Reducing Food Waste at Utrecht University

Waste within food ordered for meetings, lunch services, and banqueting

Final Paper

Group 11

Sarah McGee: Sustainable Development- International Development
Lex Dolfing: Sustainable Development- Global Change and Ecosystems
Louise Braakhuis: Sustainable Development- Environmental Governance
Elaine Girvan: Sustainable Development- Environmental Governance
Akinyi Otieno: Water Science and Management- Earth Science
Jora Slinger: Water Science and Management - Earth Science

Transdisciplinary Case Study (GEO4-2302)
Coach: Joost Vervoort
Utrecht University

04 November 2016

Executive Summary (Dutch follows English)

Globally, 32 percent of the food production goes to waste every year. The resulting environmental impacts are extensive: not only is water wasted and greenhouse gas emitted, food waste also causes loss of biodiversity, eutrophication and soil degradation.

Unfortunately, Utrecht University's catering services also contribute to food waste and its resulting consequences. The Facilitair Service Centrum (FSC) has noticed that much of what is ordered for catered events and meetings remains unconsumed. However, the overall extent and causes of the University's food waste is unclear. In order to tackle this problem and match the Sustainability goals of Utrecht University, the FSC has initiated this research into the scope of food waste in catered lunch specifically, its root problems, and possible solutions to reduce the waste. This research focuses on the *reduction* of food waste rather than the *reuse* or *recycling*, thereby proposing front end food waste minimization.

The research is divided into three phases, consisting of 1) in-depth research as to why food is wasted; 2) monitoring of actual food waste occurring in the University; and 3) calculating the environmental impact of the monitored food wasted.

1) Why is food wasted?
In order to answer this question the research consisted of both a literature review to identify general wasteful patterns as well as perform interviews with stakeholders in the Utrecht University for the specific conditions there.

Generally, one of the main reasons of food waste in the hospitality sector is the act that many stakeholders are involved and there is often a lack of communication between to adjust the supply of food to the demand. Also, being generous in the food offered is a sign of hospitality and often valued more than being sustainable or economic.

From the interviews with secretaries who ordered often, the issue of knowing the ones for whom the order is made plays an important role. Also, food waste often occurs easily when the number of attendees changes (last-minute).

2) How much food is wasted at Utrecht University?
Currently, the University utilizes the services of two external food services and facilities management companies; Sodexo and Oud London. The catering activities and produce left-overs of both organization were monitored for two weeks. At Oud London, employees filled in a registration form provided by the researchers to register waste. Sodexo events were monitored by either attendees of the events or - in the case of larger events - by researchers themselves, both using a registration form as well.
The research shows both at Oud London and Sodexo, a large amount of food was wasted. For example, at Oud London catering, a total amount of 306 sandwiches, 182 pastries and cakes, and 241,5 liter of various drinks was left over from catered events and meetings. At Sodexo, on average, 15 percent of the food at bigger events and 20 percent at smaller events was wasted.

3) What is the environmental impact of this food wasted?

The main reason why it matters to reduce food waste can be found in the impact all this waste has on the environment. This impact is expressed as both the water footprint and the carbon footprint, which also encompasses other indicators such as land use change. About 15-20 percent of all ordered food is wasted. This results in a water footprint of 933,314 liters and a carbon footprint of 571 kg. This is equal to about 12,000 bathtubs and 3500 km driven in an average car.

So, what can be done to reduce food waste?

The findings on the why, how much and what else of food waste will help determine appropriate solutions to reduce food waste. Three main end products were created by the research group: 1) a workshop plan for those who order; 2) advice on guidelines for those who cater; and 3) a website to calculate environmental impacts for those who attend lunches.

And how to continue?

In conclusion, this research has provided the first insights into food waste within food procurement at the Utrecht University. The waste is significant, though can be aimed to be reduced by the proposed solutions. The research group has provided several end products, being the the workshop plan, advice for caterer guidelines and a calculation-website. Most importantly, these products have to be put to good use. Also, further monitoring of the waste (as also proposed in the advice) is essential to track progress.

Managementsamenvatting

Wereldwijd wordt elk jaar 32% van al het geproduceerde voedsel verspild. De gevolgen voor milieu rijken ver: niet alleen wordt water verspild en broeikasgassen uitgestoten, voedselverspilling zorgt ook voor het verlies van biodiversiteit, oceaanverzuring en bodemdegradatie.

