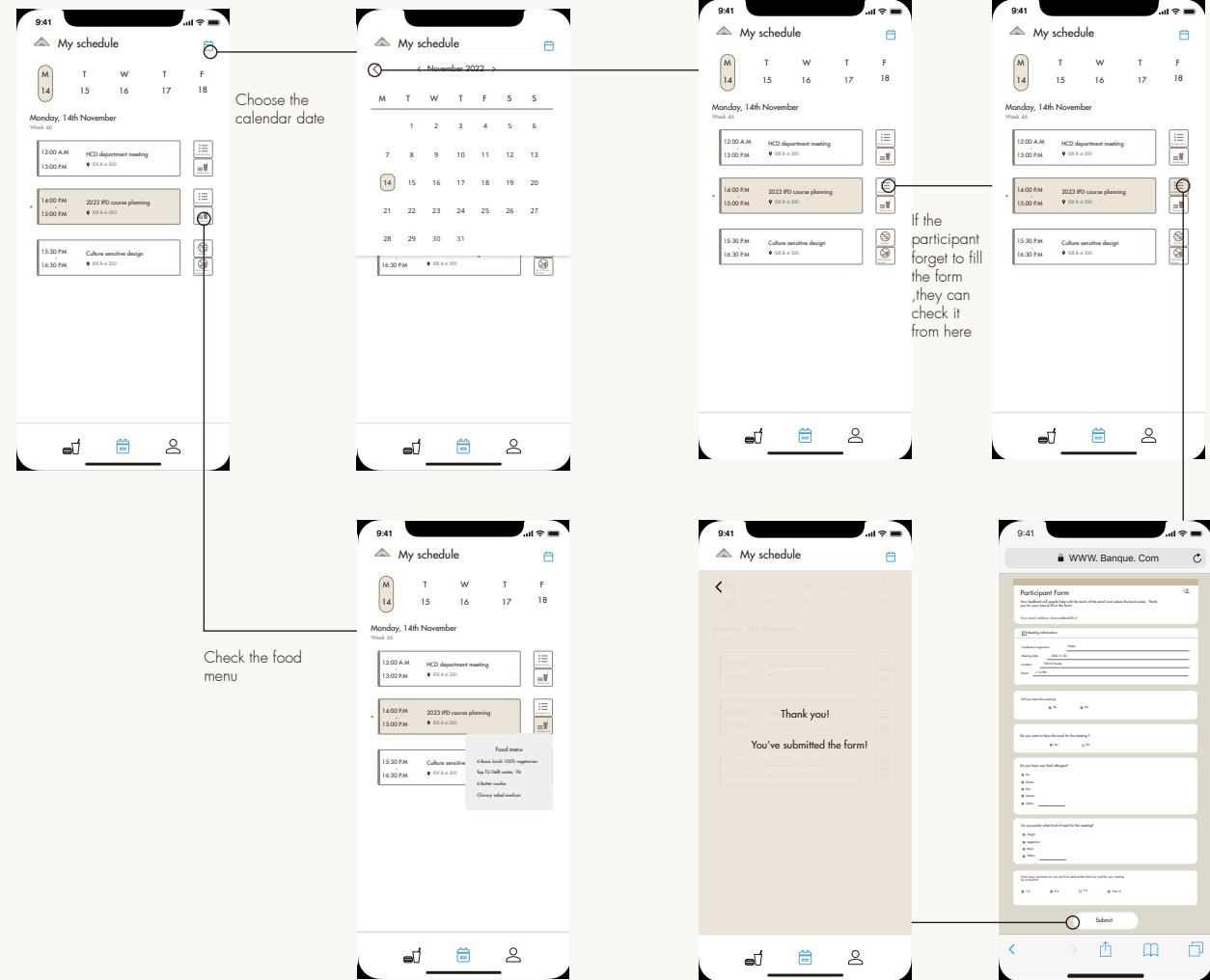
After the meeting

After the meeting, the conference organizers or the orderers could upload the left food information on the APP and motivate more students in the faculty to take away the food. When the students see the notification from the App, they can take food to eat it or use the package to take away the food to eat it or remake it later.

Overall, the App provides a platform to motivate the stakeholders to realize that they could naturally engage stakeholders to reduce food waste in their daily life.

