



## Appendix: A cup deposit system:

An implementation strategy for NS stations to engage customers to use reusable cups and lower their environmental impact.

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# Appendix 1: Transport

## Introduction

NS has to transport the paper cups to their stations. NS has a lot of stations which means that transporting every paper cup to every station that needs paper cups can be complicated. The NS distribution system exists out of a combination of their own personnel and services from other companies to transport paper cups to every store they have (see figure FIX ME).

This means that if a new solution is implemented within NS it should take into account how it can be transported to every station.

A desk research was done to find out the possibilities and limitations which can be taken into account when designing a new solution for NS.

This research answers two subquestions.

- How does NS transport their paper cups and their lids to their stations?
- What are the pitfalls when a new system is implemented into the NS distribution system?

## Process of restocking paper cups in a shop

The process of restocking paper cups and their lids in a shop starts when the barista has the time to look how much inventory the shop has left. They do this every day to make sure they do not run out of products. When there are not enough cups or lids left, they report that they need new cups to NS. NS stations ships the needed amount of paper cups or lids with the help of the distributor from one of the distribution centers of Distributor to the shop at the station.

When Distributor runs out of paper cups in their distribution centers, NS orders new cups or lids at Manufacturer or Manufacturer. Manufacturer and Manufacturer are paper cup producers. They transport the paper cups or lids from their distribution centers to the distribution centers of Distributor.

The cups are transported to the shops with lorries and vans. These lorries and vans are all filled with roll containers on which the products are transported. The usable space within each roll container is 815 mm x 662 mm x 1500 mm (DxWxH).

The cups and their lids are transported in cardboard boxes and each stack of cups is covered with plastic so the cups can not be contaminated during transport. The dimensions of these boxes and how much volume each cup takes in during transport, can be found in figure FIX ME.

When Distributor delivers the paper cups or lids at NS stations the products can be distributed to the shops in three ways.

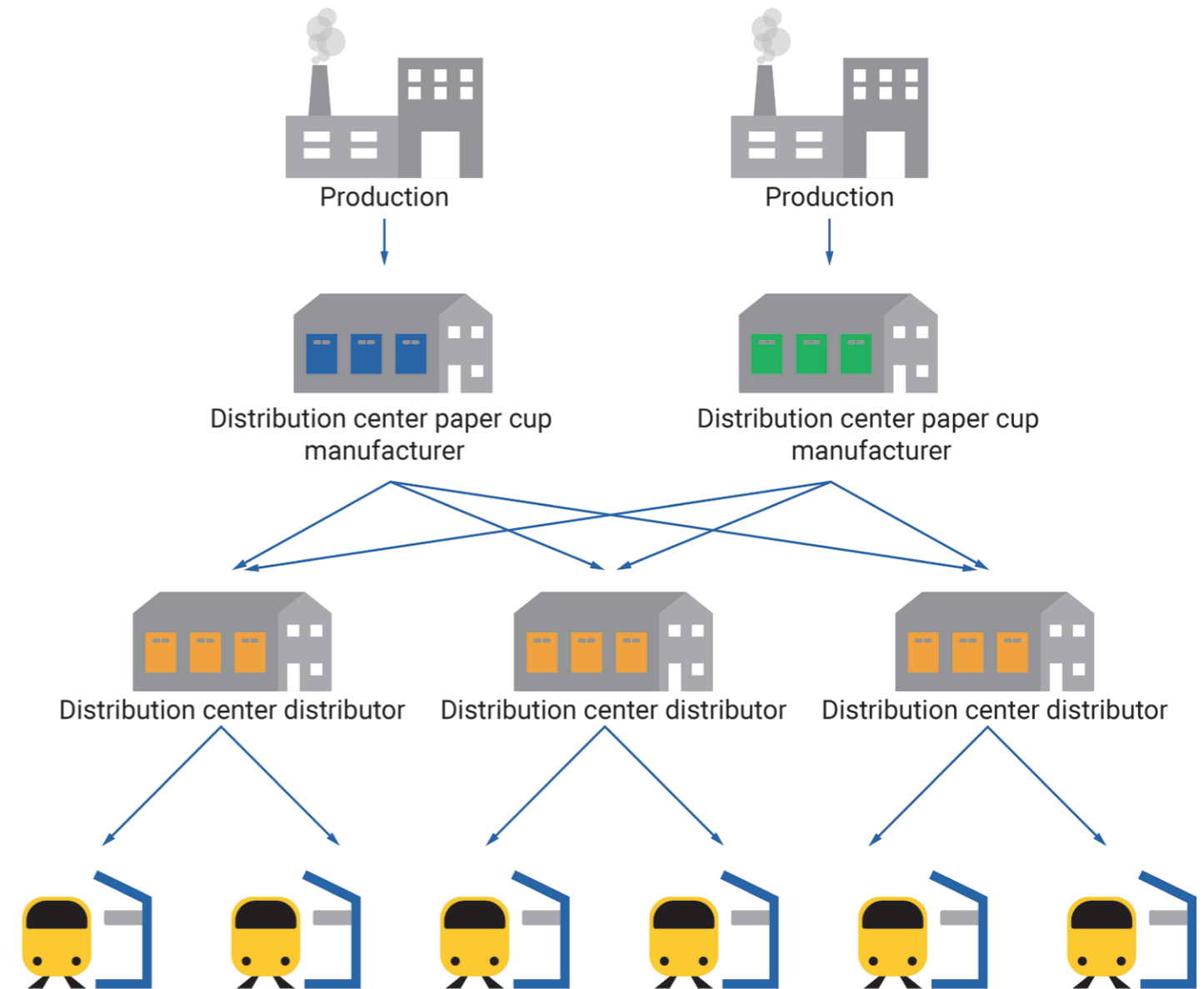


Figure 1: Distribution infrastructure of NS paper cups

# Appendix 2: Interview baristas

1. Via the logistical personnel of one station.

Logistical personnel of a particular station takes the roll container with the cups and delivers them to the shops where baristas restock the shop with the products. This is mostly done by big stations

2. Via logistical personnel that is responsible for multiple stations.

Logistical personnel takes the roll containers with the products for several stations. This means that this logistical personnel travels every day to several stations and brings each delivery to the shop. After accepting a delivery they also deliver the roll containers to the shops. This is mostly done at smaller NS stations with only a few shops.

3. Via the chauffeur.

The chauffeur of the lorry or van delivers the roll container to the shop at the station. This is done at small stations.

When the roll containers are emptied by the baristas, the roll containers are taken back by the delivery personnel, they can also be stored at the station. This mostly depends on if there is time to return the roll container before the delivery van leaves. Delivery personnel is on a tight schedule which means they can not wait long for a roll container to be delivered back to their van. If there is no time to return the roll container it is stored at the station and returned to the delivery personnel when they do the next delivery. Some stations do not have a lot of storage to store a roll container or even their products. This means that the delivery personnel has to wait for the baristas to unload the container. An even bigger problem for these stations is that they can not have many cups in storage, which means that storing a reusable cup which will take more space can be fairly hard to do.

## Introduction

To get a general idea of what employees of NS stations experienced during their shift I interviewed a few of them. The goal of this research was to find out how they experienced their work at a Kiosk. To answer and link it to my master thesis three sub questions were formulated. The first question that was asked is about how their general workday looked like. The second question is about how they felt about this work day. The third question is about what they think about reusable cups.

I choose for Kiosk store employees as these have the harshest working environment because they have very little space in their shops and they are also the busiest as most people buy their coffee at a Kiosk.

## Method

For this research interviews were done at three different stations: Nijmegen, Eindhoven and Rotterdam. These stations are all of different sizes and different amounts of warm beverages are sold. The people that were interviewed did however work on multiple places at each stations so they got experience of shops that sold 2000 cups of coffee per month which is quite a low sale number (only 16 out of the 150 NS stores scores lower) and experience in shops that sold 21000 cups of coffee per month (which is the fifth highest sale total of all the NS stores).

Also the participants were selected based on their work weeks and experience. There is a range of work weeks of 15 till 38 hours. There is also a range of work experience, there are people that just worked there for a few weeks and people that worked there for 35 years.

The interviews lasted between 15 and 45 minutes. This depended on the time people had to take part in the interview and how much they had to say. There was one interview done with two people at the same time due to time constraints. Each interview was done with the same set of questions which can be found in appendix FIX ME. After two interviews however an extra question was added and that was if they could fill in an emotion curve. During each interview the interviewer noted down what people said and later these results were digitalised, summarised and conclusions were drawn from them.

In total 6 baristas were interviewed.

## Results

During this research a lot of qualitative data was found and this is summarised in the following parts.

# Customer interaction

## Day of a barista

Figure FIX ME shows what a barista does during an average work day.

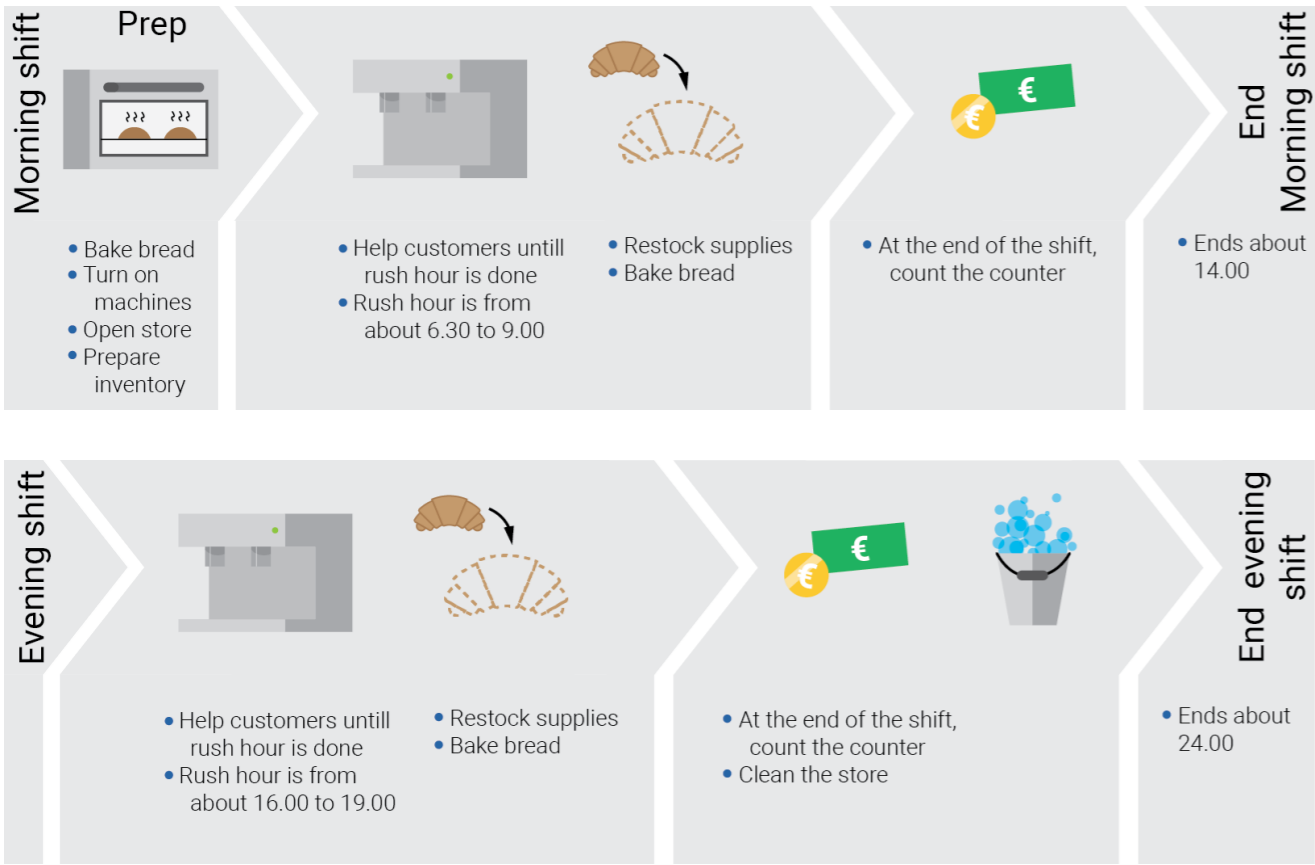


Figure 2: The morning and evening shift of a barista at a Kiosk

The emotion lines in figure FIX ME show how baristas feel during an average work day. No day is the same so the baristas filled in the lines with keeping in mind what could happen during a work day. The descriptions of each lines can be found in Appendix FIX ME. In general baristas are pretty happy during their job.

The lines go up when baristas:

- have enough work to do
- have nice conversations with customers or their colleagues.

The line goes down when baristas:

- have nothing to do and become bored.
- have a bad interaction with a customer.
- don't have a colleague
- have a high work load
- have to clean the store (only in the evening shift)

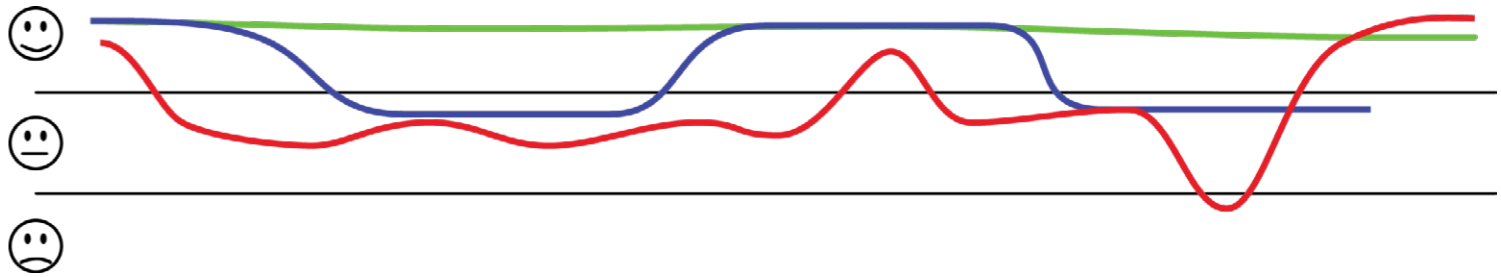


Figure 3: Emotion line during an average morning shift of a barista at a Kiosk

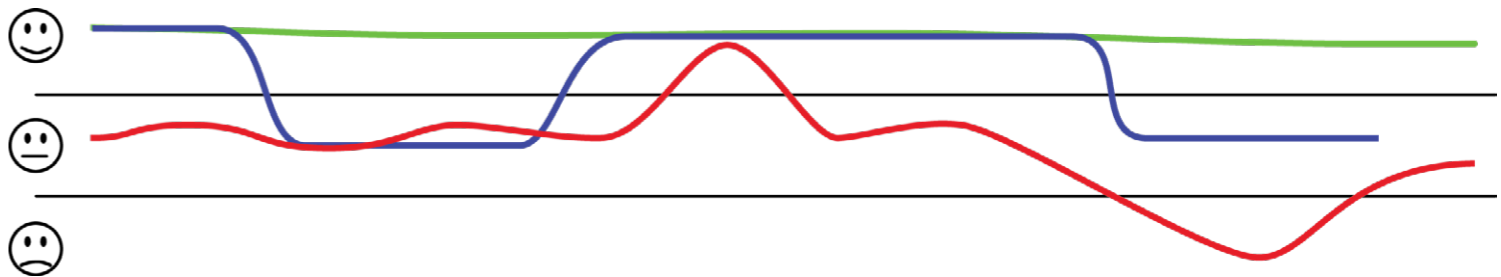


Figure 4: Emotion line during an average evening shift of a barista at a Kiosk

## Conversation

The main goal of all the baristas that were interviewed was to communicate efficient and polite to the customers. They try to do this with every customer. The general conversation can be seen in figure FIX ME.