Helaas dragen ook de catering services van de Universiteit Utrecht bij aan voedselverspilling en de gevolgen hiervan. Het Facilitair Service Centrum (FSC) is opgevallen dat een groot deel van wat er besteld wordt voor gecaterde evenementen en vergaderingen niet wordt geconsumeerd. Echter, de omvang en oorzaken van de voedselverspilling op de Universiteit zijn onduidelijk. Om dit probleem aan te pakken en te voldoen aan de Duurzaamheidsdoelen van de Universiteit, heeft de FSC dit onderzoek geïnitieerd. Hierbij wordt gekeken naar de omvang van voedselverspilling, specifieke bij lunches, de problemen die ten grondslag liggen van de verspilling en mogelijke oplossingen om de verspilling terug te dringen. Het onderzoek legt de nadruk op de vermindering van voedselverspilling in plaats van het hergebruik om zo het probleem bij de basis aan te pakken.

Het onderzoek is opgedeeld in drie fases, bestaande uit 1) diepteonderzoek naar de vraag waarom voedsel wordt verspild; 2) registreren van de daadwerkelijke voedselverspilling binnen de Universiteit; en 3) het berekenen van de impact van dit verspilde voedsel op het milieu.

1) Waarom wordt voedsel verspild?
Om deze vraag te kunnen beantwoorden is er enerzijds literatuuronderzoek gedaan om algehele verspillingspatronen te identificeren en anderzijds interviews gehouden met belanghebbenden binnen de Universiteit Utrecht voor de locatie-specifieke oorzaken.
Een van de hoofdoorzaken van voedselverspilling in de gastvrijheidssector algemeen is dat er veel belanghebbende betrokken zijn en er vaak gebrekkige communicatie is om het voedselaanbod aan te passen aan de vraag. Daarnaast is het gul zijn in de hoeveelheid aangeboden voedsel een teken van gastvrijheid en wordt dit vaak meer op waarde gesteld dan duurzaamheid of zuinigheid.
Tijdens interviews met secretaresses die vaak bestellen is naar boven gekomen dat het belangrijk is om te weten wat de voedselwensen zijn van degene voor wie het eten besteld wordt en daarop kan worden ingesprongen met de bestelling. Daarnaast ontstaat voedselverspilling snel doordat het aantal aanwezigen bij een evenement (kortdag) blijkt tegen te vallen.

2) Hoeveel voedsel wordt er verspild binnen de Universiteit Utrecht?
Op dit moment maakt de Universiteit gebruik van twee externe cateraars, Sodexo en Oud London. De catering activiteit en geproduceerde overgebleven voedsel van beide cateraars werd gemonitord gedurende twee weken. Bij Oud London vulden werknemers het voor dit onderzoek gemaakt registratieformulier in. Evenementen van Sodexo werden gemonitord door de aanwezigen op een evenement of - in het geval van grotere evenementen - door de onderzoekers zelf.

Het onderzoek laat zien dat bij zowel Oud London als Sodexo een groot deel van het voedsel wordt verspild. Zo wordt bij Oud London catering een totaal aantal van 306 broodjes, 182 stuks of gebak en 241,5 liter van een variatie aan drankjes was overgebleven na catering. Bij Sodexo wordt gemiddeld 15% van het voedsel verspild bij grote en 20% bij kleinere evenementen.

3) Welke gevolgen heeft deze voedselverspilling op het milieu?

De grootste reden om voedselverspilling terug te dringen is te vinden in de gevolgen die de verspilling heeft voor het milieu. Die gevolgen zijn uitgedrukt als zowel de watervoetafdruk als de CO2-voetafdruk, waarbij de laatste ook andere indicatoren meeneemt zoals veranderingen in landgebruik. Ongeveer 15-20% van al het bestelde voedsel wordt verspild. Dit resulteert in een watervoetafdruk van 933.314 liter en een CO2-voetafdruk 571 kg. Dit is equivalent aan 12.000 volle badkuipen en 3500 km gereden in een gemiddelde auto.

Dus, wat kunnen we doen tegen voedselverspilling?