Food news

Publish the newest left food to the app

Choose the location

Add the picture

Confirm the picture

My account

Check the replied message

Publish the news
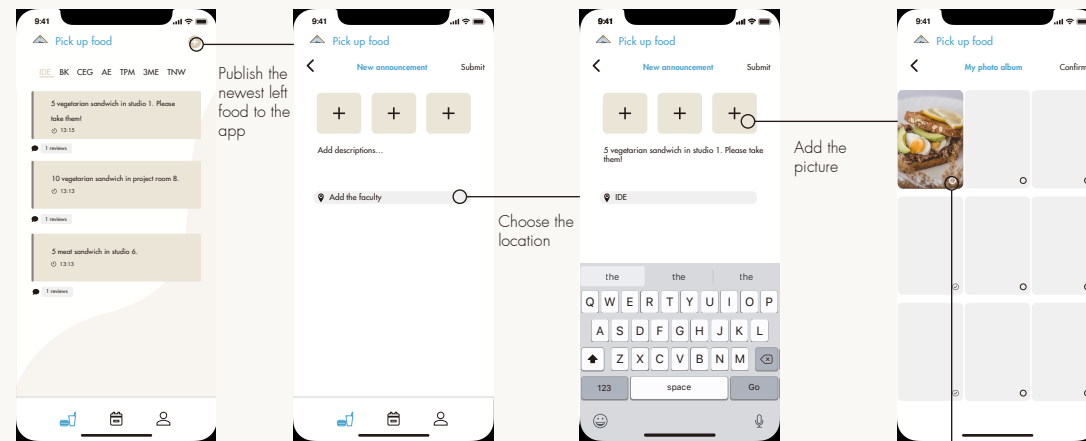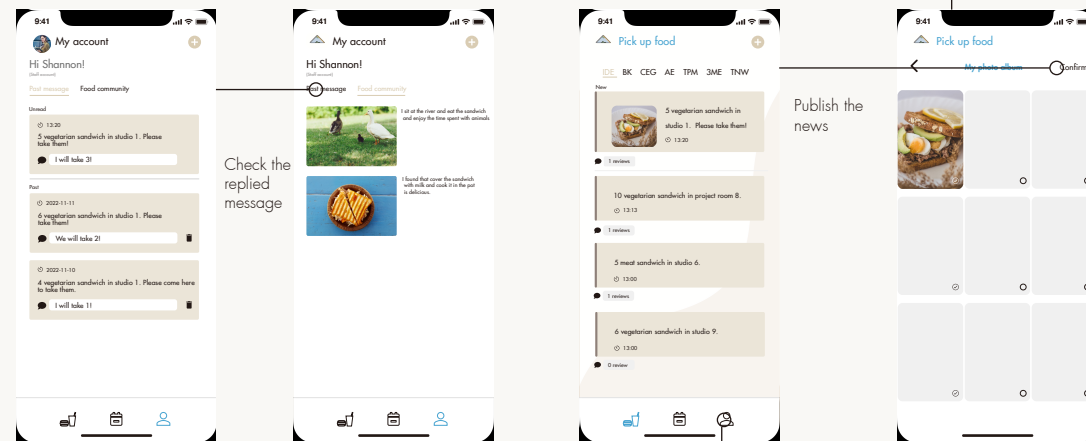
Personl paage

Touchpoint 4: Package

The package aims to motivate people to take the left food and encourage more students to join in reducing food waste.

It has two ways to encourage them to reuse the food. One is the route on the map that encourage students to walk after the intensive study and eat the sandwich with the company of the lovely animals in Delft. The other one is the recipe to recook the food. So people could take it away from home and reuse it. While for students who want to eat directly at the university can also use the package to pack the food in different faculties. It inspired people to feel motivated to reuse food and easily reduce it.
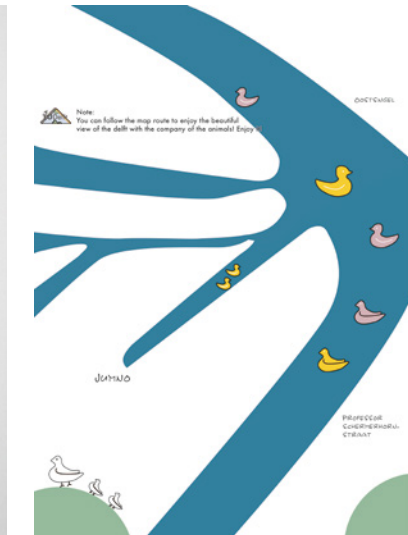
5.3 Evaluation

5.3.1:Evaluation process:

The goal of Evaluation:
With the concept developed, I conducted a round evaluation session with the orderers and caterers. The objective of the Evaluation is to assess whether the concept adapts to the design goal and find the improvement of the concept.

Set up Evaluation:
I conducted the semi-structural interview with stakeholders.During the whole testing, I introduced the whole service with the interactive prototype to the stakeholders, and they spoke out their opinion of the design during the whole session. After they go through the whole service, they fill out the questionnaire to give a mark to each stage of the service.

Participants:
I have interviewed 5 participants in total. There are 2 Cirfood caterers and 3 orderers who are from the secretariat in the faculty. All the participants also join in the interview session before the research stage.

Questionnare:

Booking the food:
•To what extent, would this new website help orderers to reduce the food waste?(score 1-7)
•To what extent, would this new conference form increasse the communication between orderers and conference organizers?(score 1-7)
•To what extent, would this service add the accuracy of order the proper food? (score 1-7)

After delivering the food:
•To what extent, do you feel the app could help orderers to reduce the food waste?(score 1-7)
• To what extent, do you feel the app promote the communication between the orderers, organizers and conference organizers?(score 1-7)
• To what extent, do you feel the package could help more students or staff to take the sandwich ? (score 1-7)

The whole banqueting service:
To what extent, do you feel the whole service help to reduce the food waste of the banqueting service?(-score 1-7)

Result

With the concept developed, I conducted a round evaluation session with the orderers and caterers. The objective of the Evaluation is to assess whether the concept adapts to the design goal and find the improvement of the concept.

Increase the communication

1 participant — 5
3 participants — 6
1 participant — 7

0   5   6   7

Reduce the food waste

1 participant — 5
4 participants — 6

0   5   6   7

Increase accuracy

2 participants — 5
3 participants — 6

0   5   6   7

Booking the food:

Orderer:

The orderer likes the new design of the website, which could give them a clear structure to know what kind of food they could order for the meeting. They also think the participant form could help them easily know what food category they want during the meeting. In the meantime, the website of the order notification could engage conference organizers to join in the ordering session and check the food.

"The form for the participants would help reduce food waste because they can choose beforehand how many they would like to eat or drink."

Cirfood caterer:

Cirfood staff think collecting the participant's information is an intelligent way to help the orderer decide on the food. In the meantime, if the orderers and conference organizers check the order. It will reduce the accuracy of making the wrong order or some mistakes.

After delivery the food:

Orderer:
The App could easily help them announce the food left to the student in the faculty to reduce food waste. The App could be a communication bridge that builds on multiple stakeholders collaborating to deal with the left food together. They also said that sometimes people are not hungry and will not take the food, and the package could easily deal with this problem.