It is interesting to see that they already ask quite a bit per customer. One of the baristas told me that adding an extra question does take up time and is also something the barista has to remember.



## Kind of customer

Most baristas thought generally the same over the kind of customers they have. they said there are two types of customers: the regular customer and the irregular customer. A short discription can be found in figure FIX ME.

Between the regular and irregular travellers there are also similarities. This is mostly in how people interact with the barista during the conversation. Here there are the open and the closed of customers.

The baristas describe the open customers as people that always try to be nice when they can. During rush hour these people stay nice to the barista and on other times of the day they are open for a small conversation with the barista. This is something the baristas appreciate very much.

The closed of customers are mostly there to just get coffee and speak the minimum amount they have to the barista. This is less nice for the barista. It feels like that these customers don't appreciate the amount of work baristas do.



The regular customer is someone that buys coffee on a regular bases. The regular customer travels the same route often and thus developed a routine. This means that they also often buy the same warm beverage every time. The baristas know regular customer by face and also know which coffee they want. This means that most of the baristas don't even need to

wait for these customers to order their beverage. They immediately make the coffee when it is the customers turn. They say that these people travel most during rush hour and are mostly commuters. These also know how the Kiosk work, they know how much time it will cost to make coffee and how the interaction with the barista will go. They are also more sure about themselves time wise as they know when the train will leave. This results in that they are a lot less stressed and trust the barista that they will deliver the coffee on time.



The irregular customer is different than the regular customer in that they don't travel often and don't know the station well. Examples of these are people that visit some friends, go on holidays and go on an occasional work trip. They are not experienced train travellers. The baristas don't know them well so they need to aks what the customer wants to order and can after this make the warm beverages. These people can be both stressed and relaxt. The stressed people are mostly stressed because

they don't want to miss their train and are not sure if the coffee can be made on time. The relaxt people are not in a hurry because they arrived too early at the station or they can take a later train.

## Reusable cups

All of the baristas I interviewed were very open for the use of reusable cups and did not seem to have any problems with washing the cups. It does not cost them that much time so they even do it easily during rush hour.

Baristas wash the cups differently. Some people use the hot water for the tea and throw the hot water in the sink. Some people use the hot water of the Quooker in the new Kiosk 2.0. Some even use the water from the sink that is not meant for drinking to clean the cup. And others use a spray device that is meant to clean the milk cans they use for the milk.

Most of the baristas ask the customer to remove the caps of the cups so they can't be liable for damage if they drop the cap or don't attach it properly. Some regular customers do have a routine for this so they do not have to ask it.

Looking into which cups are used by the customers five groups can be made: the foldable cups, the thermos bottles, the bamboo cup, the mug and exceptions like a jar (see figure FIX ME).

The foldable cup is a good cup in general it does not feel as sturdy as other alternatives. The thermos bottles are nice but they have one big downside and that is that they often don't fit underneath the coffee machine. There are two ways baristas handle this. The first is that they use something else to make the coffee in and pour the coffee in the cup. This can be a paper cup they use once or a few times, but it can also be the milk can. The second way is to use a paper cup but not give the discount as they do not use less cups.

The bamboo cup is very popular and they see them often.

The baristas sometimes see the normal mug and it does not have any problems.

One downside of some cups is that they are too small for a regular coffee and they have to pull out the drawer of the coffee machine so the cup will not overflow.

Some try with paper cups and one barista did give a discount and one other didn't give any discount for that.

## Plastic covers

Baristas also mentioned the plastic covers that are used to not spill the coffee when people walk with the cups according to one barista but also some people from NS. In this interview I found three ways baristas deal with these covers. The first one is that they always put on a plastic lid. The second one is that they ask the customer if they want one or not, they sometimes even specifically say that it is made from plastic to inform the customer better. The third is that they put the covers next to the counter and let people add the covers themselves.

In some stations they even don't provide the covers any more so the customer does not have the chance to get one.

## Conclusion

Looking at the conversation a barista and a customer have there can be concluded that the main goal is that it is efficient. At the moment the standard conversation can be quite long before the barista can start to make the warm beverage. This is time they could have spent helping another customer. This eventually results in less sales during rush hour. Adding an extra sentence to the standard conversation will also add to this time.

Some of the baristas like to be busy during rush hour, while others say that during rush hour it is just a lot of work and that can be quite a bit.

On the other hand outside rush hour this is not a problem and most baristas actually like to have a longer conversation. Almost all of them actually like to have contact with customers during their work day. They also hold value in that they know the regular customers by face and have a personal connection with them.

There are different ways baristas feel during the day. Most of the time they are positive about their job. It is interesting to see that all of the people that were interviewed were proud of their job. This can be because they are proud that they help people, but also because they managed to start early with their job. They also like their colleagues and like to help customers. Some of the baristas start to get bored when they can't help someone or there are no colleagues to talk to.

They don't like it when people don't value them as baristas, then they unconsciously help them less. Next to rude customers most of them did not like to close down the store because they have to clean quite a lot and it can sometimes be also really busy.

All of the baristas that were interviewed were positive about the reusable cups. They did not see any problems in cleaning the cups. They do want to have it without the lid so they can't break it, they do have to explain this to customers. There are some cups that don't fit underneath the coffee machine. The way how they clean the cup is different per person.

A last interesting thing to see is that most baristas are now actively trying to use less plastic covers. These are things they do themselves and there is no standard way of doing this.

## Appendix 3: Further research Kiosk

Next to the interview also some other small researches were done to get more information. In this chapter further observations will be described. These include a morning were I worked in a Kiosk coffee shop in Eindhoven myself and talked to my colleagues for that morning. Other results are gathered from talking to Stationshuiskamer personnel.

### Working at a Kiosk

Interviewing Kiosk employees was one way to understand how they experienced working at a Kiosk. However to understand better how they felt I also decided to work at a Kiosk myself. Before this I had already done three interviews with Kiosk employees so I had an idea of what happened while working at a Kiosk. I worked from 7:30 to 9:45 at a hall Kiosk as these are little bit less busy and it easier to learn there. I worked at a Kiosk 2.0 what meant that I was working with the new machine. This machine is a bit more complicated than the older machines and you have to do more actions to make one coffee. This would give me an insight in how to make the most complicated coffee. An explanation of how to make each cup of coffee can be found in figure FIX ME.

The first thing I observed was that the atmosphere was really good. The colleagues I had were very welcoming and wanted to explain everything. After 30 minutes I got the hang of it and I could help customers on my own. I also started to understand that helping customers was something that was very rewarding because you help a lot of people in a short amount of time.

I also saw a few reusable cups. One of them was the Frank Green cup, which was sold by NS. However my colleagues this was one of the two they still saw in use in Eindhoven. I also saw a foldable and the colleagues told me they were afraid that they would squeeze the coffee out of the cups as the bottom part is made from flexible silicon.

### Talking to Stationshuiskamer personnel

Because quite a few Kiosk are changed into Stationshuiskamers I also decided to look into these shops. When I visited one of these I found out that employees in these shops can have way more difficulties because there shops are bigger. This can mean that they do have to walk a lot further to a sink were they can clean the cups. They even have to walk away from the counter, through a small hallway, see figure FIX ME, to the sink. When they are working alone, which happens often, that means that they have to leave customer alone in the shop. This is why they do not like to clean the cups of customers.



Figure 5: Picture of the counter of a Stationshuiskamer. The halway starts at the doorframe next to the coffee machine.

# Appendix 4: Interview set-up and raw results

## Interview opzet reizigers

### Hoofdvraag

Hoe drinken mensen nu warme dranken op NS stations?

### Subvragen

Hoe ervaren reizigers hun reis met NS?  
Hoe ervaren reizigers warme drank drinken tijdens hun reis?  
Waarom gebruiken reizigers geen herbruikbare koffiebeker?

### Plan van aanpak

#### Wie

Mensen die een beker met een warme drank erin vasthouden. Gespreid op basis van leeftijd en geslacht.

#### Waar

De survey wordt afgenomen op het perron van de volgende twee grote stations

- Den Haag
- Rotterdam

En een middelgroot station

- Leiden

De reden dat voor het perron gekozen is dat mensen hier nog genoeg privacy hebben en ze moeten toch wachten dus ze hebben tijd. De interviews worden ten minste 1,5 meter van de perronrand gehouden aangezien dat voorgeschreven wordt vanuit NS.

#### Wanneer

De interviews zullen tussen 8:00-9:30 worden afgenomen. Volgens NS onderzoek kopen de mensen dan de meeste koffie dus de kans dat je mensen tegenkomt die koffie kopen is groot.

#### Hoe

Team van twee die los van elkaar mensen interviewen en noteren. Hierdoor krijg je meer data en is het beter uit te houden.

#### Hoeveel

20 mensen per station.

#### Hoelang

5 minuten per persoon.

Benodigdheden

- 2x NS hesjes
- Toestemmingformulier om te interviewen op stations
- Notitieboeken
- Vragen formulier
- Pak koekjes voor beloning
- Overzichtsfoto stationInterview verloop

Mag ik een paar vragen stellen aan u over uw koffie? Het zijn een paar vragen en als u trein arriveert kunnen we het interview meteen afsluiten zodat u uw trein kan halen.

Ik ben van de TU delft en ik kijk voor mijn afstuderen voor NS naar het verminderen van de CO2 uitstoot van bekertjes op NS stations. Zou u misschien een paar minuten de tijd hebben om een paar vragen te beantwoorden over uw koffiedrinkgedrag op NS stations.

1. Hoeveel keer per week reist u?
2. Waarom reist u?
3. In welke groep past de geïnterviewde (schat dit zelf in)?
  - 0-25
  - 25-50
  - 50+
5. Hoeveel keer per week koop je een warme drank op NS stations?
6. Waarom koop je een warme drank op een NS station (en waarom niet ergens anders)?
7. Hoe en wanneer bepaal je of je een warme drank wilt?
7. Welke warme drank neem je meestal?
  - Neem je die altijd?
8. Wat vindt u van de papieren beker in relatie tot uw reis?
  - Vertrek huis
  - Vertrek station
  - Overstap station
  - Aankomst station
9. Heeft u overwogen een herbruikbare beker te nemen?
  - Waar zitten de pijnpunten in je reisproces
  - Wat is ideale grootte beker?
10. Bij iemand die een herbruikbare beker heeft
  - Wat zijn de voor en nadelen?
11. Wat zou u zelf zien als een goed alternatief
  - Statiegeld bekertjes
  - Andere opties

Bedankt voor uw tijd!

#### Tips

Hou het gesprek op gang maar geef mensen ook tijd om na te denken



Deelnemer	Hoeveel keer per week reist u?	Waarom reist u?	Man/vrouw	Leeftijdsgroep	Hoe vaak per week koop je een warme drank op NS stations?	Koffie per reis	Waarom koop je een warme drank op een NS station (en waarom niet ergens anders)?	Turflijstje 2	Hoe en wanneer bepaal je of je een warme drank wilt?	Turflijstje 3	Welke warme drank neem je meestal?	Wat vindt u van uw papieren beker (kijk naar relatie met reis)?	Heeft u overwogen een herbruikbare beker te nemen?	Waar zitten de pijnpunten in je reis op het gebied van een herbruikbare beker	Wat is de ideale grootte voor een beker	Waarom heb je gekozen om een herbruikbare beker te gebruiken	Suggesties
1	12	woon werk	Man	2	4	0.333333333333333	Lekker snel als je onderweg bent	Easy	Als ik tijd blijf te hebben op het station	Time	Zwarte koffie	Prima beker drinkt fijn en niet te heet, drinkt fijn	Ja	Je moet hem schoonmaken anders is hij vies. Te lui om mee te nemen en schoon te maken	-	-	
2	10	woon werk + Privé	Man	1	5	0.5	Ritueel het is een vast schema geworden	Routine	Het is een ritueel	Ritual	Espresso + Cappuccino	Prima beker alleen de kleine espresso bekers van de broodzaak laat hij vallen	Ja	Als je geen tas meehebt moet je die in je handen meenemen. Gemak weggooien en er vanaf zijn is fijn. Als je hem laat staan het hele weekend is hij vies	-	-	Weet van koffie en dat de beker worden schoongemaakt
3	10	woon werk	Man	2	4	0.4	Routine, ligt op de route	Routine	-		Thee, earl grey	Hij is goed her te gebruiken, perfect thee formaat kan er twee keer zoveel in doen als de bekers op zijn werk	Ja	Vergeet hem mee te nemen, zou ideaal zijn om er meerdere te hebben	-	-	Beker abonnement bij NS jaar abonnement. Oplossing moet zo min mogelijk moeite zijn.
4	2	woon werk	Man	2	1	0.5	Gernak en omdat hij het dichtst bij het spoor is. De koffie is lekker en om wakker te worden	Easy, likes taste, wake up	Als hij tijd heeft voor koffie	Time	Cappuccino	Prima papieren beker	-	-	-	-	-
5	10	woon werk	Man	1	2.5	0.25	Als hij vroeg opstaat kan hij niet thuis ontbijten en hij heeft tijd over op rotterdam. Naar Amsterdam heeft hij geen overstaptijd dus bestelt hij geen koffie. Vandaar ook 2-3 keer per week	Easy, no time at home	Tijd, hij heeft tijd over op rotterdam. Naar Amsterdam heeft hij geen overstaptijd dus bestelt hij geen koffie. Vandaar ook 2-3 keer per week	Time	Koffie met melk Late	Prima	Ja	Hij vergeet hem thuis en als hij meer tijd zou nemen bij het opstaan zou hij hem niet vergeten. Hij zou het wel echter doen vanuit milieu redenen	-	-	-
6	10	woon werk	Man	3	0	0	-		-		Cappuccino extra sterk	-	-	-	-	Koffie op het station koste te veel geld dus kreeg toen een beker en hij vond het goed voor het milieu dus bedacht toen te switchen. De koffie blijft wel langer warm in vergelijking tot de papieren bekers	Wist niet van de bekerkorting
7	8	woon werk	Vrouw	2	4	0.5	Koffiezaak zit tussen de metro en de trein. Koffie is lekker en ontspannend en een vervenmomentje	Easy, likes taste, to treat herself	Smorgens		Cappuccino	-	Ja	Vergeet de beker en moet ook nog in de vaatwasser. Er is geen routine	-	-	Julia heeft beste koffie
8	2	woon werk	Man	2	1	0.5	Als hij onderweg is wil hij koffie	Routine	Elke reis wil hij koffie	Routine	Koffie	-	Ja	Hij wilde zonder veel dingen reizen	-	In Amerika gebruikte hij de beker van een koffiezaak en daar liet hij hem vervullen dat werkte goed	International. Koopt een keer per trip koffie. Wist niet van de korting af. Hij raad aan om te adverteren voor de beker.
9	0.25	Prive	Man	-	Heel soms	-	Makkelijk	Easy	-		-	Prima	Ja	Onhandig. Je moet altijd een tas bij je hebben en hij is de hele dag onderweg en dan moet je hem altijd bij je hebben. Hij weet wel dat hij handig is voor het milieu	-	-	-
10	10	Studie	Man	1	3	0.3	-		-		-	-	Ja	Waar moet je hem laten en je moet hem steeds schoonmaken. 15 euro vond hij te veel	-	-	-
11	0.5	Werktrip	Vrouw	3	0.058	0.116	Kwam te vroeg aan. De koffie is lekker en wordt gebruikt om wakker te worden	Likes the taste, wake up	Op het perron wanneer ze zeken weet dat ze de trein gaat halen de koffie koopt ze daar ook	Time	Cappuccino extra sterk	Drinkt prima	Ja	Vindt een herbruikbare beker wel belangrijk maar reist niet vaak genoeg om altijd mee te nemen. Anders zou ze het wel overwegen	-	-	Minder dan 1 keer per week
12	Niet vaak	Prive	Vrouw	3	Altijd als ze reist	-	Is handig om te kopen op een NS station. Bij koud weer warme dranken en bij warm weer warme	Easy, warm up	Als ze aankomt	When he/she arrives	Koffie	Prima	-	Ze reist te weinig	-	-	Net groep 3
13	10	woon werk	Vrouw	2	5	0.5	Om goed wakker te worden	Wake up	-		-	Goede beker	Ja	Geen tijd voor schoonmaken in de ochtend	-	-	Gewoonte geworden om koffie te drinken
14	10	woon werk	Vrouw	2	3	0.3	Om op te warmen en thuis geen tijd. Als het uitkomt als ze voor de trein op tijd is	Warm up, no time at home	Altijd iets warms	Routine	Cappuccino + zwart	-	Ja	Inklapbare beker maar die ging lekken. Glazen was geen optie omdat die kapot kan gaan. Herbruikbaar is goed voor water maar koffie is er niet lekker in.	-	-	Kiosk is fijn op het perron maar heeft niet de beste koffie. De beker van NS moet een goede beker zijn. Beker op bureau zou ook goed zijn zodat ze niet alles mee hoeft te nemen
15	2	woon werk	Vrouw	2	4	2	Koopt op overstapstations. Vind de koffie lekker en bij de AH koopt ze het liever aangezien het goedkoper is maar Kiosk is beter in tijdnood	Likes coffee,	Ze wil altijd een warme drank	Routine	Cappuccino extra sterk	Papieren beker is waardeloos	Ja	Ideaal maar ze vergeet hem	-	-	-
16	4	woon werk	Vrouw	3	0.05	0.0125	Alleen als er een vertraging is. Wachten is koud en ze vervelt zich en dan is koffie warm en heeft ze wat te doen.	Delayed train, warm up, have something to do	Als ik vertraging zie	Delay	Cappuccino	Prima qua gebruik. Waar moet hij weggegooid worden en daarom neemt ze geen koffie	Nee	Ze drinkt te weinig koffie op NS stations. Anders zou ze hem elke keer mee moeten slepen. Had er niet bij stilgestaan om hem op het station te laten vullen ipv thuis. Ze koopt hem niet door gemak en omdat ze het niet gewend is, het is geen gewoonte.	-	-	Koopt meestal koffie op kantoor omdat hij daar beter is. Er moet meer bewustwording komen en een goede beker
17	10	woon werk + Privé	Vrouw	1	0.33	0.033	Lekker opwarmen en de tijd doden. De bereikbaarheid op het station is ook fijn	Warm up, have something to do	Als ze genoeg tijd heeft voor iets te drinken	Time	Thee	Prima, niks veranderen	Nee	Vieze beker wil ze niet in haar tas meenemen. Thuis schoonmaken is extra moeite	-	-	Alleen warme dranken in de winter. Miss willen luxe koffiedrinkers eerder zon beker -> starbucks
18	8	woon werk	Man	2	0.375	0.046875	Langere reis die koud is en om wakker te worden.	Warm up, wake up	Lange reis	Long journey	Thee	Handig goed. Gooit meestal in de trein weg behalve als de prullenbak daar vol is dan op aankomststation	Nee	Niet vergeten mee te nemen	Een grote beker voor thee	-	Combi thee croissantje. Inleveren beker op eindstation klinkt als een leuk plan bij een inzamelpunt en misschien op werk een aparte bak.
19	0.5	woon werk + Privé	Vrouw	2	0.5	1	Lekker warm onderweg en gemak op de route	Warm up, easy	Ze beslist thuis en vertrekt soms eerder zodat ze nog lekker een kopje koffie kan halen	At home	Cappuccino + zwart	Prima, beter dan plastic bekertje	Nee	Gedrag, ze vind het niet fijn om de hele dag een vieze beker in je tas te hebben	-	-	Inleversysteem interessant eindvan de treinrit ben je koffie weer kwijt
		0.789473684210526				0.428924019607843							15/18 denkt aan beker	n =17		2/18	