De bevindingen over waarom, hoeveel en wat dit nog meer betekent zijn leidend in het zoeken naar geschikte oplossingen tegen voedselverspilling. Drie eindproducten zijn gecreëerd door de onderzoeksgroep, zijnde 1) een workshop plan voor degene die regelmatig bestellingen plaatsen; 2) een advies op de richtlijnen voor de cateraar; en 3) een website voor degene die lunches bijwonen.

En hoe nu verder?

Concluderend heeft dit onderzoek de eerste inzichten gegeven in hoeveel voedsel verspilt wordt binnen de Universiteit Utrecht. De verspilling is van significante grootte en kan met behulp van de voorgestelde oplossingen worden gereduceerd. De onderzoeksgroep heeft verschillende eindproducten afgeleverd, zijnde de workshop, het advies voor cateraars en de bereken-website. Prioriteit ligt op dat deze producten goed benut worden. Daarnaast is verder onderzoek naar de voedselverspilling op de Universiteit, zoals ook aanbevolen in het advies, gewenst om mogelijke vooruitgang in kaart te brengen.

Acknowledgements

We would like to thank all stakeholders who gave their time and participated in this study. Without their help and valuable insights, much of this research would not have been possible. Many thanks to Laura Hompus, Joke de Wolf, Brigitta Blankman, Amal Ng, Natasja Costeris and Roos Velzel who gave us insights in the food ordering side, Rodrigo Lozano who shared his scientific knowledge about food waste, sustainable caterers Peter Pan and Cengiz Can, for their inspiration and hopeful words, and the employees of Oud London and Sodexo, and in particular Willem van Driel and Timo Bierhoff, for their help in collecting the data on food waste and giving insights into the catering companies. Also, we would like to thank Jim Cooper for the technical expertise he gave in creating the website. Lastly, we want to thank our client Merijn Smelt for his enthusiasm and involvement and Joost Vervoort for his useful feedback and guidance.

List of Figures and Tables

List of Abbreviations

CF	Carbon Footprint
FSC	Facilitaire Service Centrum
GHG	Greenhouse Gas
LCA	Life Cycle Analysis
UU	Utrecht University
VW	Virtual Water
WF	Water Footprint
WFN	Water Footprint Network

Table of Contents

1. Introduction

1.1 Scope of Food Waste

Approximately one third of all food produced for human consumption is wasted each year (FAO, 2013). This represents 32 percent of all the world's food production. In a time where approximately one billion people still go hungry and the ecological crisis is threatening human populations, this is something we cannot afford.

The environmental impacts of food waste are extensive. Most prominent are the greenhouse gas emissions of the production of uneaten food: 3.3 gigatons of CO_2 annually—a number only slightly smaller than the total emissions of the USA and China. The amount of water that is wasted through food is about 250 km^3 annually, which is more than the annual discharge of the Danube river. The production of the wasted food represents about 30 percent of the land used for agriculture, about 1.4 billion hectares, which equals the size of Antarctica.

In addition to these measured impacts, food waste has big consequences for (1) biodiversity by the cultivation of monocultures and pesticide use, (2) eutrophication of water bodies by extensive use of (artificial) fertilizers and (3) loss of soil due to land-use change and bad agricultural practices.

Besides the disastrous environmental impacts, the large amount of food that is wasted despite 1 billion people going hungry shows the unequal accessibility to food. The world already produces about 2800 kcal of food per day for each person (FAO, 2013). In order to solve the world's hunger problem, we do not need to increase production; we need to focus on eliminating the existing food waste.

In the recently published strategic plan, Utrecht University (UU) details how with its unique combination of both natural and social sciences it is ideally placed to contribute to the transition to a sustainable society (UU, 2016). It is from this basis that it aims to put sustainability at the heart of its core tasks and business operations.

Under the strategic research theme of Sustainability, the University has set an objective for its business operations to be fully carbon neutral by 2030 (UU, 2016). By aspiring for its operational management approach to be a source of inspiration, the sustainability program of the University aims to accelerate sustainability within the University's operations as well as in its internal and external communication. The program is being designed to run alongside the existing Utrecht Sustainability Institute and the theme of Sustainability, and has been established with a mission to be a role model in sustainability performance and conduct. It defines its vision to ensure that sustainability is integrated into all activities and that the University community is visible and actively involved in this ambition.