"I like the idea of packaging a sandwich with instructions to "reheat" or something else. Moreover, you can leave a message for the community if there are sandwiches left over, so others could pick them up."

Cirfood caterer:
The Cirfood caterer worries that no one will deal with the food waste after one day. So it is also good to set the rule of who will deal with the final left food. In the meantime, they think the package will cost much money to print, and it might be good to consider how much the package would be delivered for one day to different faculties.

Increase the communication

4 participants 1 participant

0   6   7

Reduce the food waste

1 participant 4 participants

0   5   6   7

Increase accuracy

2 participants 3 participants

0   5   6   7
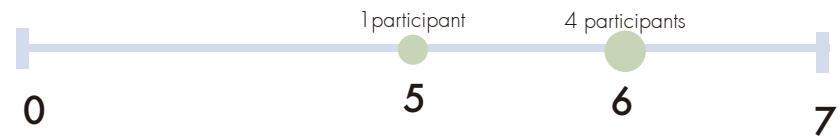
The whole banqueting service:

Compared with the previous banqueting experience, the current service help with reducing the food waste in the early intervention and also engages more stakeholders to think about how to use the small behaviours to influence the food waste of the banquet service significantly.

Conclusion and recommendation

This chapter is the closure of the project. It describes the whole project's summary and the design recommendation. In the meantime, it has an envision for future development.

06

6. Conclusion and Recommendation

6.1 Recommdendation

Involing the caterer:
During the research, the caterer also plays a critical role in reducing food waste. In the future, it is also good to enhance the caterer's collaboration with other stakeholders. For example, they could set a specific fixed time with the orderes to collect the left sandwich when one day is over, and they could deal with the left sandwich instead of leaving it in the room until the next day, which might cause the safety problem of the food.

Build the sustainable awareness:
The long-term goal of the banqueting service is to build sustainable awareness among the stakeholders so they can take action to reduce food waste spontaneously. In the future, the reward model might be added to encourage more users to engage in the system. Once more, people join in sustainable behaviour, creating an atmosphere that motivates others to reduce food waste.

Co-creation to optimise the design
The current evaluation is to validate the workability of the whole service to achieve the design goal. In comparison, it should validate it by using the whole process to make in order to observe the advantages and disadvantages of the detail of the design towards making another round of improvement and launching it in the banqueting service.

The experiment of the APP:
The app involves multiple stakeholders to use it. In order to get further usability of the APP, I recommended doing another round of research on students and staff's daily life towards rich the details according to the demand of different users. For example, it might add a function of making the students enrol in the system the day before the meeting to know how many students might previously want the free sandwich. So the orderer could have an estimated plan to deal with the food when the day is over, or the Cirfood caterer could use the left ingredient to make discount food for the students. Moreover, the student who enrols in the system is first prioritised to get the food.

6.2 Implenation of the Design

Three stages(Figure 16) are presented to achieve the long-term goal of building sustainable awareness for the users.

Horizon 1 is the current stage of the new design. In order to achieve the design goal and viability of design, the current developing process aims to engage the stakeholders to join in the service. The concept is easy to implant without the technology challenge. The IoT system and data processing and analysis aim to achieve the operation of the website and App. At present, they could improve the design based on the Banque website and integrate the functionality of the app that they are using to check the calendar daily. After completing the setting of the design, they could optimize the system.

Horizon 2 is the next step for expanding its influence by engaging more stakeholders. It could also optimize the caterer's system and find design opportunities by engaging the caterer to reduce food waste with other stakeholders. In the meantime, the package could also attract companies to collaborate with the university to reduce costs. Furthermore, the website and the App should continuously optimize during this session.

Horizon 3 aims to create sustainable awareness of the user. The faculty could build an atmosphere that achieves the goal that let almost everyone will spontaneously reduce food waste. The package could be replaced by the package box, which is collaborating with the sponsor company, and students could have a discount to buy it and take it to the faculty. It could also reduce the waste of paper and achieve sustainability. Furthermore, the website's function could integrate into the APP by reducing the touchpoint towards providing a more seamless experience for the user.

Stage	Horizon 1 (0-3 years)	Horizon 2 (3-6 years)	Horizon 3 (6-9 years)
Goal	Engage stakeholders	Expand influence	Build sustainable awareness
Touchpoints	The new banquet service	The banquet service involve the caterers	The banquet service with less touchpoints
	New website · App for conference organizers, orderers, students · Package	Version 2 website · App for conference organizers, orderers, students and caterers · Package	The App for booking the food and communicate with other stakeholders · Package box
Technology	Website & App — Data processing and analysing — IOT system	Website & App — Data processing and analysing — IOT system	Website & App — Data processing and analysing — IOT system
	Package — Paper for print the package	Package — Paper for print the package	Package box — Collaborate with food company of the sponsor of the package box — Students spontaneously take their own package box

Figure 16. Road map

6.3 Conclusion

The project starts with one situation at the delft university of technology: the massive amount of food waste during the banqueting service during the whole day. So in the initial stage, it generated a specific research question: how to reduce the banqueting service's food waste.

To answer this question, the first step of the project is to understand how the current system works and figure out the reason that causes the food waste happens of the banqueting service. The whole project follows with the research aim and questions as the initial start to conduct the depth interview. I interviewed the orderers, carters and students to get a preliminary understanding of the workflow of the banqueting service and the stakeholder's behaviours that cause the food waste. The journey map integrated the interview data to determine what actions the stakeholders take in the corresponding stages will drive the problem. The key findings from the interview become the foundation of building the design vision in the define stage.