Table 1

Deelnemer	Hoeveel keer per week reist u?	Waarom reist u?	Man/vrouw	Leeftijdsgroep	Hoevaak per week koop je een warme drank op NS stations?	Koffie per reis	Waarom koop je een warme drank op een NS station (en waarom niet ergens anders)?	Turflijstje 2	Hoe en wanneer bepaal je of je een warme drank wilt?	Turflijstje 3	Welke warme drank neem je meestal?	Wat vindt u van uw papieren beker (kijk naar relatie met reis)?	Heeft u overwogen een herbruikbare beker te nemen?	Waar zitten de pijnpunten in je reis op het gebied van een herbruikbare beker	Wat is de ideale grootte voor een beker	Waarom heb je gekozen om een herbruikbare beker te gebruiken	Suggesties
1	0.12	woon werk	Man	3	0.06	0.5	Makkelijk	Easy	Voor vertrek altijd	At home	Koffie	Goed	Nee	Er is niet echt een probleem maar hij reist weinig en daarom heeft het voor hem weinig zin om hem altijd mee te nemen			
2	4	woon werk	Man	1	1	0.25	Gewenning koffie maakt hem wakker en hij vindt het lekker	Routine, Wakes up, likes taste	Thuis als hij geen koffie thuis drinkt	At home	Zwart	Prima	Ja	Vergeet de beker mee te nemen			Hij moet steeds inloggen op de ah to go app voor sparen -> eventueel iets aan koppelen
3	3	woon werk	Man	3	0.5	0.16666666666667	Smaak en kwaliteit vindt hij belangrij	Likes taste	Hij vindt de koffie te duur maar hij beslist vooraf of hij koffie wilt. Hij is dan op tijd op het station omdat hij dan koffie kan kopen	At home	-	Beter dan plastic	Nee	Lastig want hij is lomp en groot. Duurt te lang om te vullen			Wist van de korting. En wilde er zelf weinig moeite in steken. Was wel voor meer stimuleren. Boomer
4	6	woon werk	Vrouw	2	3	0.5	Omdat het lekker is en om wakker te worden. Makkelijk want hij zit op het perron en je moet toch wachten	Likes taste, wake up, easy	Het is een routine dus altijd. Hangt wel af van overstap tijd want meestal koopt ze als ze aankomt maar nu had ze wat meer tijd op haar overstapstation dus kocht ze koffie daar	Routine	Cappuccino	Leuke beker				Kan meer in en je krijgt korting. Er kan ook meer in dan in de stationsbekers. Ze had alleen vandaag geen zin om hem te pakken	
5	10	woon werk	Man	2	5	0.5	Moet toch op het station zijn. Hij heeft het nodig om wakker te worden.	Easy, wake up								Bekertjes zijn niet duurzaam. Er is weinig mis met de beker al moet hij er niet vergeten aan te denken. Hij vindt de kortingsregeling een goed initiatief	Raad aan om meer bewustzijn te creëren. Hij had zijn beker in een kerstpakket gekregen.
6	10	woon werk	Man	2	5	0.5	het is makkelijk en hij vindt de koffie lekker	Easy, likes taste	In de ochtend. Maar interviewer dekt dat het een routine is aangezien hij het elke dag drinkt	In the morning	Cappuccino + espresso	Okay	Ja	Hij had de tijd nog niet gehad er een te kopen. Hij vond het wel duurzamer			International
7	8	woon werk	Vrouw	3	4	0.5	Lekker en dan kan ze hem in de trein opdrinken	Likes taste								Korting die je krijgt is fijn. Ze wilde een bijdrage leveren aan het milieu. Ze heeft geen problemen met haar beker.	Ze heeft een hema beker.
8	0.5	woon werk	Vrouw	3	0.5	1	Als ze reist koopt ze altijd koffie. Ze heeft 's ochtends trek in koffie. Ze koopt bij het station omdat het makkelijk is.	Easy, routine	-		Koffie verkeerd		Nee	Ze had nooit over de mogelijkheid nagedacht			Ze wist niet van de korting
9	8	woon werk	Man	3	1	0.125	Als hij een lange reis voor de boeg heeft. Hij neemt het niet van huis mee omdat hij op de fiets is en verwacht dat koffie meenemen moeilijk is en je stopt niet even ergens	Easy	Routine	Routine	Cappuccino	Geen mening	Nee	Vergeeten mee te nemen. Hij drinkt te variabel om steeds een beker mee te nemen. Want anders heb je de hele week een vieze beker in je tas			Hij reist een keer per week lang. Kwaliteit van de koffie is goed.
10	6	woon werk	Man	2	1	0.16666666666667	Praktisch en is lekker	Easy, likes taste	Hij koopt een keer per week koffie omdat het anders te duur wordt. Hij baseert die ene keer op of hij er zin in heeft	When he wants it	Zwart en soms cappuccino bij starbucks als hij zichzelf wilt verwennen	Prima beter dan een plastic beker	Ja	Niet altijd bij zich en hij wilt ze niet vies meenemen			Wist niet van korting. Weet wel dat ze bij Starbucks leegspoelen.
11	0.25	Privé	Vrouw	3	0.125	0.5	-		Als je tijd hebt. Als ze er te vroeg is of op iemand met wachten	Time	-		Nee				Ze wist niet van de plastic in de bekens. Ze is wel tegen de bekens omdat ze vervuilen en ze miste voorzieningen voor scheiden.
12	8	woon werk	Vrouw	2	1.5	0.1875	Praktisch en lekker. Als ze tijd over heeft	Easy, likes taste	Onderweg op de fiets/bus	When he is going to the station	-	Prima, papier is beter dan plastic	Ja	Volle tas als hij erin zit. Bang voor lekken			
13	10	woon werk	Man	2	0	-	Makkelijkste	Easy	Wanneer hij zijn trein mist. Als het koud is	Delayed, cold	Zwart	Papier is beter dan plastic	Ja	Kiosk heeft geen bekens. Starbucks wel maar hij vindt Starbucks niks			International. Voelt slecht om de beker weg te gooien
14	10	woon werk	Vrouw	2	0	0						Papier smaakt minder dan beker en lekt				Zodat ze van huis koffie mee kan nemen. voor het milieu	
15	1	Studie	Man	2	0.04	0.04	Behoeftte aan iets warm. Als hij verkouden is	Likes something warm	Pas als hij op het station is. Behoeftte aan iets warm. Als hij verkouden is.	At the station, cold	Zwart	Wel prima, wel vol	Ja	Thermoskan zou kunnen maar dat is te rommelig en hij vergeet het			
16	2.5	woon werk	Man	2	0.33	0.132	Vertraging en als hij de tijd heeft	If he has the time	Vertraging en als hij de tijd heeft	Delayed, Time	Koffie	Prima	Ja	Hij drinkt te weinig koffie om altijd een beker mee te nemen			Statiegeld kan
17	8	woon werk	Man	2	8	1	Lekker en veel korting bij NS	Likes taste, sale at NS	Als hij behoefte heeft aan koffie	When he wants it	Zwart	Prima	Nee	Geen idee waarom niet			NS medewerker. Ik zie mensen ze wel gebruiken. Hij hergebruikt zijn bekertje wel voor water
18	0.25	Privé	Vrouw	3	0.25	1	Spaart tijd	Easy	Bedenkt het al thuis	At home	Latte machiato	Goed	Nee	Ze heeft wel een dopper maar die is niet bruikbaar voor warme dranken voor water wel.			
19	6	woon werk	Vrouw	2	1	0.16666666666667	Geen tijd thuis als ze haast heeft	Easy			Cappuccino	Prima beter dan plastic	Ja	Ze heeft niet de gewoonte om het mee te nemen. Ze heeft wel een thermosbeker maar vergeet die dus mee te nemen.			International
		0.842105263157895				0.401916666666667							12/19 denken eraan	n=14		4/19	



# Appendix 5: Observation of space in the bags of customers

## Introduction

The goal of this research is to find out if customer of NS have enough space in their bags to bring a reusable cup. This research originates from the answers of the previous research where customers said they did not have enough space to take a cup with them. Another goal of this research was to look into how people behaved on a station while they were walking around with coffee. The research questions of this part are:

- Is there space for a reusable cup in bag bag of a warm beverage drinker on stations?
- How do warm beverage drinkers behave on stations?

## Method

This research was conducted at Den Haag central station. This station is one of the biggest stations in the Netherlands and a lot of warm beverages are sold here. Also a lot of people use it as a station to depart, change or arrive, which makes a representable stations. The research was conducted during rush hour (8:15-9:30), because NS data shows that the rush hour travellers are responsible for a large part of the coffee consumption and have thus also a large effect on the amount of coffee cups that are used See appendix FIX ME.

The second reason is that a reusable cup would also be more beneficial for them as they buy coffee more consistent.

The research was an observation of how people behaved so the researcher observed from a spot where he could almost see every train track.

During the observation there was looked at what kind of bag people that were carrying a cup with a warm beverage and there was estimated if there was enough space in that bag. Enough space was defined as enough space to store a small reusable cup with the dimensions of 84\*84\*133 mm (W\*D\*H) (rCup, 2020).



Next to this other interesting observations about the behaviour of customers were also documented.

## Results

In total 132 people that were carrying coffee were observed. In figure FIX ME the results can be found which bags were seen. From these bags almost all of the bag packs, shoulder bags and trolleys had potentially space for a cup. These three groups accounted for 77% of the people observed. The handbags and the other kind of bags did not have much space left and the same applies for people who did not have a bag. These three groups accounted for 23% of the people observed.

There was also observed how people with coffee behaved on stations. During the research the following observations were made:

- Everybody walks with their warm beverage and thus has one full hand. This means that when customers want to for example check in they placed their warm beverage on a bin and got their ov card from their wallet. Walking with warm beverage also means that people also have to watch out that they don't walk into someone else and spill their warm beverage.
- Sometimes there was no one with a warm beverage. While at other times there were a lot of people

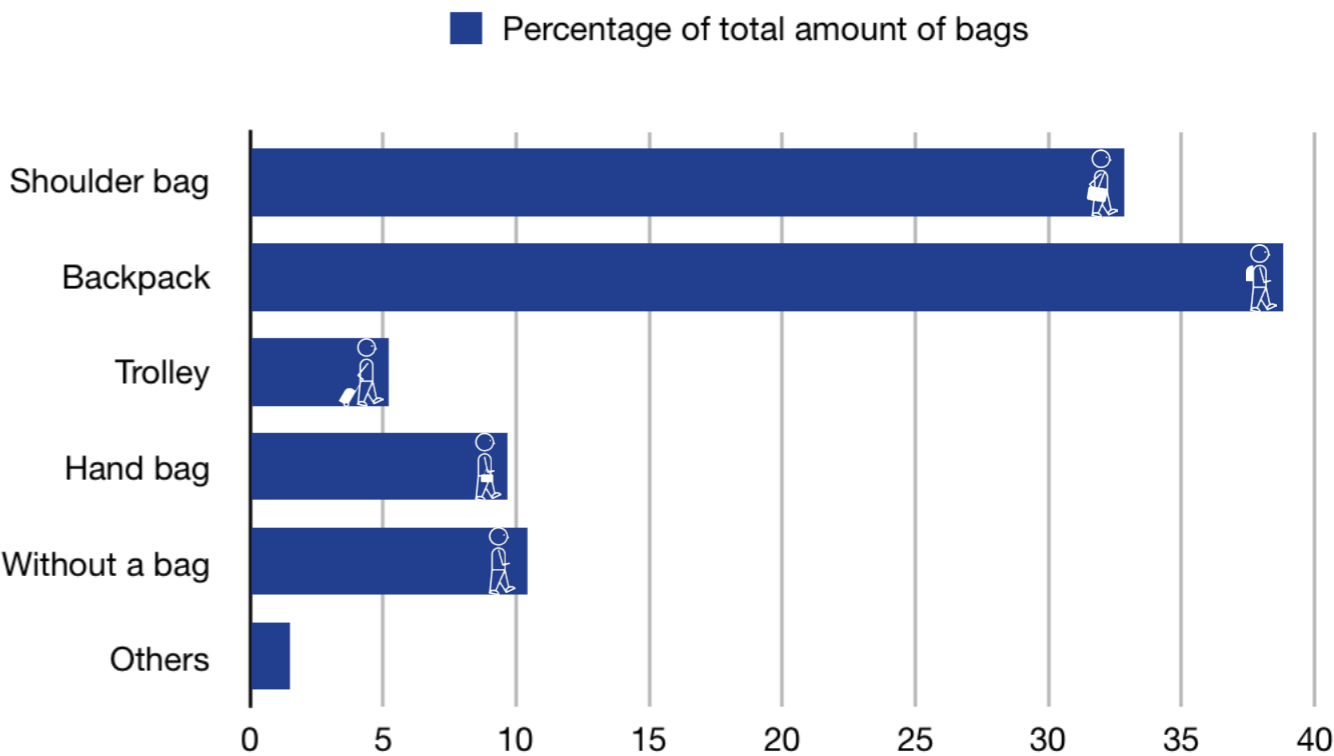


Figure 6: Kinds of bags at Den Haag Centraal

## Appendix 6: Own experience using a reusable cup

with a warm beverage. This was very clearly linked to when train would arrive or depart. This means that sometimes the Kiosk and the Julia's I looked at were very busy and sometimes they were completely empty.