The Facilitair Service Centrum (FSC) is a key area keen to contribute to this objective by investigating ways in which food waste at the University can be reduced. Currently, the University utilizes the services of two external food services and facilities management

companies: Sodexo and Oud London. These organisations supply food and beverages for events such as departmental meetings, lunches and conferences. The ordering for these activities are normally carried out by departmental secretaries via access to an online portal. A recent estimate puts expenditure with Sodexo alone at around €1.5 million annually.

The FSC has noticed that much of what is ordered remains unconsumed and recently measured that approximately 40% of coffee ordered for meetings ended up being disposed of. However, the overall extent and causes of the problem is unclear, so the FSC requested data collection to be carried out for more detailed findings.

1.2 Problem Definition

Food waste is defined relative to a particular point of comparison and is often framed in relation to specific environmental controls. Lipinski et al. (2013) defines food waste as the discarding of food that is of good quality and still fit for human consumption—either before or after it spoils. It is the result of negligence or a conscious decision to throw food away.

The categories and quantities of foods that are wasted differ according to the food activity (production, distribution and consumption) and where they occur. A third of the global food waste stems from the processes linked to the consumption of food. Therefore, food waste at the pre-consumption (ordering) and consumption (events) stages will form the focus of this paper. This will include food wasted from activities and operations at the point at which food is consumed and the quantities of food wasted. The working definition of food waste will then refer to wholesome edible materials purchased but not eaten by the intended consumers. There are often variations in wastage rates of different food types. The food categories in focus will be those that are lunch-type foods catered in small meetings, banqueting and coffee and tea sets.

Attaining greater efficiency in food activities can help to reduce waste and save valuable resources such as water, energy, land and biodiversity. In response to the food waste problem at Utrecht University, this study proposes to investigate the extent of the problem and its impacts through quantifying the waste and analyzing the resulting food waste. With this information collected, suggestions will be proposed on how the problem could be improved. Each measure will highlight issues related to the different food categories.

This study will also present different practices and tips for reducing food waste. As a way to prevent and manage food waste, the hierarchy (Fig. 1) provides and prioritizes options for dealing with food waste. The most favourable options are placed at the base (top) and the least optimal at the tip (bottom) of the food waste pyramid. Based on this hierarchy and the wishes of the client, attention is given to “reduce” strategy to deal with food waste at UU given that the main intent is about limiting food waste at the front end.

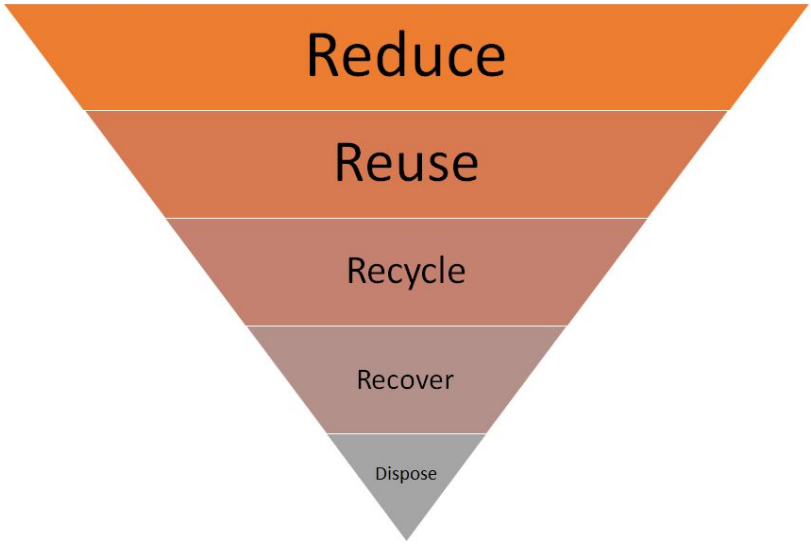

Fig. 1 - The waste hierarchy. European Parliament Council, 2008.

1.3 Research Questions

Central multidisciplinary question: How can food waste generation be reduced at Utrecht University?

In order to support this central question, the following subquestions have been defined:

1. What are the socio-economic context and causes of food waste?
2. How much food is wasted in lunches ordered from Sodexo and Oud London?
3. What is are the environmental impacts of *this* food waste?
    - 3.1 What is the water footprint?
    - 3.2 What is the carbon footprint?

The aim of the first subquestion is to gain an understanding of the factors that contribute to food waste generation and how they relate in the context of the University. Subquestion 2 aims to quantify the extent of food waste generated at the University, with the third sub-question detailing the impact it has. The results of each of these subquestions will lead to the answering of the main research question and provide practical solutions to reduce food waste generation at Utrecht University.