Later, to translate the insight into the design opportunities, I made another round of data integration to convert it to the how might we questions that inspired me to think about the potential design opportunities. According to the priority of reducing the food waste of the banqueting service, I set the final design vision: " I envision a seamless banqueting service aiming to help the organizers, orderers and audience collaborate to reduce food waste." Under the design vision, I have three goals: The first is to provide a seamless banqueting service to the stakeholders. The second is to engage the conference organizers, orderers and audience to collaborate to take action to reduce food waste. These two goals could help achieve the final goal of reducing food waste. When the design goal was set, three iterations were conducted with the designers, caterers and orders. As a result, a holistic banqueting service system is mapped out to solve the problem.

The thesis conducted a new banqueting service which multiple interventions in each stage of the journey by engaging the conference organizers, orderers and students with a seamless service to collaborate and achieve the goal of reducing food waste. After completing the design, I also conducted the evaluation session to get feedback on the design's weaknesses and advantages towards making future improvements.

6.4 Reflection

After 6 months of an individual project, It is good to review the whole process again and to find out what I have learned and what I should improve in the future.

Watch problems at an abstract level.
At the beginning of the project, I was eager to design the questionnaire without thinking about the purpose of why I used this tool. If I take action and focus on what I do, it will confuse me throughout the time. I learned that before starting to do it, I should think about why I should do it and the purpose I want to get from it. For example, the purpose of drawing the journey map of each stakeholder is to understand their action workflow and use this tool to see the problems in different stages. It is still a task I need to improve on how to watch things at the abstract level.

Deal with the complexity problems:
The system still involves multiple stakeholders and complex problems. I learned how to manage the time to gradually interview different stakeholders to draw a clear map and use the design perspective to show up by solving problems. Even though sometimes I am lost in the process while thanking Rick and Pinar for reminding me to get back on the right track. While in the future, I need to reflect on myself in time and transfer complex problems into simple problems.

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8. Appendix

Appendix A: Proposal

Reducing the food waste for banqueting services of TUD

project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date   01 · 07 · 2022   07 · 12 · 2022   end date

**INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

The project "Reducing the food waste for banqueting services of TUD " is cooperating with TU Delft Food & eating lab. It focuses on the service-related research and design, user experience and consumer behaviors. The project aims to explore the current TUD banqueting service toward finding the design solution to reduce food waste.

Food waste has received attention from local, national, and international organizations in recent years. Food waste has been brought a bad influence on the environment. Such as resource depletion and greenhouse gas emissions attributed to food waste (Schanes, K, 2018). Even though some people realize that food waste is an issue for the environment, they don't pay much attention and take action to change their behaviors or don't know how to make the change. Food waste happens anywhere. At the Delft University of technology, different department staff has weekly/ monthly meetings with the faculty. Normally, the departments will prepare the food for the meeting. For example, the department secretaries will order the lunch from the TUD banquet service for the staff meetings. And it will generate a lot of food waste after the meeting. There are many meetings organized at the university every day which generate a lot of food waste problems that need to be solved. For example, the project also needs to explore the food life span to research the food journey from the start of booking to the end of wasting towards finding how to reduce the food waste. Furthermore, it also needs to provide a comfortable user experience during the whole journey, which also needs to explore the consumer's behavior and their mind.

In terms of the system, there are several stakeholders in the whole journey. Cirfood is the primary food company that provides the banqueting service for the TU delft. They collaborate with Tu Delft Faculty management, with whom they make agreements on what services to offer. Furthermore, the department secretaries and the staff are also involved in the system. Even though the staff is the main stakeholder, it needs to figure out the other stakeholders' influence and how to engage these people in the system to reduce food waste.

Overall, the graduation project will focus on helping the banqueting service of TUD reduce food waste through a service-product system that they can use in their daily operations.

space available for images / figures on next page

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Initials & Name   X   Yang   Student number 5232899
Title of Project   Reducing the food waste for banqueting services of TUD

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introduction (continued): space for images

image / figure 1:   Food waste in the daily life
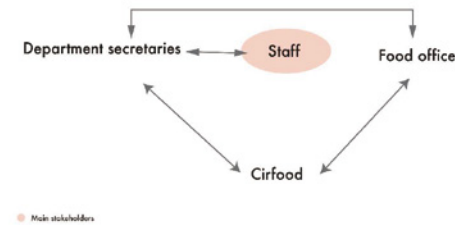
Main stakeholders

Graduation proposal

image / figure 2:   The stakeholders map

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Title of Project   Reducing the food waste for banqueting services of TUD

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

The food waste from the banqueting service of TUD has existed for a long time. People in the system might not realize the severity of the problem and how they could take action to reduce the food waste for the whole system. Currently, several problems exist in the different stages of the system. For example, The secretary's department orders the food previously, while the staff will not eat all the food during the meeting. The secretary department and staff don't have an overview of the food options and order the wrong food. The secretary department don't familiar with the staff's food preference and orders the wrong food. People say they will attend the meeting while they don't show up or bring their own food during the meeting. It will produce a lot of left food after the meeting, while the Cirfood couldn't take the food back which will produce a number of waste etc. In this system, each step will influence each other to figure out the food waste problem that needs to research the reasons for the actions.

The project aims to stand in the entire system's perspective to find the problems and design opportunities. The challenge will be creating the experience and service for the TUD to reduce the banqueting service's food waste by engaging the university staff. So, in this assignment, I aim to build a service-product system to solve this problem towards reducing food waste.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

The project aims to research how could help with the banqueting service of TUD to reduce food waste. The project aims to design a product-service system that reduces food waste for the staff meeting within the project's scope. The outcome will involve experience design and product service system design.

Research the context of the food waste situation of the banqueting service of the TUD and find the design opportunity to reduce the food waste for the banqueting service by engaging the staff.

Product-service design system:
Deliver a concept for the TUD banqueting service to effectively reduce food waste and create a complete service to engage different stakeholders. The whole systematic thinking of the final delivery.