### Conclusion

Three conclusions can be drawn from this research:

- The majority of people have enough space to bring a cup, which is 84\*84\*133 mm (W\*D\*H).
- People at this stations had their hands full with the cup. This hindered some people during their travel. This means that lowering this hindrance during the design phase can improve the user experience.
- The shops are not always that busy but the design needs to work at their peak moments.

### Discussion

A downside is that not a lot of people change at this station. This means that it does not represent the behaviour of people that change trains. However all of these travellers still travel and I don't expect major differences with other stations.

To understand how people experienced travelling with a reusable mug I also decided to also do it myself. I heard from others that they stopped using the cup after a few weeks. Within NS there was already some research done about which cups worked well. They already did a pilot with one cup at their offices, from which the results can be seen in chapter FIX ME. This one had some downsides but it looked like a good contender for a travel mug. The biggest selling point was that the cup is waterproof during transport. The only thing that I changed from the cup that was tested was that I choose a 8 oz version compared to the bigger 12 oz from the NS pilot. The reason for this was that from the pilot quite a few people saw the seize as a downside. I wanted to find out if I was able to use a smaller mug without running into problems. I planned to take my cup with me for on average four days per week for two months.

After two months I still succeeded to bring my cup with me and I did not have to use any paper cups. I still felt a bit anxious to put a cup of hot coffee or tea inside my bag next to my laptop. But it worked out. It was nice to know that you could just put your cup with the drink in your bag and you did not have to worry about it anymore. When you wanted to drink something you could take it out and you still had a warm beverage. Cleaning the cup was less nice as I can not use a dishwasher to do this. I saw myself sometimes cleaning the cup at work and using way more water than I would have cleaned it at home. The reason for this is that I left the tap running while cleaning it. At home I would clean it together with all my other dishes and thus use less water. I tried to wash it as often as I could at home but when I wanted to switch from coffee to tea I had to clean the cup at home.



Figure 7: using my own reusable cup.

# Appendix 7: LCA assumptions

## Assumptions

The following assumptions are taken to answer these questions:

1. To be able to get an idea how the user owned cup and the deposit cup system compared to the paper cup an estimation was made for the environmental impact of the paper cup. The LCA of Cupclub and CIRAIG both found a total emission around 70 grams of CO<sub>2</sub>, the Keepcup LCA found 37 grams and the Huhtamaki LCA found 20 grams of CO<sub>2</sub>. All these numbers are formulated into a range, low, middle and high, which can be used to give an indication of how the paper cup compares to the user owned cup and the deposit cup system. This means that no final conclusions can be drawn from these parts of the figures.

2. The end of life of the cups is neglected in the scenario analysis because the Keepcup, Cup club and CIRAIG LCA showed that the EOL of the cups had little impact on the overall environmental impact. The end of life of the paper cups was taken into account, because CIRAIG showed that the end of life of the paper cup had an significant impact.

3. There is no specific data for human health, ecotoxicity and resources to base the cradle to gate environmental impact on for the cups. It was still kept in this analysis to find out if there were large noticeable differences in the use phase. The results of this can be found in appendix FIX ME.

4. As the Ecoinvent database only has generic soap, this was used to do the analysis. This means that some results can be very different when a different kind of soap is used.

5. It was assumed that the cradle to gate environmental impact of the deposit cup is the same as a Keepcup without its band, box and plug as a deposit system cup would not have these.

6. The impact of the transport was included into the analysis, because all the Keepcup, Ciraig and Cup Club showed that the transport had a small impact. To be able to implement a solution into the system of NS transport could be an important factor and should thus be taken into account.

7. It was assumed that the deposit cup would be produced in the same factory as a Keepcup to get an idea of the distance the cup would have to travel to NS.

8. The station where the deposit cup is bought at is Utrecht. The reason why there is chosen for Utrecht is that most warm beverages of NS are sold here.

-The three different stations the deposit cup would be delivered to were chosen based on:

-Zoetermeer: the average travel distance of a train passenger is 47 km (CBS, 2013).

-Groningen: a faraway station that is also large.

-Woerden: this is a very nearby station.

9. The deposit cup has a life span of 40 to 120 usages and than they need to be replaced. This was based on a conversation with a cup deposit expert.

10. The washing facilities would be located in places where there are already distribution points of NS. This was done because it was assumed that these were placed on very central points and would thus be ideal as a washing facility.

## Appendix 8: APPENDIX: LCA per cup

[illegible]

Figure 8: LCA paper cup

Figure 9: LCA user owned cup.

												Process Data	ReCiPe human health DALY	ReCiPe ecotoxicity H species/year	ReCiPe resources USD2013	Carbon footprint kg CO2 equiv.	CED (Total) MJ	Results	ReCiPe human health DALY	ReCiPe ecotoxicity H species/year	ReCiPe resources USD2013	Carbon footprint kg CO2 equiv.	CED (Total) MJ																																																																																																																																																																																																																																																																																																																																																																																																																																																							
Cradle to gate plastic cup	Cradle to gate plastic cup	Action	Amount	Unit	Source	how many times	Source	Weight ratio pSource	weight ratio mode of transport kg/m3	Conversion rate to volume	Source											0.33	9.6																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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		Materials bin	0.2	kg	Estimation based on bin sizes							kg	Electronic component, passive, unspecified (GLO) market for   Cut-off, S				58.6264043					11.7252809																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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Washing cup	Dishwashing machine	Water	0.3	l	Keepcup, 2018						kg	Tap water (Europe without Switzerland)	0.00000	0.00000	0.00002	0.00035063	0.0072	9.236E-10	4.54583E-12	5.59678E-06	0.00010519	0.00217237																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		Energy	0.00084	kWh	Keepcup, 2018						MJ	Idemat2020 Electricity Low Voltage, 2.42409E-07	2.42409E-07	6.96835E-10	0.01032149	0.18292427	2.9243802	7.71444E-10	2.21761E-12	3.28471E-05	0.00058214	0.00930655																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		Soap	0.0008	kg	CIRAIG, 2014							0.00	0.00	0.10	4.55	52.85	6.51864E-09	4.19523E-11	7.85767E-05	0.00064301	0.04276878																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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## Appendix 9: LCA bins

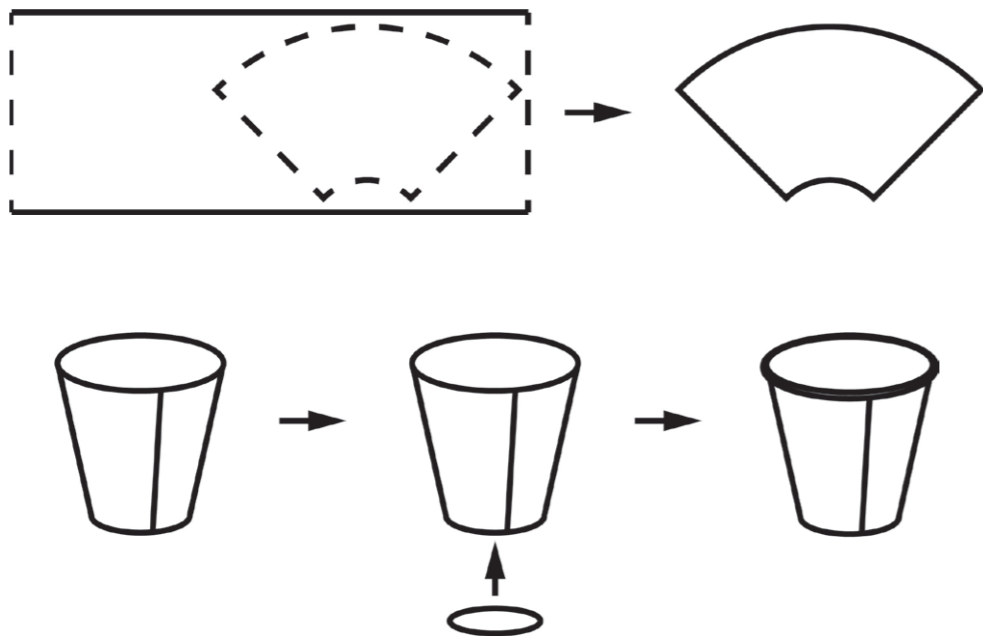
Just a bin									
						lifetime	per year	per cup	Amount of times the is cup is used
m2	Idemat2020 Powder coating steel	2.16940871	3.456	m2		7.49747649	0.74974765	2.14214E-06	
m	Welding, arc, steel {GLO} market for   Cut-off, S	0.17986377	7.2	m		1.29501912	0.12950191	3.70005E-07	
kg	Idemat2020 Rolling steel	0.40683955	15	kg		6.10259328	0.61025933	1.7436E-06	
kg	Idemat2020 Steel beams, pipes, sheet (from market mix 44% recycled)	1.79090716	100	kg		179.090716	17.9090716	5.11688E-05	
kg	Electronic component, passive, unspecified {GLO} market for   Cut-off, S	58.6264043	0.2	kg		11.7252809	1.17252809	3.35008E-06	
MJ	Idemat2020 Electricity Low Voltage, domestic use Netherlands	0.18292427	0.00864	MJ		0.01580466	0.00158047	4.51562E-09	
<b>Total</b>						<b>205.72689</b>	<b>20.572689</b>	<b>5.87791E-05</b>	<b>0.029389556</b>
Self scan									
		CO2				lifetime	per year	per cup	Amount of times the is cup is used
m2	Idemat2020 Powder coating steel	2.16940871	3.456	m2		7.49747649	0.74974765	2.14214E-06	
m	Welding, arc, steel {GLO} market for   Cut-off, S	0.17986377	7.2	m		1.29501912	0.12950191	3.70005E-07	
kg	Idemat2020 Rolling steel	0.40683955	15	kg		6.10259328	0.61025933	1.7436E-06	
kg	Idemat2020 Steel beams, pipes, sheet (from market mix 44% recycled)	1.79090716	100	kg		179.090716	17.9090716	5.11688E-05	
kg	Electronic component, passive, unspecified {GLO} market for   Cut-off, S	58.6264043	3	kg		175.879213	17.5879213	5.02512E-05	
MJ	Idemat2020 Electricity Low Voltage, domestic use Netherlands	0.18292427	47.304	MJ	https://m.made-in-china.cc	86.5304967	8.65304967	2.4723E-05	
<b>Total</b>						<b>456.395514</b>	<b>45.6395514</b>	<b>0.000130399</b>	<b>0.065199359</b>
tomra						lifetime	per year	per cup	Amount of times the is cup is used
kg	Steel, low-alloyed, hot rolled {GLO} market for   Cut-off, S	1.92164362	520	m2		999.254683	99.9254683	0.000285501	
kg	Polystyrene, general purpose {GLO} market for   Cut-off, S	3.76275155	65	m		244.578851	24.4578851	6.98797E-05	
kg	Electronic component, passive, unspecified {GLO} market for   Cut-off, S	58.6264043	32	kg		1876.04494	187.604494	0.000536013	
kg	Synthetic rubber {GLO} market for   Cut-off, S	2.7297056	16.5	kg		45.0401425	4.50401425	1.28686E-05	
kg	Flat glass, coated {GLO} market for   Cut-off, S	1.19572681	16.5	kg		19.7294924	1.97294924	5.637E-06	
kWh	nordic	0.0781	525	kWh		410.025	41.0025	0.00011715	
<b>Total</b>						<b>3594.67311</b>	<b>359.467311</b>	<b>0.001027049</b>	<b>0.513524729</b>
	amount of cups	350000							
	years of use	10							
	times used	500							

Figure 11: LCA collection bins

# Appendix 10: Production

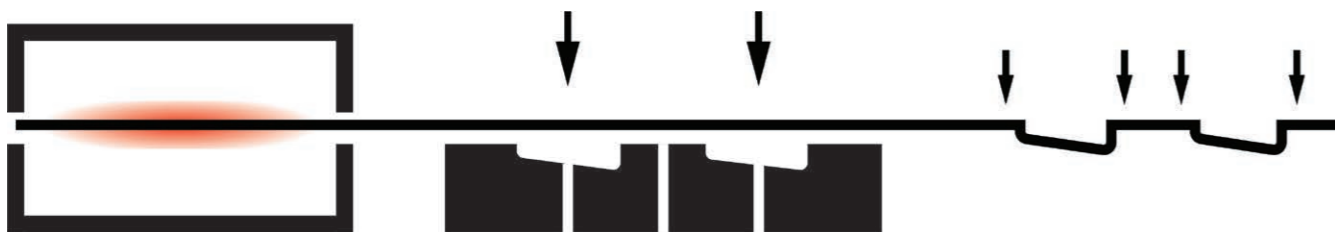
## Production of a paper cup

To make a paper cup several steps have to be taken. First the outer layer of the cup is printed on a paper sheet covered with PE. This sheet is cut to the size of the outside of a paper cup. These pieces of paper are inserted into a machine and folded into their round shape. Where they have their round shape they are heat sealed to make them leak proof (Huhtamaki, 2019). After this the bottom of the cup is added and this part is also heath sealed in place. At last the rims are folded so it is more comfortable to drink out of the cup (KVA Paper cup machine, 2013).



## Production of plastic lids

The production of a plastic lid for NS starts with heating a sheet of Polystyrene. This sheet is thermoformed into the right shape. After this the drinking hole is cut out of the lid. In the last step the lid is cut out of the plastic sheet (Tina Wu, 2014).



## Options for one time use cups

The PE lined paper cups that NS is using are not the only possibility for one time use cups. There are multiple other solutions that can improve the environmental impact of the paper cups. A short summary of the most common ones can be found in table FIX ME.

	Paper cup lined with PE	Paper cup lined with Plant based PE	PLA compostable cup	Recycled PET	Cookie Cup
CO2 emission production	10,4 gram	10,2 gram	13,1 gram	Unknown	Unknown
EOL	Burn/ landfill/ down cycling	Burn/ landfill/ down cycling	Compostable	Burn/ landfill/ down cycling	Eaten

## Paper cup lined with PE

The Paper cup lined with PE is the standard cup. There are cups with other plastics for the linings but they all have the same principle. Only the paper used in this cup is recyclable, but this will mostly be down cycled and using it in a new paper cup would be close to impossible due to the high standards needed for food save products (Durrell, 2019).