2. Theoretical Background

2.1 Reducing Food Waste

The issues that encompass food waste are complex and multifactorial, and often, they become entwined with the questions that surround food practices more generally.

One aspect is the inherently social nature of food, with the routines for growing, preparing and eating often influenced by the socio-demographic background of an individual. In a

number of studies, factors including a higher education, availability, price, gender, gardening, and growing up in a family that already has a lifestyle towards sustainability have been identified as having a positive influence on sustainable behavior around food. However, these studies also show an intention–behaviour gap, even though values, intentions, and attitudes may be positive towards sustainable food consumption and its disposal, is often not reflected in everyday practice (Ganglbauer et al. 2013).

A further aspect to be considered is the variety of actors involved in the food supply chain. In a study into addressing food waste in Denmark, Halloran, Afton, et al, (2014) observed that the varying agendas of supply chain actors influenced the decision-making processes of other actors in the supply chain, which had the effect of making food loss a dynamic flow. Their study also highlighted that the communication between actors, and the choices made by individual stakeholders, ultimately affected the choices made by other stakeholders in the food value chain. This complex interrelation between different stages of the food chain was also examined by Sonnino & McWilliam (2011). Their study into catering practices and public procurement in hospital food systems in Wales highlighted the need for a more integrated approach, one which mobilized all actors in the food system around a shared vision for sustainable development. In another study into food waste at hospitals, Goonan et al (2014) also observed the challenge in achieving organisational sustainability due to the multiple differences in perceptions and behaviors of food-service personnel.

One way of addressing such challenges is to engage in social learning, which is defined as the collective effort of working together to improve a situation, and requires a commitment to effective and authentic dialogue (Mackenzie et al, 2012). By ensuring the engagement of stakeholders, the quality of decision making and implementation improves. This in turn leads to an increase in legitimacy through greater transparency and the pursuit of legitimate self-interest (Mackenzie et al, 2012). Moreover, this will enhance exchange of knowledge and best practices, which also can contribute to the solution (Marthinsen, Sundt, Kaysen & Kirkevaag, 2012).

2.2 Environmental Impact Assessment

Food production can have severe impacts on the environment. To quantify the impact of the food wasted at Utrecht University, the water footprint and carbon footprint were chosen as indicators to assess the impacts on freshwater use and climate change respectively, as well as being indirect indicators of land-use, ocean acidification and eutrophication (Roös et al., 2013).

2.2.1 Water Footprint

According to Lipinski et al. (2013), inside the 1.3 billion tons of food wasted every year worldwide is 45 trillion gallons of water. This constitutes 24 percent of all water used for agriculture. Agriculture is one of the world's biggest users of freshwater amounting to 70 percent of all the water use around the world (Lipinski et al. 2013).

Not all food products are created equal in terms of water. In order to visualize the consumption of products in relation to the consumption and pollution of freshwater resources, the water footprint (WF) concept is introduced. This concept visualizes the hidden water behind a product and assists in quantifying the effects of consumption on water resources (Hoekstra & Chapagain, 2008). Water Footprint Network (WFN) defined the water footprint of a product as the total volume of freshwater directly or indirectly used for the production of the product (Hoekstra et al. 2011).

Accounting for a product's WF takes the form of the product's consumptive water use. Consumptive water use is the water that is no longer available for the immediate water environment because it has been incorporated into a product. The global standard on water footprint assessment developed by the Water Footprint Network (WFN) will be used for this WF assessment. The WF data are from the WFN reports on the global WF of different foods and the data of the amount of the products wasted are from the research surveys.

The WF for the products is measured in volumes of water per unit of production. By this measurement, there is a possibility to assess how efficient the production was. This provides a picture of how the product contributes to the escalating concern of degraded water quality and water scarcity. It also allows for comparison of different products and their contribution to the critical water issues. The WF also aids sustainability by identifying areas where water resources are not used efficiently. These measurements will then facilitate the sustainability goal of Utrecht University by identifying where there are opportunities to reduce the WF of University food procurement, hence improving the resource efficiency.