User experience design:
Introduce a new product service experience to the TUD staff, effectively reducing food waste and providing the new service for them.

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date   1 - 7 - 2022   7 - 12 - 2022   end date
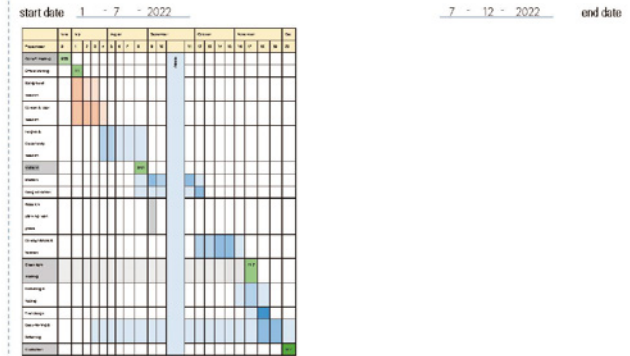
Followed by 100 (more than) working days, the project stages could be divided into : Define the project scope and background research to understand how does the current system works, Context user experience to gather insights and design opportunities, design vision and requirement analysis, idea exploration and design direction, choose the design direction for the iteration, detailing concept, evaluating and testing for the final delivery.

The kick-off meeting is on the 29th of June. After finishing the research, problem definition and ideation that the kick-off meeting will be scheduled on project week 8 (around 40 working days) and suppose me to check the concept direction. In the next phase of the time, I will make the ideation session and iterate the concept to set a specific concept. The green light meeting will be on project week 16 (over 80 working days). Finally, I will test the concept, finish my final concept, and continue the final finishing process to document and visualize the final report.

P.S. The time schedule is based on the tasks of each stage, and the specific time may be fine-tuned according to the actual situation or unexpected situation.

Appendix B:Interview questions

Personal Project Brief - IDE Master Graduation

MOTIVATION AND PERSONAL AMBITIONS
Explain why you set up this project, what competences you want to prove and learn. For example, acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, ... Stick to no more than five ambitions.

From the design perspective, I start with a specific and small problem to explore to find the proper design solution to solve the problem, which is attractive to me. And I am always curious about how design could contribute to the topic of food waste and how designers could engage people to solve this problem. As a student of TUD, I think if I start to solve the problem in my surrounding environment, which is our university and make changes to it will be a passionate thing. Furthermore, I want to use the knowledge of the product-service system thinking to solve the problems, which could explore how much knowledge I have learned.

In the compulsory course ACD, I learned how to transfer the research from different perspectives into insights and how the interaction works between the human and the product. Furthermore, I learned how to provide a holistic system for the user. In the AED, I also choose the recorder cleaning machine which has a little connection with the sound. I learned systematically use different methods to gain insights from users and iterate better solutions based on analysis and insights. So I expect in the thesis project, these competencies will be consolidated and use the service design thinking and stand in the human-centered perspective to provide a better solution.

In this thesis project, I will mainly explore how to use the product -service design system to solve the problem. The user experience will be considered in the design to achieve the final solution in the perspective of feasibility, viability and desirability to fit the needs of the people.

FINAL COMMENTS
In case your project brief needs final comments, please add any information you think is relevant.

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Initials & Name X.   Yang   Student number 5232899
Title of Project Reducing the food waste for banqueting services of TUD

The questions to the banqueting staff:

Before booking the food-
1. What choices could people make when they order food?
2. What kind of meeting that you will organize in the TUD?
3. What's the difference between these meetings?
4. What's the audience of the people?
5. Would the different types of meetings and the audience influence the waste of food?
6. Would you provide different services for different sizes of meetings?
7. Who will be in charge of the order? And what's she will do after she gets the order?

During booking the food:
1. Normally, How will you organize the different orders?
2. How long before will you prepare the food?
3. Would the sequence of the preparation of the food that influenced by the different sizes of the meeting?
4. If you meet some situation where they want to adjust the order, what kind of adjustment request that they ask for you?
5. How will you deal with it?
6. How flexible that they can adjust the order?
7. Dose that influenced by the categories of the meeting?
8. How do you estimate how many ingredients you need for one week or one day?
9 . What kind of people will involve in the session of prepare the food?

Book the food- before the meeting:
1. What are the rules for cancelling the meeting? (the ingredients are already in the kitchen/the food has already been made)
2. What's the deadline for cancelling the meeting?
3. Will the situation change based on the different categories of the meeting?
4. What's the problem you meet if someone cancels the order?
5. Would the measured change be based on different categories of food?
6. During this session, what are the factors that you think cause food waste?

After the meeting:
1. If there is still something left after the meeting, How will you deal with it?
2. Is there different rules to deal with different categories of food?
3. Who will be in charge of dealing with the food?

The questions for the Tudelft :

1. What kind of meeting do you need to book the food?
2. What's the size of the meeting?
3. How long before that you will book the food? Will it change that based on the different types of meetings?
4. Who will ask for help to book the food?
5. What kind of situation you will ask about the staff's food preference? And why?
6. Do they have the request for the food?
7. How do you think about the current platform?
8. What problem did you meet before you arrange this food activity?
9. In which situation that the food is wasted?
10. How will they deal with the food
10. If they don't attend the meeting, will they inform you beforehand?
11. Could you describe the situation that waste a lot in the past time?