## Paper cup lined with plant based PE

The paper cup lined with plant based PE is the first step into lowering the environmental impact of a warm beverage cup. The production CO2 emissions are a bit lower according to (Huhtamaki, 2019). But most importantly the PE used in this cup is renewable. Only the paper used in this cup is recyclable, but this will mostly be down cycled and using it in a new paper cup would be close to impossible due to the high standards needed for food save products (Durrell, 2019).

## PLA lined compostable cup

Another solution to lower the environmental impact is to use PLA which is a compostable plastic. The production CO2 emissions are a bit higher than the PE cups because the lining needs to be a bit thicker. The first pro for the PLA cups is that the lining is made from corn starch, a renewable source. The second pro is that this cup scores better in the end-of-life of the cup. There is little research done into composting PLA cups. The closest research that is done is about PLA flower pots (Zee, 2020). This research shows that PLA is visibly gone within two recycle cycles of 11 days if it thrown in an industrial composter. The lining of paper cups is thinner than a flower pot so it can be expected to go a bit faster than the pots. However this research is based on a visual inspection and they say that micro plastics could still be there. Another problem that could arise according to the research with PLA lined cups is that they could be filtered out during the filtering process of the compost.



# Appendix 11: Appendix NS waste disposal

The last problem is that when the cup is composted it becomes hard to recycle the paper in the cup. To combat this a complete PLA cup could be made.

## Recycled PET cup

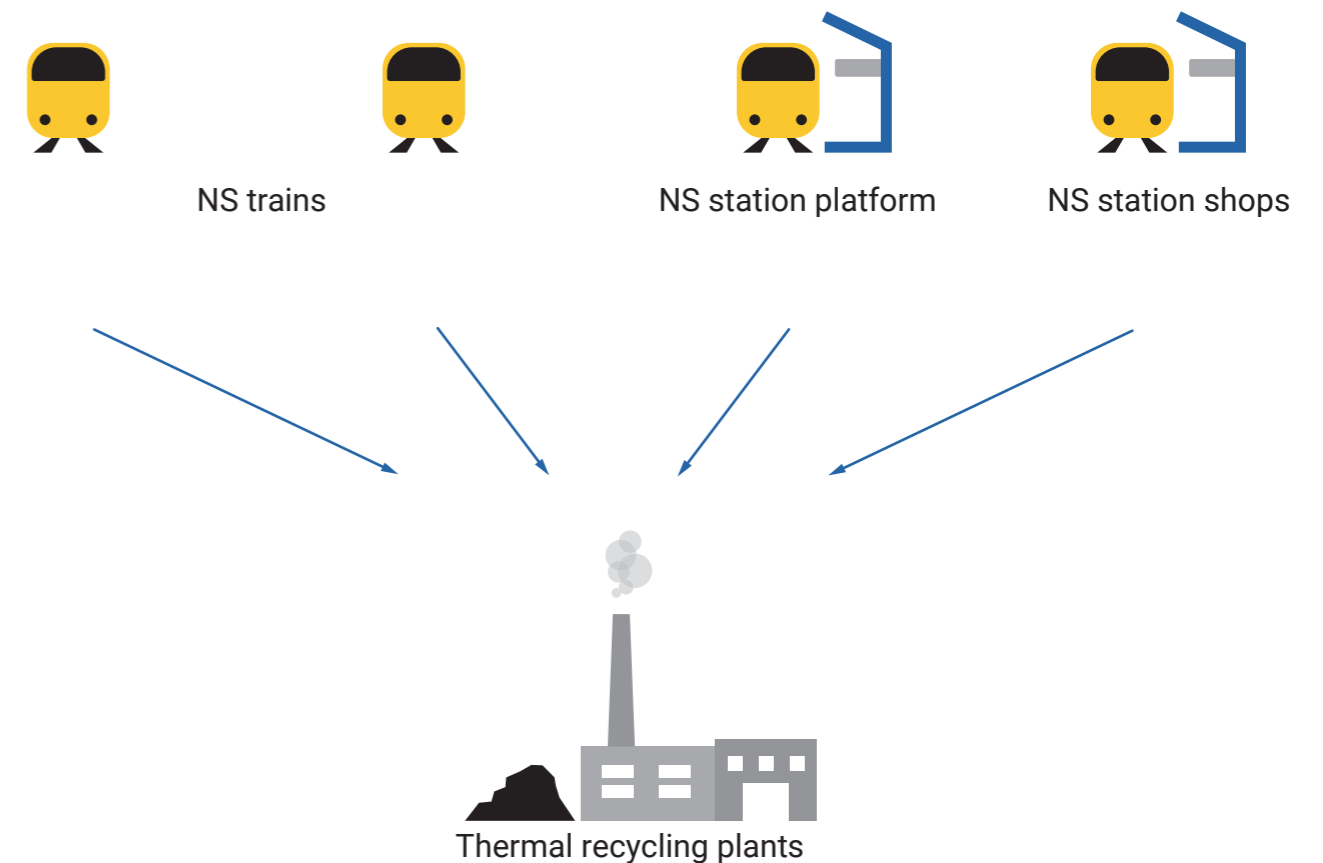
The third solution is to create the whole cup out of a recycled material. PET is a good contender for this because there are many ways to recycle PET into a food safe plastic. There are other types of plastic, which could be recycled, but PET is the only plastic that is approved for hot beverages by the EFSA (EFSA, 2020). If NS would succeed in creating a closed loop with PET cups they could in theory implement a circular system. However in practice NS found out that this is very hard to achieve.

## Cupfee cup

Cupffee is a coffee cup that is edible. This is a new concept in the disposable cup industry. At the moment there is no LCA of this product so it is hard to get an idea of what the emission of this product is. This product tries to mostly tackle the problem of the waste created by paper cups. The price is also significantly higher than the other alternatives (Biodisposables, 2020).

## NS waste disposal infrastructure

At the moment NS picks up the waste from the bins on their stations, in the trains and collects the waste of cleaner. This is picked up by the company that collects waste in the area of the station and brought to their facilities. Most of this waste is thermally recycled at this moment. Figure FIX ME gives an overview on how much waste is generated in the trains, transfer platform and the shops. This figure shows that most of coffee cups end up in the bins of the trains. This results in a problem for NS because one or two cups can fill up one bin in the train. The bins are designed for smaller waste and not for the big cups. The full bins result in dirtier trains as people leave their waste more often outside of the bin and in the train. This lowers the customers experience during a train ride and it costs NS more money to clean the train.



NS research into lowering the impact of paper cups

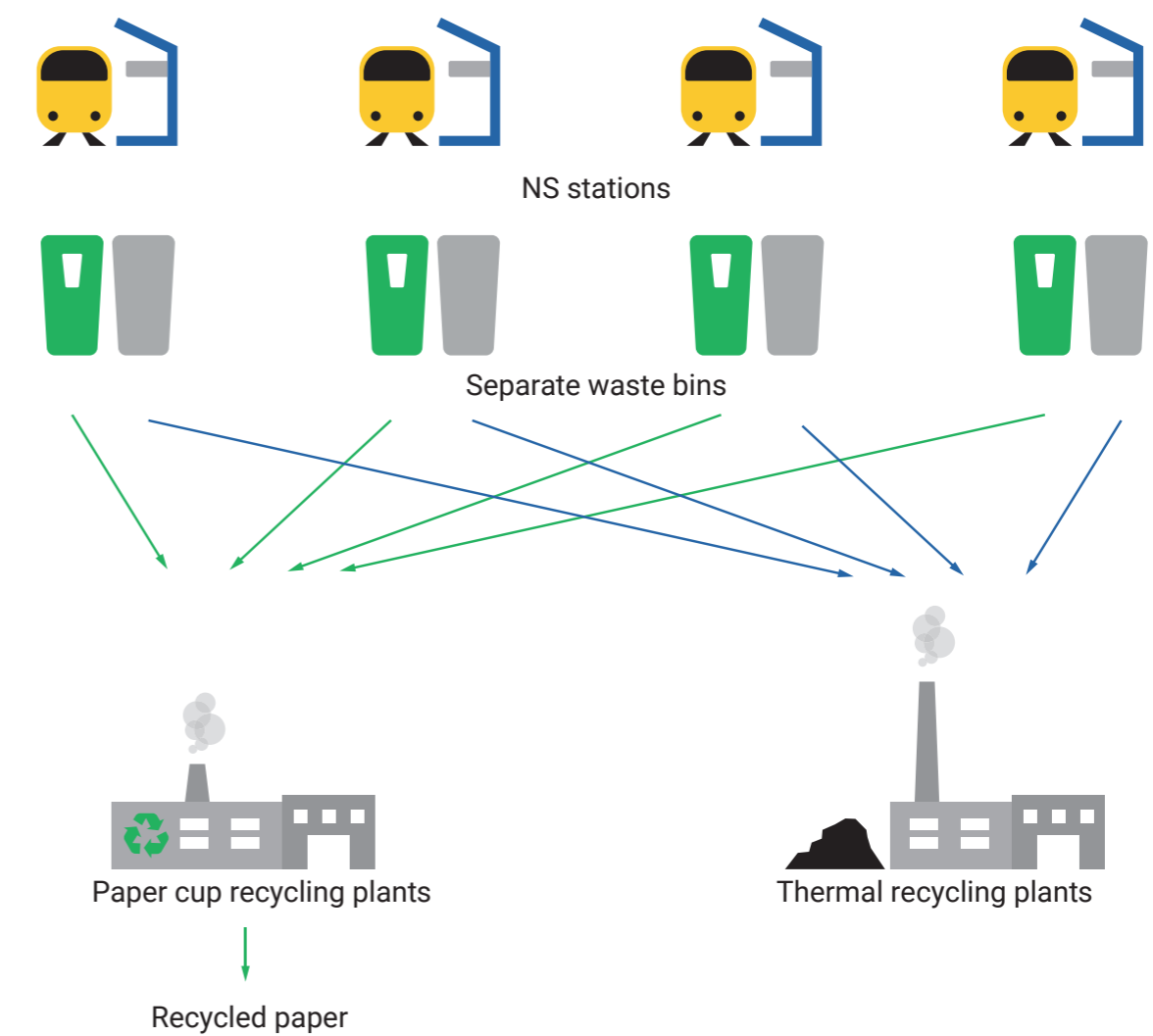
Before this master thesis was started NS already looked into how to lower the environmental impact. They looked at three solution: sell a reusable cup, filter the cups out the trash at the station and filter the cups out of the waste stream in a recycling facility.  
In 2016 NS did a two pilots where they tested Frank Green reusable cups at Kiosks. The idea was that by providing te option of a reusable cup people the barriers would be lower to use them at stations.

The first test was to determine how did customers of NS experience the cup and how they could increase the succes of the cup. During this research 20 participants used the cup for two months and at the end an online questionnaire was filled in. They stress at the end of the research that due to the low amount of participants that this is research is done to give an indication and not a final result.  
Looking at this research multiple results are also interesting for this master thesis.  
The first result that is interesting is why people would use a reusable cup. The main reasons are that people like to do something for the environment and they like the reusable cup more than a paper cup.  
The second result that is interesting is what would increase the chance that people would buy a reusable cup. The first driver is that the participant like to have a price reduction, they propose an average of 0,30 euros. The second main driver is that they can use the cups at multiple stores at the station and the baristas react positively on the cup.  
The third result that is interesting is what the positive and negative points are from the Frank green cup. A few are specific for this cup, but the main ones apply to most reusable cups. The result form this can be found in table FIX ME.

Possitive	Negative
The cup is good for the environment	You have to remember to bring the cup with you
The warm beverage stays warm for longer	Takes space in my bag
It is less hot to hold than a paper cup	

A second pilot was also conducted in 2016. During the second pilot they sold the cups at 9 Kiosks and 5 SHK's. When the customers would buy a warm beverage at one of the stores of NS they would get a 25 cent discount on their warm beverage.  
The main results that were found during this pilot were that people did like the cups that NS sold the cups. They did also run into a few problems. The one that is useful for this maters thesis is that they did not have a clear solution what they would do with broken cups.

The second initiative NS did to lower the environmental impact of paper cups is to place a separate bin for the paper cups at the stations, see figure FIX ME. This is already done in England and it looks like it is a succes FIX ME. The challenge for implementing this is that the purity collected cups need to be 95%. This means that in the bin there can be no lids of the cups and other waste like wooden mixing sticks.  
To find out if the separate bin would work at railway stations of NS they did multiple test at railway stations Utrecht centraal and Zwolle. The main goal of their pilot was to find out how they could influence behaviour of customers enough to get to the 95% purity.  
From these tests it became clear that at this moment they did not find a set up that influenced the behaviour of the customers enough to achieve the needed purity of paper cups. They think that there are multiple reasons for this. The first reason is that it is not common knowledge to the public how they should throw away their paper cup. The second reason is that people are at stations to mainly travel. This means that the motivation to separate waste is very low and that they will do it when it is very easy.  
Another finding from their research is that for their application only icons and a few words were enough. Their explanation is that people do not want to read all of the text because they are in a hurry.

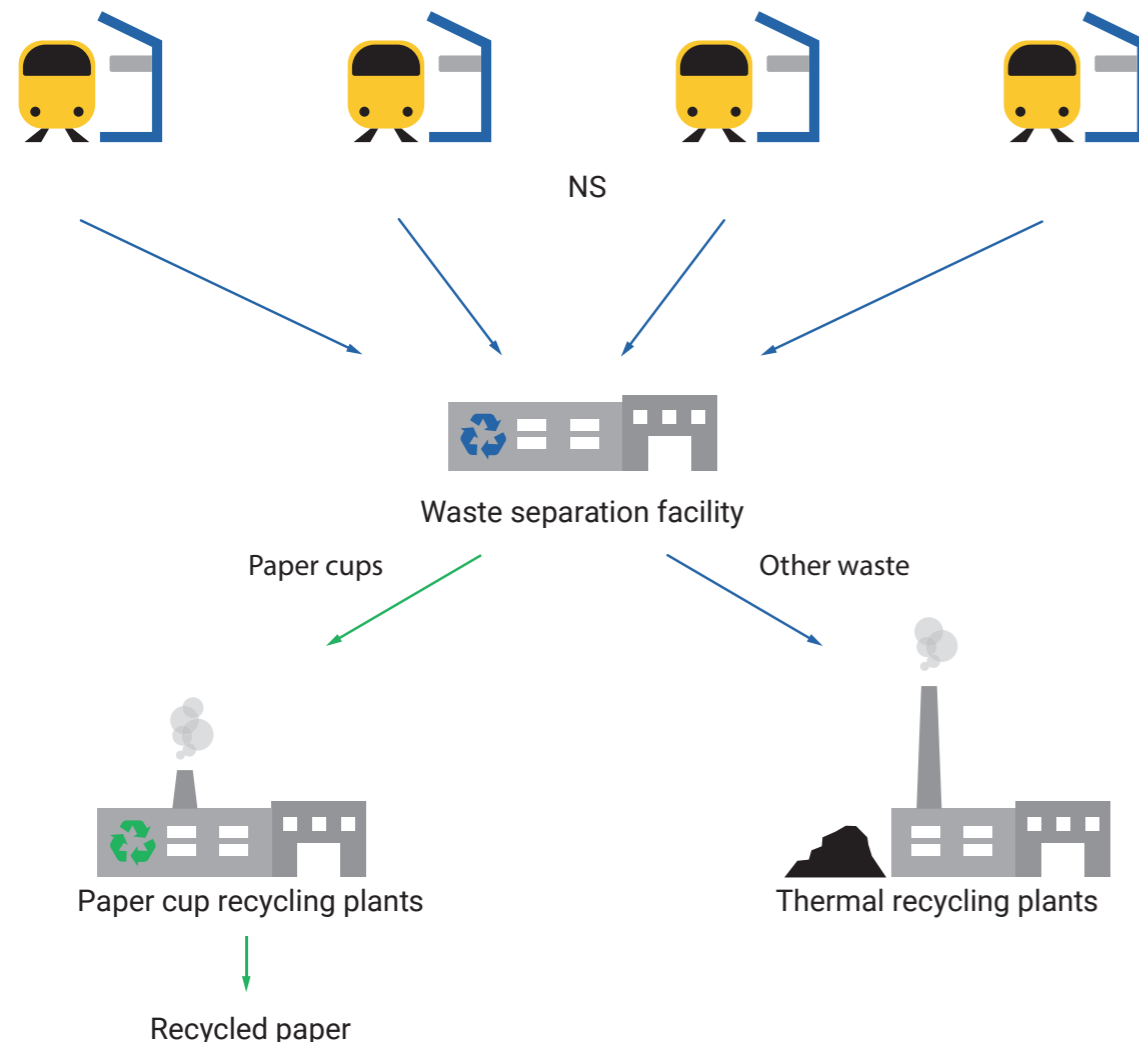


## Appendix 12: Contextmapping: assumptions

The third initiative within NS is that they try to filter the paper cups out of their waste stream. They do this by sending the waste from the stations, trains and shops to a recycling plant and there the cups are filtered out of the stream, see figure FIX ME. This facility can filter out organic matter, paper and in theory also paper cups. After being filtered out the paper of the paper cups is recycled.