The concept of WF is closely linked to the concept of 'virtual water'. Allan (1993) defined 'virtual water' as *"*the volume of water required to produce a commodity or service along its whole supply chain*"*. The 'virtual water' concept is an indicator of freshwater use that looks at both the direct and indirect water use in the same way as the earlier definition by WFN . It shows water consumption volumes by source and polluted volumes by type of pollution with all components of the water footprint specified in both space and time.

Based on the above definitions, three components of the WF arises. These are blue water, green water and greywater. Blue water is the consumptive use of water withdrawn from surface or groundwater resources. Green water is the water evaporated from soil moisture supplemented by rainfall and finally, greywater is the polluted volume of water returned after production (Hoekstra et al. 2011).

The water footprint (WF) and virtual water (VW) concepts are therefore used in this particular study to offers a wider perspective on how the use of water resources is linked to the consumption of goods. For example, Chapagain and Hoekstra (2004) calculated that it requires 1,300 cubic meters of water to produce a tonne of wheat and 15,500 cubic meters to produce a tonne of beef, in the Netherlands.

As argued by Hoekstra et al. (2011), the concept does not measure the severity of the local environmental impacts of water consumption and pollution. Rather, it relates the severity to

the vulnerability of the water system and the attributes of the water consumers and polluters making use of the same system (Chapagain & James, 2011). Thus, the WF of the product is said to show the amount of pressure that a particular product has on the freshwater resources.

2.2.2 Carbon Footprint

The world's food system is one of the big contributors to climate change. One third of all greenhouse gases (GHG) are emitted by the agricultural sector and its related land-use change (Cole et al., 1997). Considering that one third of the food in the world is wasted (FAO, 2013), food waste accounts for about 11 percent of worldwide GHG emissions.

The concept of the carbon footprint (CF) has become widely popular in the public debate on the responsibility to mitigate climate change (Wiedmann & Minx, 2008). The CF definition used in this research: "... a methodology to estimate the total emission of greenhouse gases (GHG) in carbon equivalents from a product across its life cycle…" (Carbon Trust, 2007). Note that this includes emissions of other greenhouse gases expressed in CO_2 equivalent and not only CO_2 as the name suggests. This corresponds to the term Global Warming Potential, which is often used in life cycle assessments. However, the term 'carbon footprint' is chosen here because the CO_2 equivalent emissions of a product compare easily with day-to-day activities that also produce CO_2, such as driving a car (Weidema et al., 2008).

Not all food products create the same amount of carbon dioxide emissions. The CF can be used to show the importance of food production and waste on the global greenhouse emissions and to visualize the differences of impact between different types of food products. For example, meat and dairy products have, on average, a larger carbon footprint than plant-based products (Hamerschlag & Venkat, 2011).

Besides the type of product, the production method and location have impacts on the CF. For example, wine consumed in the Netherlands which is imported from Australia can have a larger footprint than wine that is produced in France, due to the difference in transport distance (Wiedmann & Minx, 2008). Therefore, calculating a product's carbon footprint requires a sophisticated life cycle assessment as it needs to account for the whole life cycle of a food product from seed to waste.

Another benefit of using the CF as an indicator for environmental impact is that it is also an indicator of ocean acidification, land use change, and nitrogen and phosphorous eutrophication, three important planetary boundaries (Roös et al., 2013; Röckstrom et al., 2009). CF acts as an indicator for acidification and eutrophication because a lower (or more efficient) use of nitrogen leads to less greenhouse gas emissions (in the form of nitrogen oxide) as well as less ocean acidification and eutrophication. Decreased GHG emissions can result from a more efficient food production, so CF also acts as an indicator for land-use (Roös et al, 2013).