1. What's the normal booking process when you book the food from the food office?
(From the start of booking the food to receive the information that you book it successfully)
2. Do you use any platform to book it? If you use it, could I have a look at it?
3. How long before will you contact the food office to book the food?
4. What's the request for the food when you book from the food office?
5. Will food request change based on the meeting?
6. At the normal time, How many people will join the meeting?
7. Could staff choose the food previously before the meeting?
(Vegan choice?)
8. How do you think about the food? Why do you think it will waste?
9. How's the feedback from the staff about the food?
10. Do you think what's the biggest reason that causes food waste?
11. Do you meet any problems when you book the food or when you get the book during the meeting?
12. If they don't come to the meeting, will they inform you previously? In a normal situation that when you will know that they will not come. Like how long before the meeting?
13. If I make a questionnaire about the feedback from the food, is that possible that you help me to send it to the staff that is in the HCD department? Or do you know any way that I could send it to them at one time?
14. Any thoughts or opinions about food or food waste?

How does the current system work:
1. How does the process going from booking to delivering the food?
2. How many people will be involved to finish this process?
-How would you deliver the food? And who is in charge of sending the food to the current classroom?
3. In normally, who will ask for booking the food?
4. What's the range of the meeting that could take the order of the food?
5. How long before the meeting do they request for booking the food?
Does it change based on the size of the meeting?
6. What kind of request do they ask for the food?
7. If they have, What kind of request do they ask for the food? What's the in-control request that you could provide to them?
8. What kind of problems do they meet when they book the food?
9. What's the authority for different people to book the food?
10. Dose this platform the only method to book the food? Do you have any other way?
11. How could they adjust the order?
12. What's the deadline to adjust the order?
13. What problems did you meet in the past to adjust the order of the food?
14. How could they cancel the order?
15. If the food has already been made and they said that they want to cancel the food. What will you do?
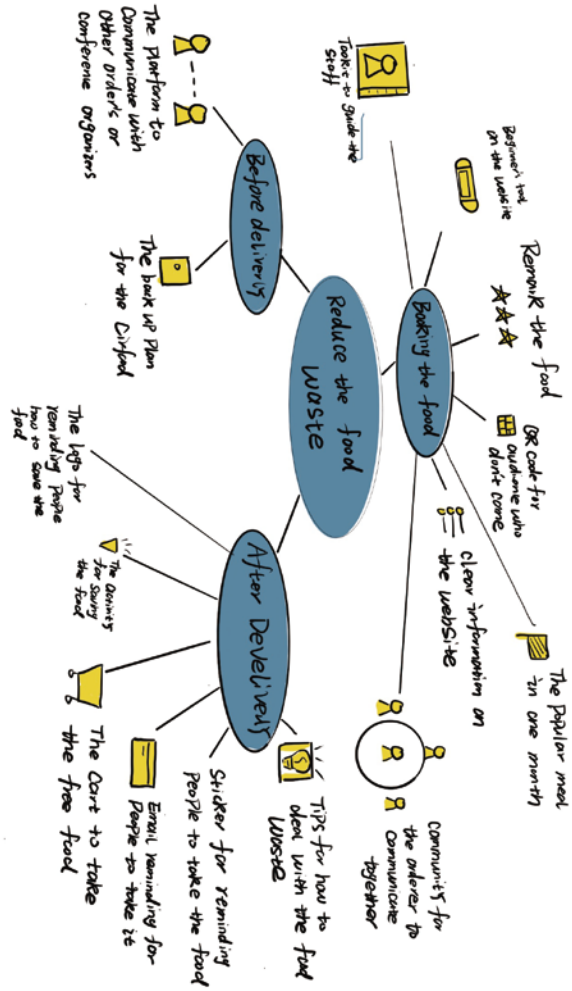
Food:
1. How would you deliver the food? And who is in charge of sending the food to the current classroom?
1. How do you decide on the menu list on the website?
2. Does the menu change based on some reason?
3. How big size of the meeting you will take the order?
4. Would some regulations changed based on the size of the meeting?
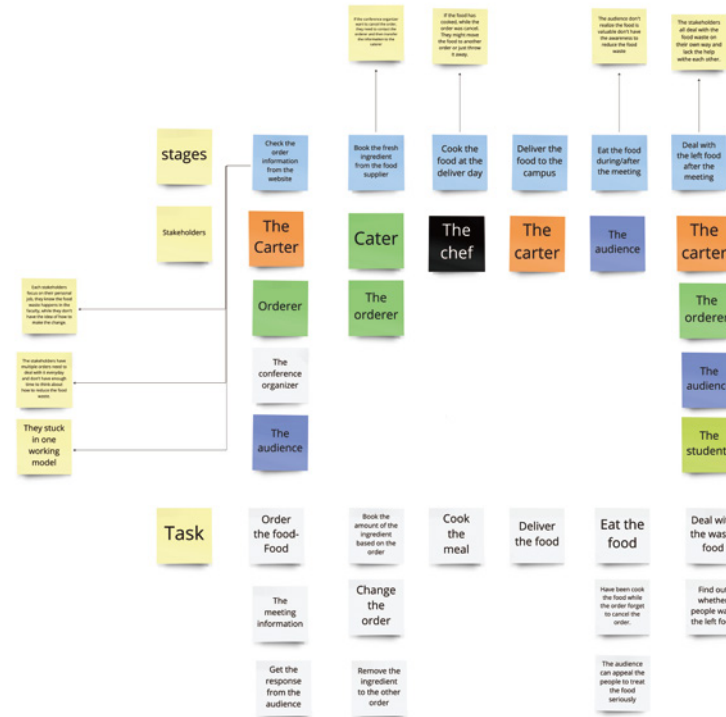
Food waste
1. In the normal time, How will you deal with the left food after the meeting?
2. Who will deal with it? Could I talk with them?
3. What's the biggest problem that you think cause the huge food waste?
Is there a particular situation that happens to produce a lot of waste? Could you tell me what happened?
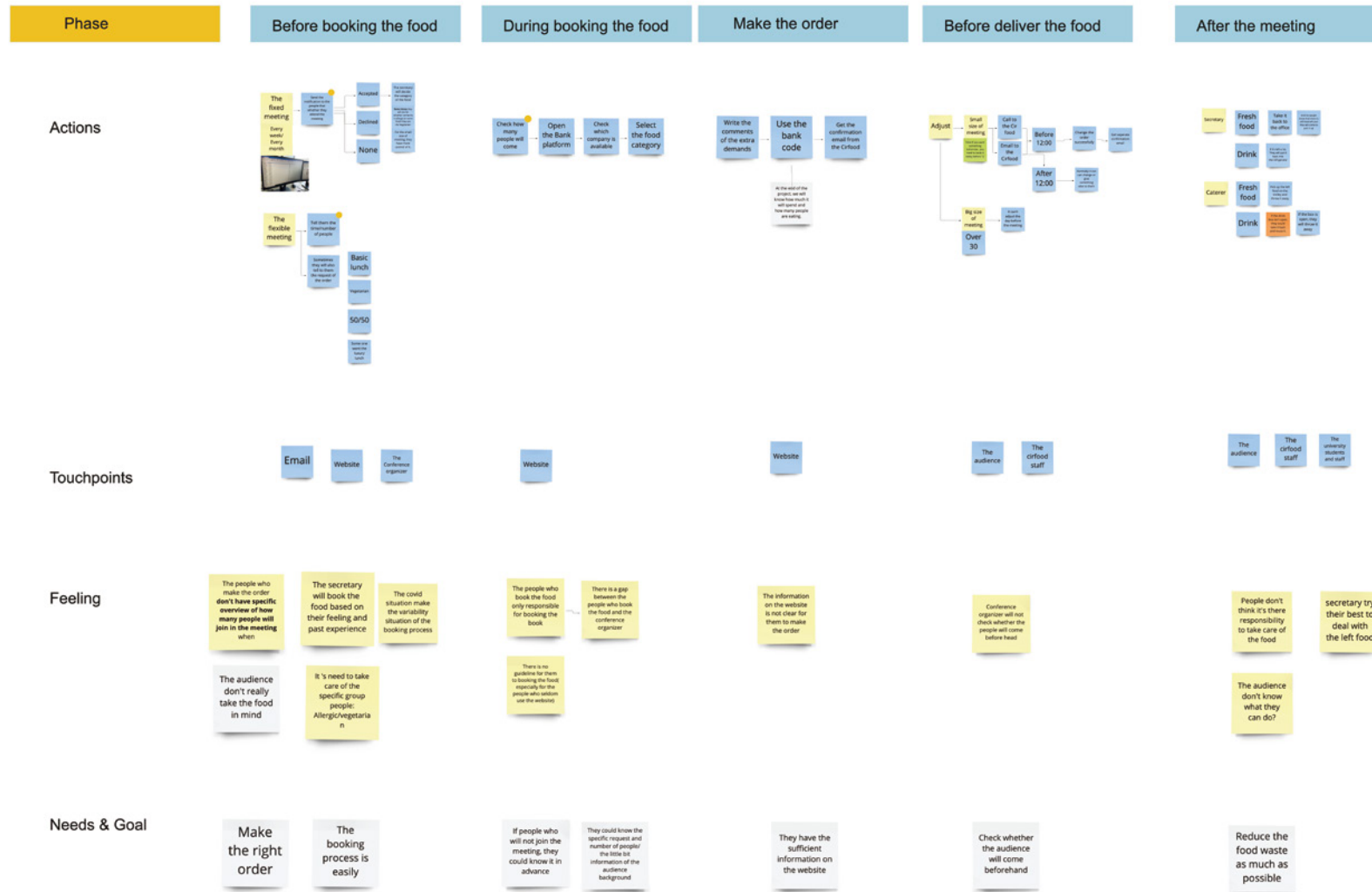
Appendix C:Sketching