At the moment the quality of the paper resulting from this process is fairly low. This is due the fact that the paper is quite contaminated from being in the other waste streams. The quality of the paper when the paper cups are collected in their own bins is for this reason also of a higher quality.

This means that it is not worth much and companies that use recycled paper do not pay much for this paper. This is a downside for NS but also for the companies who filter out the paper cups. For them it is a lot more profitable to use their facilities to recycle other more high quality paper.



Gebaseerd op de interviews die ik eerder gedaan heb en de informatie van NS verwacht ik dat:

- Mensen koffie drinken op stations omdat ze
  - Daar even de tijd hebben wat te drinken
  - Zin hebben om koffie te drinken in de ochtend
  - Het toch op de route is naar werk
  - Ze zichzelf willen verwennen
- Mensen ervaren warme dranken drinken als
  - Een moment om wakker te worden
  - Genieten van de smaak
    - Uit onderzoek blijkt dat mensen de smaak van koffie deels lekker vinden omdat ze er wakker van worden
  - Iets warm te drinken op een koud perron
- Mensen de volgende emoties hebben tijdens het kopen van warme dranken
  - Vaste reiziger
    - Ontspannen -> hij weet hoeveel tijd hij heeft en weet precies wat hij wilt en hoelang alles duurt
    - Voelt zich thuis -> het is zijn vertrouwde plek en hij kent de mensen die er werken
    - Beloond -> Hij krijgt de warme drank die hij kent en waar hij van houdt
  - Niet vaste reiziger (laat)
    - Stress -> hij weet niet of alles op tijd klaar is voor het geval hij weg wilt
    - Niet op zijn plek -> het is een vreemde winkel en je moet alles ook nog zien te vinden
    - Beloond -> Hij krijgt de warme drank
  - Niet vaste reiziger (op tijd)
    - Welkom -> de winkelbediende heet de klant welkom wanneer die wat wilt bestellen
    - Ontspannen -> hij heeft alle tijd en kan rustig uitzoeken wat hij wil
    - Beloond -> Hij krijgt de warme drank
- Ik denk dat de meeste mensen de volgende nadelen van de bekertjes gaan vinden
  - Dat hij te groot is om makkelijk mee te nemen
  - Dat de rand te dik is
  - Dat het niet makkelijk is om te zien of de beker open of dicht is
  - Dat hij niet heel lekker drinkt
- Ik denk dat de testpersonen de beker het volgende gaan ervaren
  - Positieve reacties van de baristas
  - Verrast zijn dat ze schoongemaakt worden
  - Hem gaan vergeten mee te nemen
  - Een aantal hem erg vies vindt maar ook een aantal het niet echt een probleem vinden dat hij niet helemaal schoon is
  - Dat ze de beker naar koffie vinden smaken en er dus liever geen thee uit drinken
  - Het in hun systeem moeten krijgen om hem te gebruiken

# Appendix 13: Contextmapping further explanation creation of the personas

This appendix provides more detail about how the personas were created and placed in the quadrant.

With the axis visible in chapter 2.5 a quadrant was formed. Each participant is placed in the quadrant based on how they answered questions during the interview, see figure FIX ME. The place of a participant on the ratio and emotion axis was determined by looking what the main reason was that they bought a warm beverage. Participants were placed on the ratio side of the axis when they said they described it as a habit and they were placed on the emotion side when they said I want to treat or comfort myself. The place of a participant on the quality and efficiency axis was determined by looking at where they bought the warm beverage and why they bought it at that place. People that bought their warm beverage at Julia's or Starbucks and said that they were willing to spend some extra time and money on their warm beverage were place on the quality side. The participants that bought at Julia's or Stationshuiskamer and said that they wanted a warm beverage as soon as possible were placed on the efficiency side of the axis. Each participant can behave differently on the situation they are in. This means that they are in a different position in the quadrant based on the situation. Thus each participant is not a fixed point but an area on the quadrant. The place of each participant can be found in appendix FIX ME. Per participant it was determined in which area they are located and based on that multiple clusters were formed from participants that moved around in the same space.

These two axis result in four different groups that all have different wishes and motivations. Per group an estimation was made on how big they would be. This was done based on how much warm beverages were sold at stores and how much beverages were sold at certain moments of the day. The quality drinkers drink their warm beverage often at Julias because Julias sells warm beverages that have a higher quality. However Julia accounts for only a small percentage of the warm beverage sales of NS. FIX ME %. This means that the enjoying business travellers are the smallest group, because they mostly buy warm beverage at Julias. The emotional comfort seeker is the second smallest as they exist out of people that not buy a warm beverage often. However it can be expected to be quite a large group as there are many people who fit in this group can be both lust and must travellers. The self treater is the second to largest group because they are a large part of the customer base of kiosk and SHK. They buy a warm beverage more often than the green group but less often than the red group. The caffeine drinker is expected to be the largest as this group ha the most must travellers that buy a warm beverage regularly.

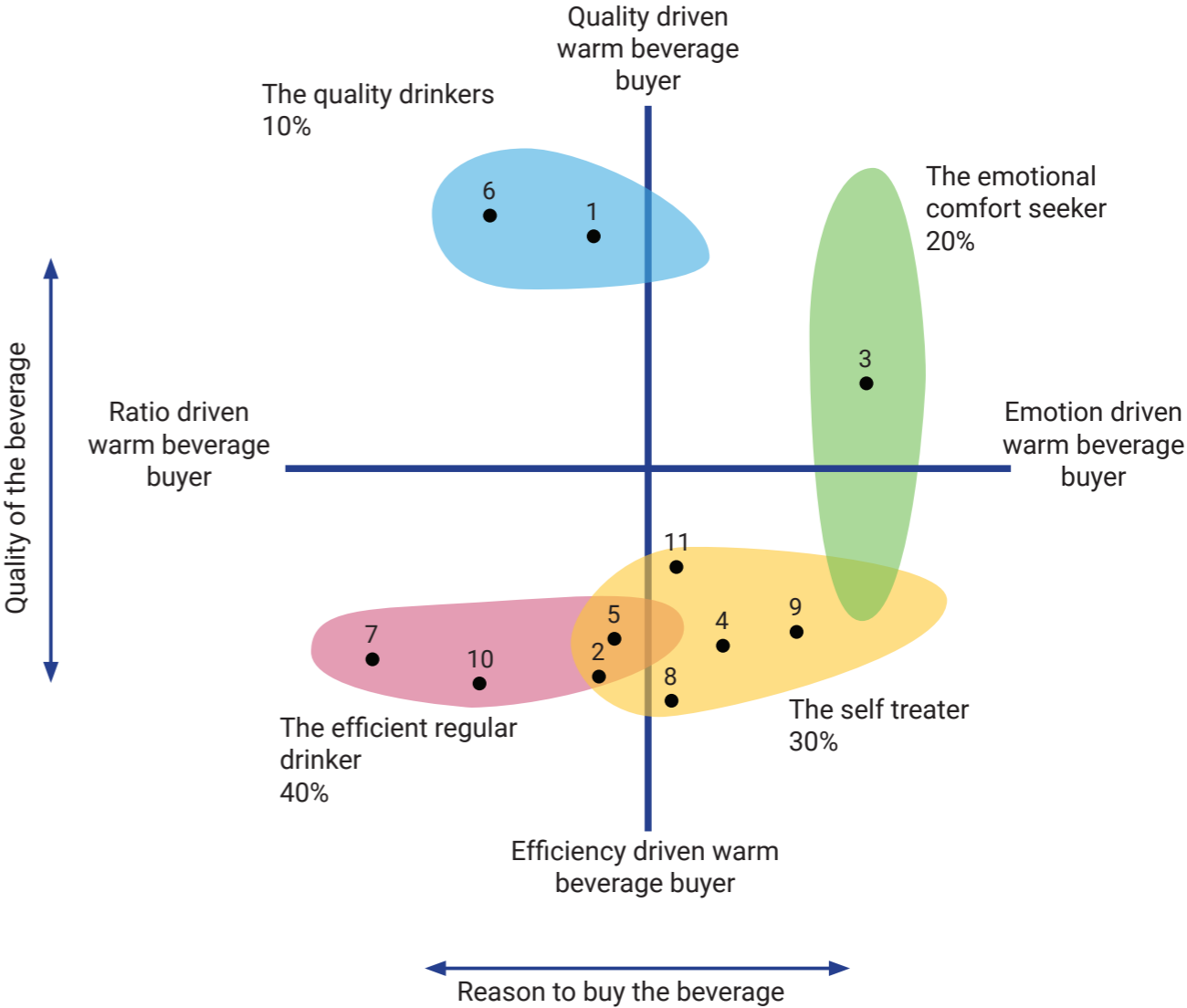


Figure 12: Figure fix me: quadrant with participants placed in their respective groups

# Appendix 14: Creative session

For the ideation phase three creative sessions were organized: one with an NS graduation student and two sessions with students from the industrial design faculty. I decided to facilitate every session myself due to the Corona and time constraints. During each session I did only tell the participants about topics that could spark new ideas and did talk about restraints to the design except when the participants asked about it themselves.

## Creative session with the NS graduation student

The goal of this creative session was to focus on ideas that would fit the context of NS. This was why this creative session was conducted with a graduate intern of the sustainability department of NS. Although she was a graduate intern at NS she was very knowledgeable about what was possible within the NS domain.

The idea of this session was to discuss and brainstorm about different how to's. First a small presentation about my project was given. Then quite a lot of how to's were discussed as this was a one on one session. When the ideas would die down I would suggest a new direction within that I found in my research the how to's to spark new ideas.

This creative session was focused on the following how to's:

- How to convince customers to use the cup deposit system?
- How to inform customers about the cup deposit system?
- How to fit the cup deposit system within the different formulas?
- How to enable the customer to walk safely with the warm beverage
- How to improve the experience of the cup itself?
- How to stimulate customers to hand in the cups?
- How to hand in the cups?

Each suggestion of the participant was noted down and later analyzed to find solution spaces.

## Creative session 1 with TU Delft students

This session was focused on how the system should work out as a whole. This session was done with three industrial design students that did master that focused on the technical feasibility of a design or the interaction with a design. This would ensure that both the feasibility and interaction would be covered in the solution.

The session consisted of:

- A small presentation that showed the results from my research.

This was a very minimal presentation where the content was focused on sparking new ideas instead of telling the participants of what was not possible. After the presentation the participants could ask questions and already give suggestions they had for a cup deposit system.

- The first how to: how do you get the deposit cup back?

This session started with brain writing with post-its. Where the participants write ideas they have on post-its for a limited amount of time. 6 minutes. When the timer is finished each idea was presented and clustered with other ideas participants had. After this the technique hidden presumptions was used. Here participants look at what aspects the ideas have in common. After this they brainstorm about ideas that can not include that aspect the other ideas have in common. This challenges the participants to think outside of the box.

- The second how to: how to ensure the deposit cup does not spill a warm beverage?

Here a technique called brain writing was used where each participant wrote down their ideas for the how to's for 5 minutes. After they presented the ideas to each other and had the time to reiterate on each other's ideas. To stimulate out of the box thinking the technique criminal round was used. The participants focus on thinking of solutions that are criminal. By criminalising the ideas other problems within the how to can become visible.

- The third how to: how do you convince customers to use the deposit cup system?

Because this was the last how to and the session was already quite long this how to was kept very simple and fluent. Here the traditional technique of brainstorming was used where the facilitator wrote down the ideas participants had.

- Linking ideas together.

To summarize the creative session the participants looked at the system as a whole and how it should be designed.

## Creative session 2 with TU Delft students

This session was focused on how customer should experience the cup deposit system. This session was done with three industrial design students that did master that focused on the technical feasibility of a design or the interaction with a design. This would ensure that both the feasibility and interaction would be covered in the solution.

The session existed out of:

- A small presentation that showed the results from my research.

This was a very minimal presentation where the content was focused on sparking new ideas instead of telling the participants of what was not possible. After the presentation the participants could ask question and already give suggestions they had for a cup deposit system.

- The first how to: How to improve to experience of handing in the cup?

This phase started with a 20 min mind mapping session where participants were stimulated to freewheel and hitchhike on each others ideas. After the amount of ideas died down the hidden presumptions technique was used to spark new ideas.

- The second how to: How to design the experience of each formula of NS, Kiosk, SHK and Julia's?

This phase started with a small story about how a customer would arrive at each formula. After this each participant was told about the main focus of each formula. Based on this information the participants were asked draw and describe the ideas they had for each formula for 4 minutes and hand the paper over to the person sitting next to them so they could hitchhike on the ideas the other participants made. After every participant filled in each paper they presented each other their ideas and reiterated on them.

- The third how to: How to make customers feel relaxt, confident and proud?

This phase started similarly as the previous phase with writing and drawing the ideas the participants had and passing it to the next participant. However instead of only presenting and reiterating on the ideas it was also asked to look at similarities between the ideas. Here the idea was having an idea that addresses two or three of the emotions would be much more efficient than an idea that only addresses one emotion.