3. Process

3.1 Flow Diagram of Research Set-Up

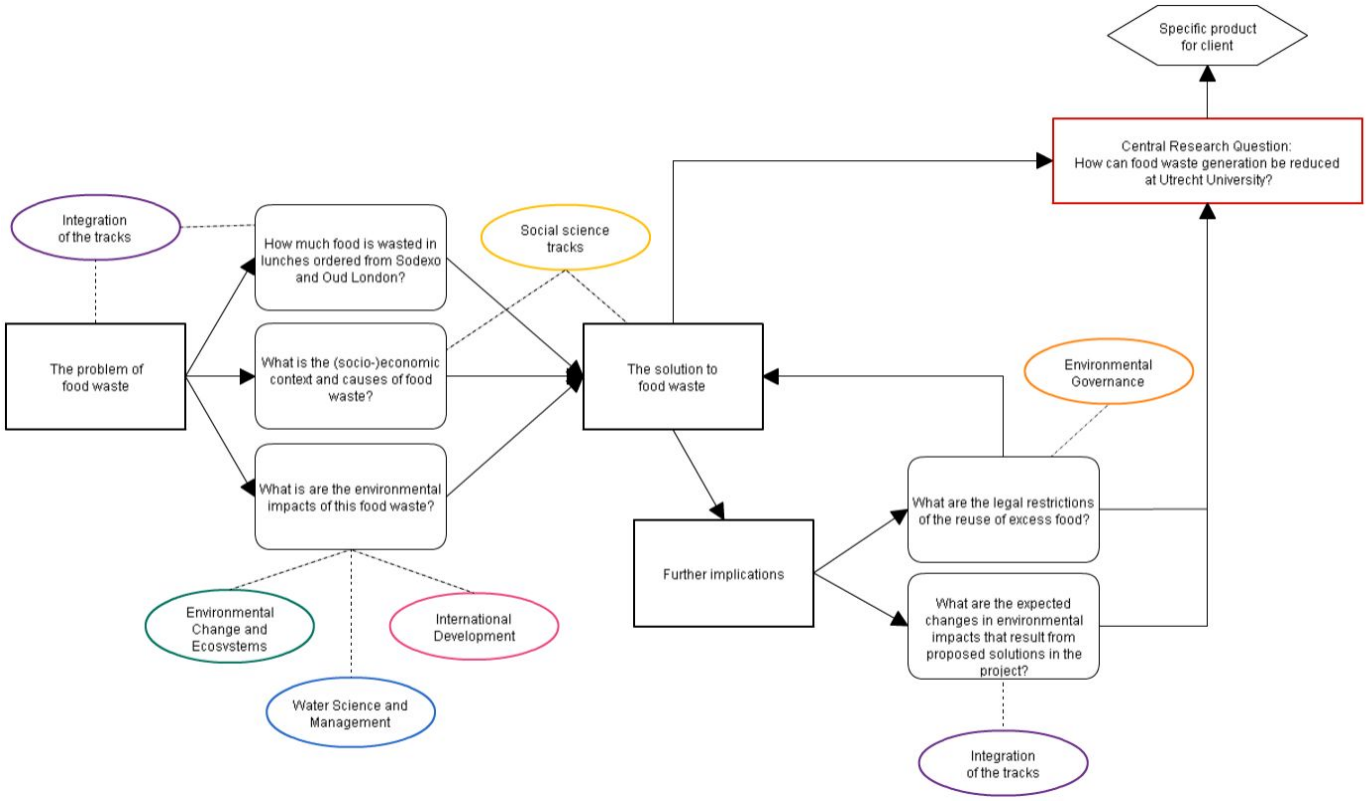

Fig. 2 - Research flow diagram

3.1.1 Integration description

The flow diagram visualizes the content of this paper and the pathway to the central research questions. In order to answer the central research question, first the extent of the problem needs to be clear. Therefore, it needs to be clear how much food is wasted, what the context of this food waste is and what the resulting impacts of this waste are. From this stage an integrated approach is necessary, as the problem of food waste has many aspects. This information concerning the problems is necessary to propose solutions, which are examined in the discussion section. Literature and interviews from a social science approach are also used to answer this subquestion. Thereafter, the proposed solutions have to be taken in a wider context. This includes an overview of the legal restrictions concerning excess food. In addition, the expected changes that would result from the proposed solutions are presented, for which an integrated approach is necessary. In summary, the detailed problem description helps to formulate solutions which have further implications. These solutions and its implications lead to the answer to the central research question. Finally, the end products for the client will be based on the answer to the central research question.

3.2 Proposed End Products

Based on the outcomes of this scientific report, three end products will be developed for the client. Firstly, a workshop will be designed that can be attended by clients who order catering often. The goal of this workshop will be to raise awareness and knowledge among clients in order to reduce food waste at the ordering side of the process. Secondly, recommendations will be given for adopting food waste reducing criteria for potential caterers. The final outcome will be the development of a website to show the carbon and water footprint of foods normally consumed in lunches. Its aim is to maintain awareness around the issues raised in this research.