Appendix D :Food journey map

Appendix E : Food journey map

Phase	Before booking the food	During booking the food	Make the order	Before deliver the food	After the meeting

Actions

Touchpoints

Before booking the food: Email, Website, The Conference organizer

During booking the food: Website

Make the order: Website

Before deliver the food: The audience, The cirfood staff

After the meeting: The audience, The cirfood staff, The university students and staff

Feeling

Before booking the food:
- The people who make the order don't have specific overview of how many people will join in the meeting when
- The secretary will book the food based on their feeling and past experience
- The covid situation make the variability situation of the booking process
- The audience don't really take the food in mind
- It 's need to take care of the specific group people: Allergic/vegetarian

During booking the food:
- The people who book the food only responsible for booking the book
- There is a gap between the people who book the food and the conference organizer
- There is no guideline for them to booking the food especially for the people who seldom use the website

Make the order:
- The information on the website is not clear for them to make the order

Before deliver the food:
- Conference organizer will not check whether the people will come before head

After the meeting:
- People don't think it's there responsibility to take care of the food
- secretary try their best to deal with the left food
- The audience don't know what they can do?

Needs & Goal

Before booking the food:
- Make the right order
- The booking process is easily

During booking the food:
- If people who will not join the meeting, they could know it in advance
- They could know the specific request and number of people/ the little bit information of the audience background

Make the order:
- They have the sufficient information on the website

Before deliver the food:
- Check whether the audience will come beforehand

After the meeting:
- Reduce the food waste as much as possible

Appendix F : Design iteration round 2

Conference food Form ⋮

🖥 **Meeting information:**

Conference organizers: _____

Contact information: _____

Delivery date: _____

Delivery time: _____

End time: _____

Location: _____

Room: _____

🖥 **Food decision:**

Meeting category: _____

Audience:

How many are excepted: _____   External: _____

Estimated costs : _____

Comments : _____
_____

Menu:

Participant card

Name : _____

Contact information: _____

Do you want to **order the meal** for the conference ?