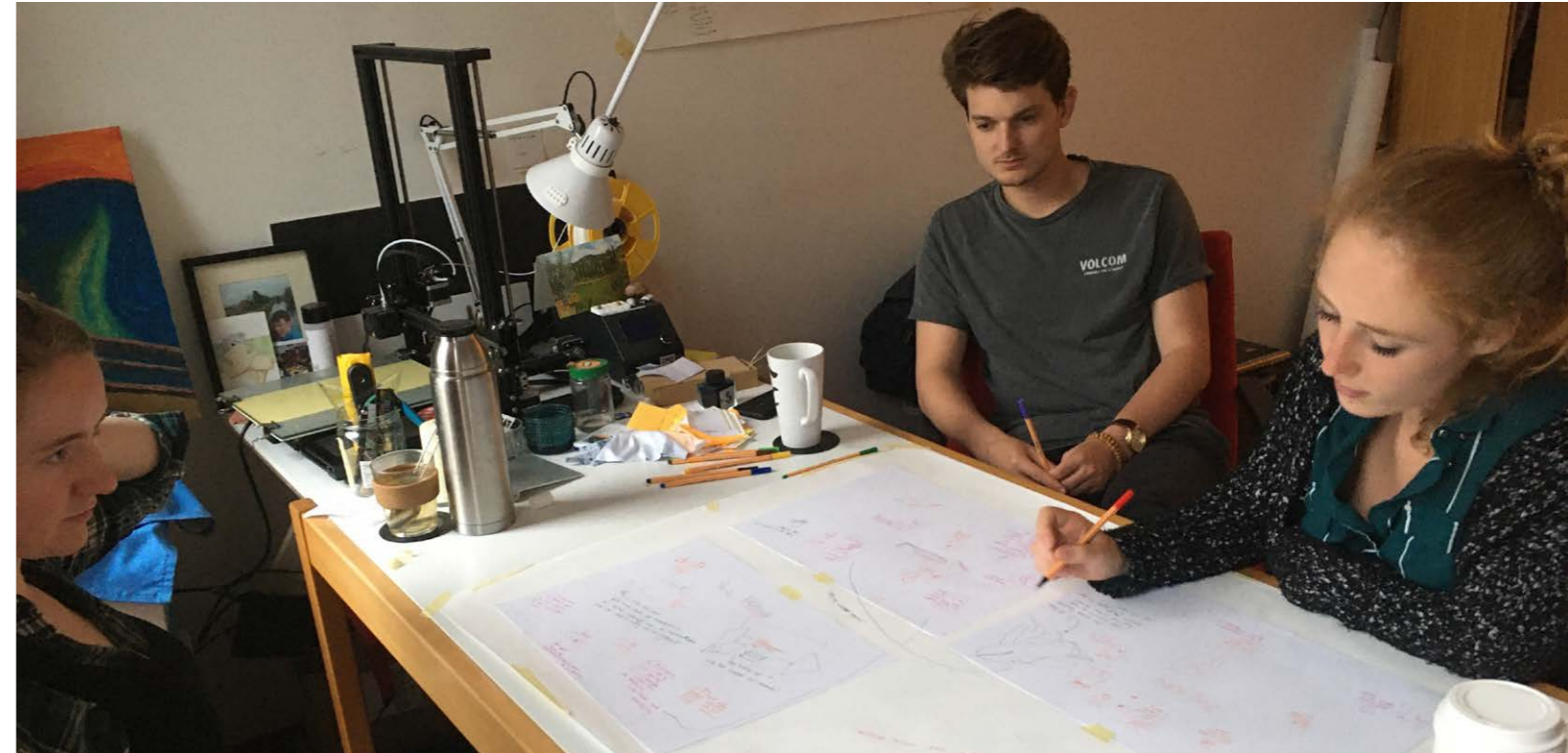


Figure 13: Creative session 1



Figure 14: Creative session 2

## Summarised results from the creative sessions

### Return money

#### Via a card

The service can be linked to something like an ah bonus kaart

### Prevent spillage

#### Change the cup

This not only result in less spillage but it also provides a way for the customer to hold the cup on place that is colder to the touch and more comfortable to hold. Make a thicker top part of the cup to limit spillage. Or attach the lid via a living hinge to the cup.

#### Provide an user owned lid

The customer can buy their own lid at NS. They can choose out of multiple variants. These lids can be for example focused on:

- The smell of the warm beverage.
- Limiting the spillage as much as possible.
- Drinking while walking.

### Motivate customers to bring back the cup

#### Thank the customers for handing the cup in

With for example a personal thank you from NS or a thank you from a traveller of the future.

#### Make it more fun to hand it in

This can be achieved by putting a slide in the deposit bin. but also by putting fun facts linked to sustainability on the bin. Other ideas are to slide the cup into a deposit bin from an escalator. Another idea is to make a sound, e.g. clapping, when someone hands in the cup.

#### Make it undesirable to not hand the cup in

Black list of people that bring not back their mug. Provide no lid to the cup. Due to the risk of spillage customers wil not take it with them.

#### Remind the customer

This can be done with a RFID tag that sounds an alarm when it leaves the station. It can also be done by reminding customers at the ov chip card gates to bring back their cup. Another option is to put eyes on the cup itself because people will feel more responsible about something that looks at them.

#### Give a purpose when they return the cup

By giving the cup to someone to support them with the money or give answer to a question with your cup. Another option might be to show they are part of a bigger initiative. This might not only give them more purpose but also more confident because they know other people are using the system as well.

### Stimulate customers to choose the deposit cup

Present the cup as the best option

Present the cup as the ideal travel cup for the train or ask if they want the deposit cup. People like to say yes and it also presents the cup as the standard.

### Collect the cups

With a:

- Bin on the station
- Bin in the train
- A net next to the train

### Create an identity for Kiosk, Julia's and SHK

#### Kiosk

Keep it as simple as possible and put positive quotes on the cup.

#### Julia's

Focus on the traditional properties of Julia's. This can be by making the shape very clean and simple and making the edge of the cup thick and rounded so it looks more like an Italian espresso cup. Also show the story of the warm beverage itself, here you can talk about the journey the coffee beans took to the kiosk.

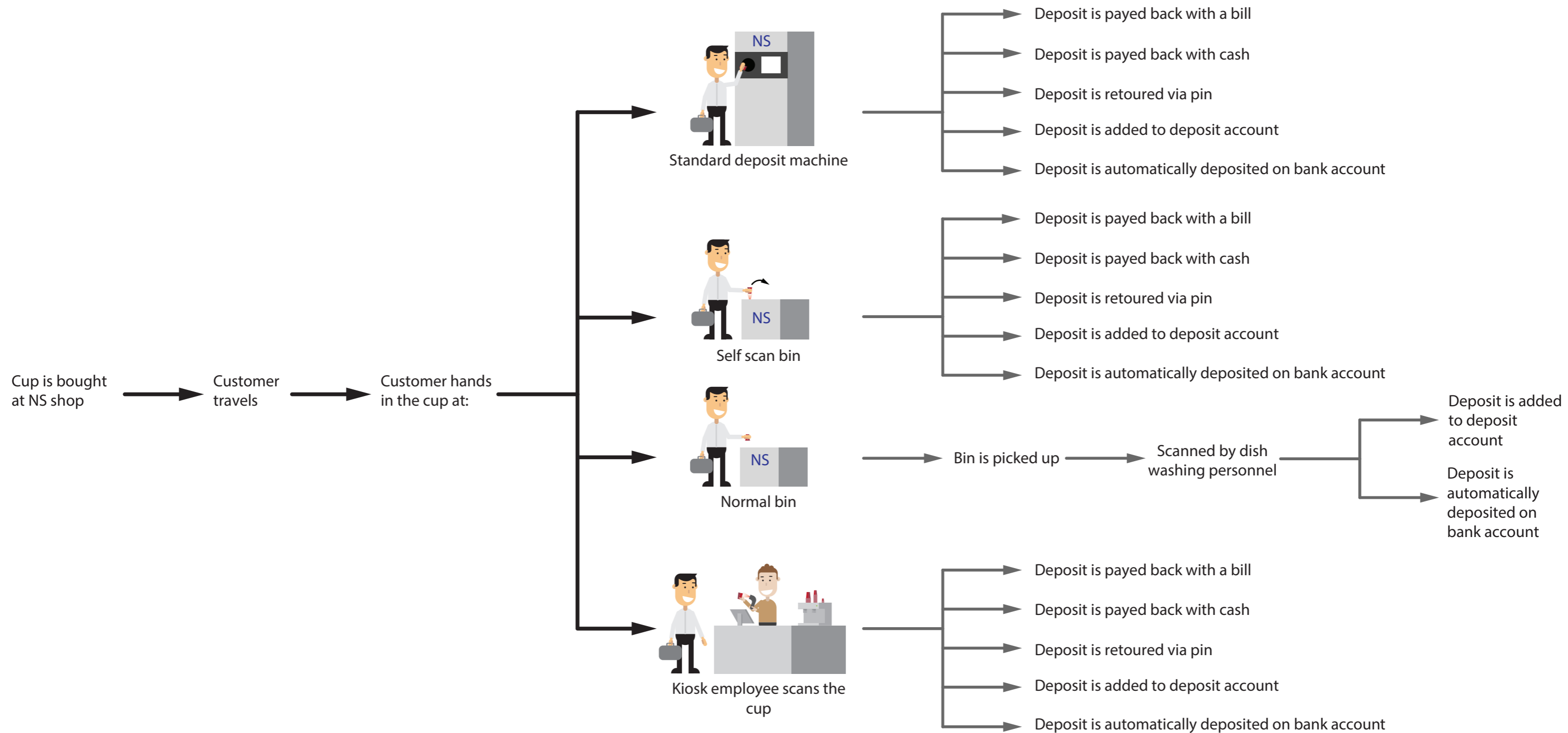
#### SHK

Focus on the social part of SHK by for example providing the customers with conversations starters. Another focus can be on the homely part of the SHK. Using more rounded shapes for the cups wil make the cup feel more homely.

Appendix 15: Inspiration design cup



## Appendix 16: Evaluating sub solutions



Collecting cups



Standard deposit machine



Bin with sensor



Bin without sensor



Kiosk employee

	--	-	+	++
User effort				
Reach				
Environmental impact				
Price				
Implementation				
Fail proof				
Maintenance				

	--	-	+	++
User effort				
Reach				
Environmental impact				
Price				
Implementation				
Fail proof				
Maintenance				

	--	-	+	++
User effort				
Reach				
Environmental impact				
Price				
Implementation				
Fail proof				
Maintenance				

	--	-	+	++
User effort				
Reach				
Environmental impact				
Price				
Implementation				
Fail proof				
Maintenance				



The standard deposit machine is widely used in the Netherlands to collect deposits of plastic bottles. The machine has a hole in which the cup can be deposited and a 360 degree camera array can scan the sides of the cup for a bar code and to analyse the shape of the cup, see figure FIX ME. This is used to determine if the cup is from NS and if the customer gets their money back.



### Ease of use

The standard deposit machine is fairly easy to understand for users because they already have experience with them in the super market. Using the machine is also straight forward as the customers can drop their cup in the machine and they get their money back.



### Price

The price of the standard deposit machine can be kept fairly low due to the fact that NS already needs to buy these for their small bottles. However deposit cups will add to the amount of products that need to be handed in during the day. Warm beverages are drank often during rush hour which means that there will be a a moment where a lot of cups needed to be handed in at the same time. This means that in the end new machines need to be added to fulfil the capacity needed to collect both the cups and the bottles. NS also needs to add one extra compartment to each machine to be able to split the bottles and cups.



### Environmental impact

Based on a fast LCA which can be found in the appendix the standard deposit machine scores the worst of all of the solutions. However it is still a small part of the total environmental impact of a deposit cup.



### Implementation

Implementing the standard deposit machine to collect cups is not very hard. There are already machines on NS stations to collect small bottles. NS needs to add more machines to be able to collect the added amount of cups per hour that are handed in. The software can be also easily changed so the cups can be accepted as well.

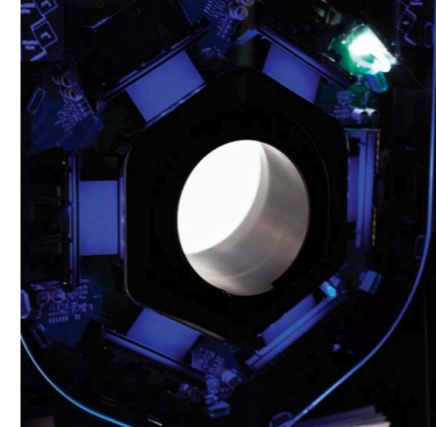


Figure FIX ME: the camera array of a standard cup deposit system of Tomra



### Fail proof

The standard deposit machine has been in use for many years and is very reliable. The main reason for this is that the 360 degree camera array can scan each side of the cup. This allows to machine to both scan a bar code and the shape so it has two ways of controlling itself.



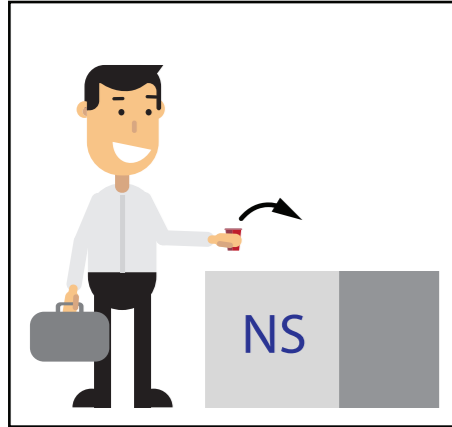
### Maintenance

Standard deposit machines are fairly easy to maintain. The camera array of the machines need to be cleaned regularly to ensure that the cameras can still see the barcodes. The machines can store 400 cups before they need to be emptied which means that on a busy station like Utrecht, where 2000 cups would be handed in every day, a single machine would have to be emptied 5 times a day.



### Distribution of machines

The standard deposit machine is quite hard to distribute on a station compared to the other solutions. The main limitation is that it needs a socket for power, which severely limits the spots it can be placed at. Another reason is that the standard deposit machines are quite expensive this means it is hard to place them on a lot of spots on the station.



The bin with a scanner is a simplification of the standard deposit machine. This bin will work with a single barcode scanner in the bin itself on which the customer places their cup. The cup has a barcode on the bottom. The machine automatically scans this barcode. After scanning the cup the user can deposit the cup in the bin and get their deposit back. When the bin is full it is emptied and brought to the washing facility.

An example of this is the system of Goodless (Goodless, 2020). They have a collection machine which works with RFID where customers can hand their cup in and get their deposit back.



## Ease of use

The bin scanner is not a system that is known to be able to hand in a deposit system. It does already exist but it is not common yet. This means that users have to learn how to use this.



## Price

The price of this machine can be lower than the standard deposit machine. This system only needs one camera instead of the six of the reverse vending machine. This will significantly reduce the price. However it also needs to be developed into a solution as it is fairly new at this moment. This will also add to the costs. When a bin with scanner solution is developed it will cost less than the standard deposit machine per machine because it needs less scanners.



## Environmental impact

Based on a fast LCA which can be found in the appendix the standard deposit machine scores the second worst of all of the solutions. However it is still a small part of the total environmental impact of a deposit cup.



## Implementations

Implementing the bin with a scanner will be harder than implementing an already existing solution like the standard deposit system. The bin with a scanner still needs to be developed which is harder than taking an off the shelf solution.



## Fail proof

This is a sub solution that is more fail proof than the other sub solutions. The reason for this is that this is a system that user need to get used to, which means they can make mistakes when they use it for the first time.



## Maintenance

The maintenance of the bin with a scanner will be fairly easy. It does need to be cleaned, but that will be fairly similar to the other sub solutions. The machines can store 500 cups before they need to be emptied which means that on a busy station like Utrecht, where 2000 cups would be handed in every day, a single machine would have to be emptied 4 times a day.



## Distribution of bins on the station

The bin with a scanner is quite hard to distribute on the station because it needs a power source to power the scanner. However it can be significantly lower than the reverse vending machine due to its smaller size and the more efficiently stacked cups. This means that it can be placed on more stations.



The bin sub solution is the simplest. This will be a bin in which the customer can deposit their cup. When the bin is filled the cup will be brought to the washing facility where the cup is washed and scanned. This solution is not entirely new, because Cup Club is using a similar concept. Cup Club uses RFID instead of bar codes.



### Ease of use

This is a new concept which means that it should be explained to the customers. However they can not mess up much because they are not responsible for much. They do not have to scan the cup themselves.



### Price

Implementing this solution for NS will be not as costly as the reverse vending machine and the cup with a scanner, because it does not have a scanner in the bin itself.



### Environmental impact

Based on a fast LCA which can be found in the appendix the standard deposit machine scores the second best of all of the solutions. It is a very small part of the total environmental impact of a deposit cup.



### Implementations

Implementing this sub solution will be harder than using an off the shelf solution like a reverse vending machine. The product needs to be further developed to fit on a NS station. However it will be less hard to implement than the bin with a scanner because the scanner does not have to be implemented in the bin.



### Fail proof

The user can not do much wrong with this sub solution because they just have to deposit the cup. Something can still go wrong because NS could lose the cups while transferring them back to the washing facility. When this happens NS it will become very hard for NS to know. which cups were in the bin. This means they can not transfer the deposit back to customers.