☐ Yes   ☐ No

Do you have any food allergies?

☐ Neither
☐ Gluten
☐ Nut
☐ Lactose
☐ Others _____

Do you prefer what kind of meal for the meeting?

☐ Vegan
☐ Vegetarian
☐ Semi-vegetarian
☐ Meat
☐ Others _____

How many croissants can you eat if we measure the food you need for your meeting by croissants?

☐ 1-2   ☐ 3-4   ☐ 5-6   ☐ Over 6

Submit

Screen 1 (top left):

TUDelft Menu Contact How does it works 🔍 👤

Lunch ⊘ | Reception

Sandwich ＞ | Meat sandwich ＞
Coffee & Tea ＞ | Vegan sandwich ＞
Salads ＞ | Vegetarian sandwich ＞
Sweets ＞ | Special:Allergic sandwich ＞

Basic Lunch 100% Vegetarian | Plus lunch 100% vegetarian | Sandwich 100% vegetarian
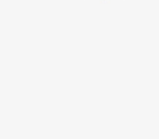
Mini sandwiches lunch 100% vegetarian | Tricolore 100% vegetarian

Screen 2 (bottom left):

TUDelft Menu Contact How does it works 🔍 👤

Lunch ⊘ | Reception

🏠 ＞ Sandwich ＞ Vegetarian Sandwich

Basic Lunch 100% Vegetarian

Normally it is based on 2 sandwich 2 person

Size:

Energy:
X 2
is approximately equal to the energy of 2 croissants.

6.81 €

— 4 — | Add

Minimum order for all lunches of 4 pieces per lunch

🛒 0.00 €

Check out

Ingredient

Soft buns (brown/white) with daily changing toppings, for example:
Goat cream cheese
Hummus
Young cheese

Fruit:
Fruit juice from a pack

Allergy information

Gluten, egg, wheat, lactose, sesame, sulfite, sulfur dioxide
May contain (traces) of: peanuts, nuts, soy

Screen 3 (right):

TUDelft Menu Contact How does it works 🔍 👤

Lunch ⊘ | Reception

Finish the order

To complete the order(s) please fill out the form below.

Email address: X.Yang-22@student.tudelft.nl

Meeting information

Delivery date:
Delivery time*
End time*
Location/building:
Room:
Number of attendees:
Conference organizers:
Contact information:

Food decision

Meeting category:
Attendees:
How many are excepted: | How many are external?

Supplement
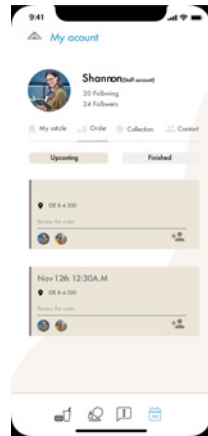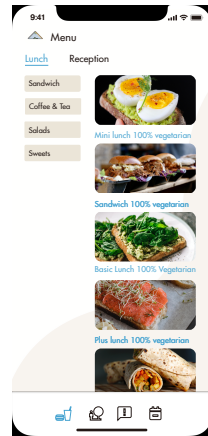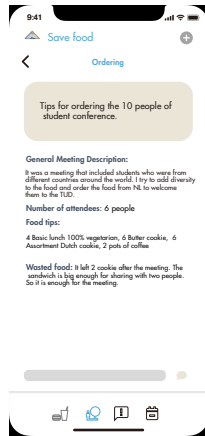
Dimcode:
Projectcode:
Description event:
Contact person + telephone number:
Comments:

Repeat the order

○ *Agree to the Terms and Conditions of the Cirfood. Click here to download these.

Basket summary

Items (1) 6.81€

Total 6.81€

Check out

Cancel
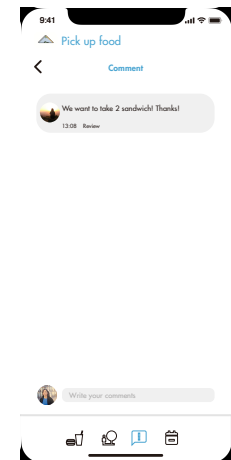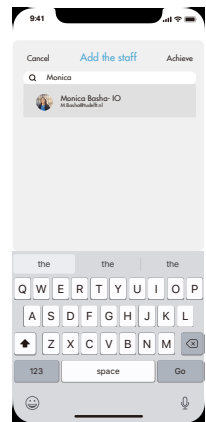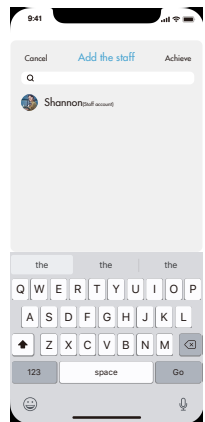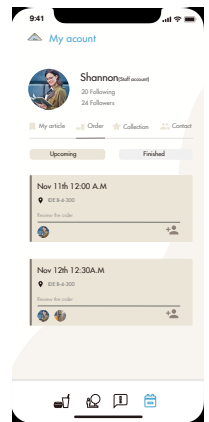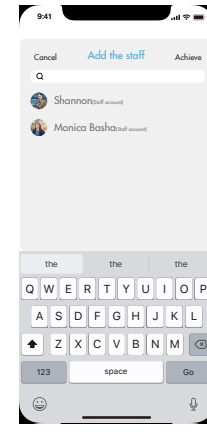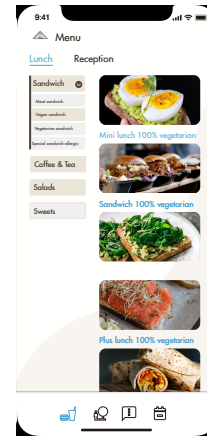
Appendix G :The kitchen in the Aula