### Maintenance

The maintenance of the bin will be fairly easy. It does need to be cleaned, but that will be fairly similar to the other sub solutions. The bin can store 500 cups before they need to be emptied which means that on a busy station like Utrecht, where 2000 cups would be handed in every day, a single machine would have to be emptied 4 times a day.



### Distribution of bins on the station

The bin is very easy to distribute because it does not need a plug to run as it does not have a scanner. It is also cheaper to make the bins because it does not need a scanner. This means more can be bought and thus distributed on the station.



In this sub solution the customers brings the cup back to the store on the station they arrive. Here a NS employee can scan the cup. The NS employee stores the cup in a bin in the store. That bin is later picked up and brought to the washing facility.

An example of this sub solution is Recup. Recup has a cup system where customers can buy their cup at one coffee shop that is part of the Recup programme. When they finished their warm beverage they can hand it in at another Recup coffee shop. Here the cup is picked up by Recup and washed.



## Ease of use

The system is quite easy to understand and it is also quite logical to hand in the cup at the shop you bought it. There is one big problem and that is that most warm beverages are drunk and handed in during rush hour. This means that customers will have to queue to be able to hand in their cup. This can take quite long and it can be expected that it will frustrate quite a lot of customers.



## Price

Developing and building this system will be the cheapest as it only needs simple collection bins for in the NS stores.



## Environmental impact

Based on a fast LCA which can be found in the appendix the standard deposit machine scores the second best of all of the solutions. It is a very small part of the total environmental impact of a deposit cup.



## Implementations

This sub solution is fairly easy to implement. The biggest problem is the limited space to store the cups in for example a Kiosk. Deposit cups already take in more space compared to paper cups, but now the store will have to store both cups they use to serve the warm beverage in and the cups that are returned.



## Fail proof

The solution is quite fail proof because NS employees know how to handle the cups.



## Maintenance

The bins that are used to store the cups in have to be cleaned. However they can be cleaned when they are returned with the cups at the washing facility.

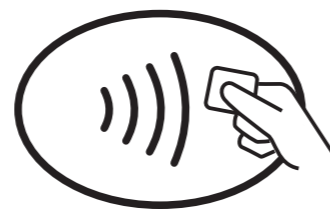


## Distribution of bins on the station

The distribution is very easy because the customer can hand in their cup at each NS store.



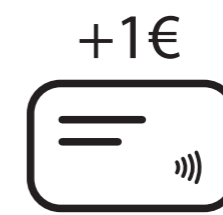
Deposit is payed back with cash



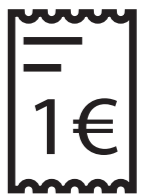
Deposit is retoured via pin



Deposit is added to deposit account



Deposit is automatically deposited on bank account



Deposit is payed back with a bill

	--	-	+	++
User effort				
Time till money is returned				
Ease of implementation				
Support of payment methods				
Privacy customer				

	--	-	+	++
User effort				
Time till money is returned				
Ease of implementation				
Support of payment methods				
Privacy customer				

	--	-	+	++
User effort				
Time till money is returned				
Ease of implementation				
Support of payment methods				
Privacy customer				

	--	-	+	++
User effort				
Time till money is returned				
Ease of implementation				
Support of payment methods				
Privacy customer				

	--	-	+	++
User effort				
Time till money is returned				
Ease of implementation				
Support of payment methods				
Privacy customer				

Worth to take advantage of

## IDE Master Graduation

## Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

**! USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT**

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

**STUDENT DATA & MASTER PROGRAMME**

Save this form according to the format "IDE Master Graduation Project Brief\_familyname\_firstname\_studentnumber\_dd-mm-yyyy". Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !



family name Visser  
initials J. S. given name Jan Simon  
student number 4365593  
street & no. \_\_\_\_\_  
zipcode & city \_\_\_\_\_  
country \_\_\_\_\_  
phone \_\_\_\_\_  
email \_\_\_\_\_

Your master programme (only select the options that apply to you):

IDE master(s): ☐ IPD ☒ Dfl ☐ SPD

2<sup>nd</sup> non-IDE master: \_\_\_\_\_

individual programme: - - (give date of approval)

honours programme: ☐ Honours Programme Master

specialisation / annotation: ☐ Medisign

☐ Tech. in Sustainable Design

☐ Entrepreneurship

**SUPERVISORY TEAM \*\***

Fill in the required data for the supervisory team members. Please check the instructions on the right !

\*\* chair Ruud Balkenende dept. / section: Circulair ProductDesign  
\*\* mentor Renée Schuffelers dept. / section: Industrial Design  
2<sup>nd</sup> mentor Katelijan van den Berg  
organisation: NS  
city: Utrecht country: Netherlands

comments  
(optional)

Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..



Second mentor only applies in case the assignment is hosted by an external organisation.



Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

**APPROVAL PROJECT BRIEF**

To be filled in by the chair of the supervisory team.

chair Ruud Balkenende date - - signature \_\_\_\_\_

**CHECK STUDY PROGRESS**

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2<sup>nd</sup> time just before the green light meeting.

Master electives no. of EC accumulated in total: \_\_\_\_\_ EC

Of which, taking the conditional requirements into account, can be part of the exam programme \_\_\_\_\_ EC

List of electives obtained before the third semester without approval of the BoE \_\_\_\_\_

☒ YES all 1<sup>st</sup> year master courses passed

☐ NO missing 1<sup>st</sup> year master courses are:

name \_\_\_\_\_ date - - signature \_\_\_\_\_

**FORMAL APPROVAL GRADUATION PROJECT**

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked \*\*. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: ☒ APPROVED ☐ NOT APPROVED

Procedure: ☐ APPROVED ☐ NOT APPROVED

\_\_\_\_\_ comments

name \_\_\_\_\_ date - - signature \_\_\_\_\_

## Lower the environmental impact of cups at NS stations

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 08 - 12 - 2019

01 - 05 - 2020

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, ...).

At NS stations travellers drink 30 million warm beverages a year. The environmental impact of drinking warm beverages is quite substantial. This impact can be found in the paper cup the drink is served in. The paper cups used at NS stations result in 750 tons of waste and a big environmental impact of at least 208 tons of CO<sub>2</sub> (Huhtamaki, 2019). This project will be about reducing the environmental impact of paper cups at NS stations. At this moment only 2.4% of the people that buy warm beverages use a reusable cup. NS wants to find out which solutions can be implemented that lower the environmental impact of the paper cups. The project will be done in collaboration with NS. To get an idea which stakeholders were important for this project a stakeholder analysis was performed. The overview of which can be found in figure 1. From this analysis four stakeholders were chosen to discuss in further detail.

#### NS stations

This is the client for the project. At this moment NS stations provides warm beverages through their stores at train stations (Kiosk, Stationshuiskamer and Julias) and through the stores that rent shop spaces from NS stations (Albert Heijn is a franchise of a NS and Starbucks is a separate company). These shops all sell their warm beverages in paper cups.

The goal of NS stations is to lower their emissions but also the amount of waste generated by the shops on their stations. The main reason for NS is their goal to reuse, reduce or recycle 75% of the waste they generated in 2020. This project will fit in well with this goal as it is focused on reusing a cup, reducing the amount of cups and looking into recycling the paper cups.

Lowering and or reusing this waste would result in a positive environmental impact. Lowering their paper cup waste is also a recognisable goal for many people and would result in positive media attention.

Lowering the paper cup waste stream would also result in lower cleaning costs. This applies to stations, but more importantly, to the small bins in the train. These would benefit from this as one paper cup can easily fill one bin. A limitation from NS stations is that the solution needs to be sustainable without having a large negative impact on their profit.

#### Warm beverages customers NS

These are the people that buy warm beverages in the shops on NS stations. Experts within NS say that these people want to do everything as efficiently as possible most of the time. At the station consumers do not think about the environmental impact their actions have.

#### Manufactures of more sustainable alternatives

These are the companies NS is in contact with to find a more sustainable solution. Most plastic cups need to be used for 24-40 times to be better than a paper cup according to Keepcup and CIRAIG. NS will however promote the cup in their stores which will result in people seeing the cup. This could result in a growth in sales.

#### Manufacturers of paper cups

With 30 million cups a year NS stations is quite a big client of the paper cups manufacturers. NS stations was in contact with them to switch to PLA lined paper cups but they decided to not do that because there are no facilities to filter out the PLA cups after they have been thrown away.

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introduction (continued): space for images

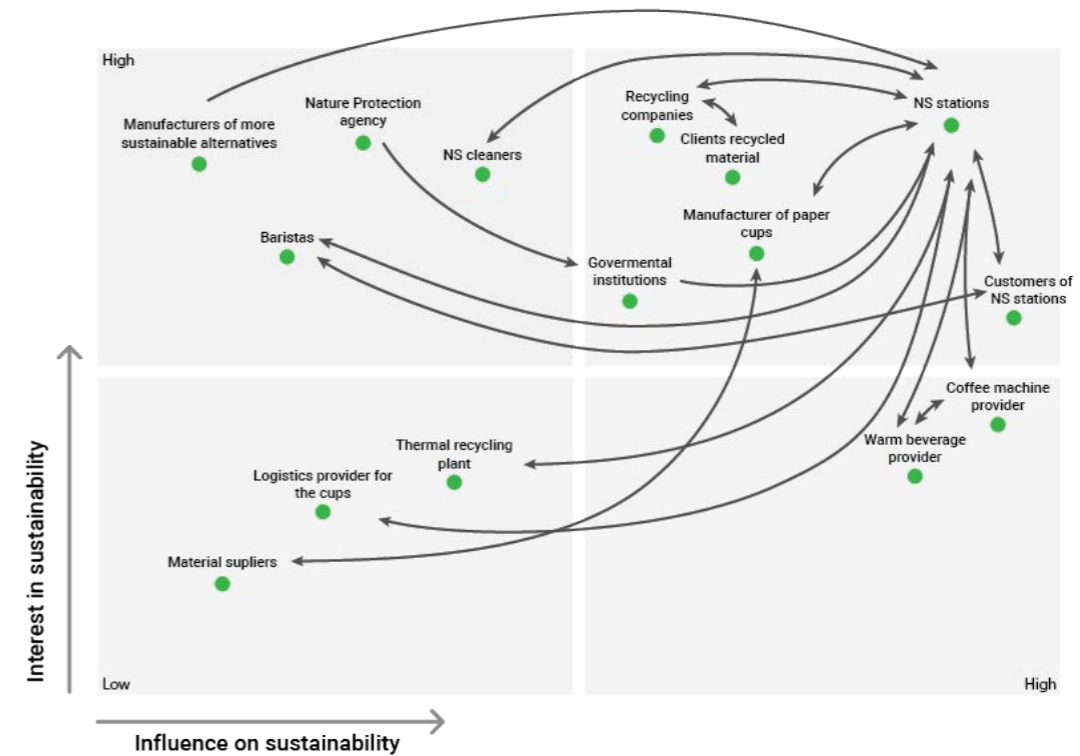


image / figure 1: Stakeholder analysis

image / figure 2:

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 goal of NS stations is to lower their emissions but also the amount of waste generated by the shops on their stations. The main reason for NS is their goal to reuse, reduce or recycle 75% of the waste they generated in 2020. At the moment NS does not succeed in this as they are largely unable to convince travelers to use reusable cups, reduce the amount of cups travelers use and recycle the paper cups travelers use.

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.

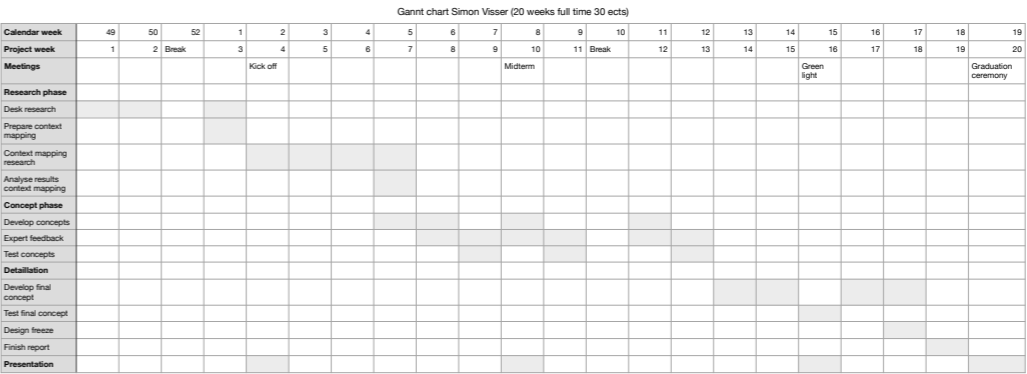
The goal of this project is to create a product that lowers the environmental impact of paper cups of travelers drinking warm beverages while traveling with NS. This can be a new product that NS will use but it can also be guiding principles on how to implement a more sustainable solution.

During this project I will look into how travelers drink warm beverages at NS stations. Based on this I will design a product or a service that allows the travelers to lower their emission with ease. The solution space will in be the NS food shops, the NS partner food shops, the NS trains and the NS stations.

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 8 - 12 - 2019 1 - 5 - 2020 end date



1

I will start to look into what has already been done within NS to get an overview of the current situation. Based on this I will do initial research to fill the knowledge gaps within the information of NS. This research will be mostly focused on the customer and the barista, because the main interaction of buying warm beverages is between these people. I will also look into how the overall experience of the customer is while traveling with NS.

When I have an overview of the situation I start a more in depth research on the experience of drinking warm beverages at NS stations. Here I will follow a diverse group of users that travel often by train and drink coffee while doing that for two weeks and ask them for 6 times in 2 weeks questions about their warm beverage drink in relation to to their train journey. The participants will be divided in two groups, one that uses paper cups and one that uses a reusable cup. This will give me insights in how people use reusable cups and it will provide me with insights about how a paper cup user drinks coffee. This I can later use to influence the paper cup user into using a more environmental friendly alternative.

While I do the in depth research I will look for LCA's of the paper cups. I will also look into how I can calculate the environmental impact of implementing a more sustainable solution into the NS ecosystem. This ensures that I will have a way to compare environmental impact of my solutions to the existing situation.

After completing this research I will make a complete customer journey of where the pain points and opportunities are. I will do this for the customer, the barista and NS.

Based on this research I will create multiple concepts, user test them. I will also test their environmental impact with an LCA. Based on this I will perform multiple design iterations to come to a final concept. This final concept will be further developed and a final feasible concept will be generated.

I expect to design a product service combination. The reason for this is that it will have to work inside the eco system of NS stations and I expect that some kind of service has to be provided for either the customer or the shops.



## 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.

During this project I have four goals. All these goals are based on which direction I want to later work in and I thus want to develop them or want to prove I'm able to do them.

My first goal is to learn how to implement a truly sustainable solution into a big company. I also want to learn this because at the TU Delft I learned quite a lot about designing a solution for a specific context and company. However it was not focused on keeping each stakeholder within the company itself happy. I think that especially in the sustainability context it is important to actually design a solution that each stakeholder supports.

My second goal is to improve my context mapping skills. I did already do two big projects were I used my own version of context mapping. It would be interesting to learn other techniques of context mapping and use these during my project. I think broadening my knowledge of context mapping and getting more experience doing it can make me a better designer.

My third goal is to prove that I can influence peoples behavior with my design. This is what the master DFI is al about so I should be able to do that.

My last goal is prove that I can successfully complete a design project and prove that my solution actually improves on the alternatives.

## FINAL COMMENTS

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

Huhtamaki (2019). Taking a closer look at paper cups for coffee. Retrieved from <https://www.huhtamaki.com/globalassets/global/highlights/responsibility/taking-a-closer-look-at-paper-cups-for-coffee.pdf>