4. Methodology

The research is divided into three different phases, which are not necessarily performed chronologically. The first phase explores the socio-economic causes and context for food waste in general. The second phase entails data collection to quantify the extent of food waste within UU catered services. The third phase investigates the environmental impacts of the quantified waste, calculating water and carbon footprints. In the sections below, the methodology of each phase is detailed. The outcomes of these three phases will shape the proposed solutions to reducing food waste.

4.1 Socio-Economic Context and Causes of Food Waste

Determining the various causes of food waste required a small literature review. Food waste generation can occur at many different levels (i.e. household, commercial, etc.), so the literature review focuses on research conducted on food waste in the hospitality sector. This provided a general overview of how food waste could occur. This was then used as a foundation to be able to narrow in on the specific context of food waste at the University.

In order to facilitate the understanding of attitudes and perceptions surrounding food waste at the university, semi-structured themed interviews were conducted with various stakeholders. These interviews were held with the secretaries who ordered most for various events. This was determined by examining the orders from September 2016 and determining the top ten secretaries who placed the most orders. Eventually four interviews were performed and three more responses on the questions were given by email. Furthermore, an interview with the operational manager from Oud London was also carried out. Appendix 1 contains the questions for these interviews.

4.2 Quantification of Utrecht University's Food Waste

Before coming up with solutions to reducing food waste in UU catering services, data needed to be collected on how much food was actually wasted. 'Waste' was defined as what was leftover from an event compared to the original order. It could not be defined as what actually got thrown into the bin because oftentimes after an event, the leftovers would get taken by students or put into department lounges for other staff to eat. As a result, how much was ordered and how much was left over was the focus for this research.

The method was through registration forms and primary counting of the waste. As mentioned before, this research focused on waste in lunches and coffee and tea sets that are ordered for University events. For the counting of leftover products, a form was created for both caterers (See Appendix 2 and Appendix 3).

- Oud London employees agreed to register the leftover products from their catered events. The measuring took place for a period of two weeks (from 26 September to 9 October 2016).
- In the case of Sodexo, the registration was done by attendees of the events themselves. At relatively smaller events, the forms were distributed with the order and collected by the Sodexo employees when they come by to clear the food after the event. The measuring took place for two weeks as well (from 3 to 16 October 2016).

  At the larger events, at least two researchers were present to collect the waste data directly following the schedule of these larger events as given by Sodexo. The researchers were available to count the leftovers as soon as the event ended. Based on the frequency of these events, the measuring period was three weeks (from 3 to 23 October 2016).
- A previous study carried out by Sodexo in conjunction with the FSC (from 1 February to 12 February 2016) was also included as part of the data for the coffee and tea waste studies.

4.2.1 Results Processing

At the end of the data collection periods, the results from the data collection were analyzed in Excel and comparisons were made with the amounts in the original orders. Of the original orders of small lunch events catered by Sodexo, only the standard lunch package orders have been taken into account (Basic and Luxury lunches A, B and C. See Appendix 4). These represented 70 percent of the lunch orders during the counting period. Due to the limited number of forms filled out by consumers of Sodexo lunches, an extrapolation of the results were needed to calculate the total amount of food waste during the counting period. Due to lack of data, no comparison could be made between food waste and original lunch orders from Oud London.

Food waste was counted in terms of units left-over, not in weight. To calculate the carbon footprint and water footprint, the average weights of these products were needed. The average weight of sandwiches and the toppings were given by Timo Bierhoff, hospitality manager at Sodexo Education at Utrecht University. The average weight of pieces of fruit were derived from http://www.voedingswaardetabel.nl.

Due to different counting methods at the Sodexo lunches (explained above), sometimes sandwiches were not counted by what their topping was but just counted ‘sandwich’ as one category. However, there can be large differences between the footprints of sandwiches based on their toppings. Therefore, the footprint of an “average” sandwich needed to be calculated. Of all sandwiches, roughly 50 percent had cheese and 50 percent had meat toppings. The meat toppings consisted of mostly chicken and pork meat (both 40 percent), a

smaller fraction of beef (14 percent), and on average 6 percent of fish (personal correspondence with T. Bierhoff). Therefore, the average sandwich can be calculated as:

$$Bread + 0.5 * cheese\ topping + 0.5 * (0.4 * chicken + 0.4 * pork + 0.14 * beef + 0.6 * fish)$$

4.3 Environmental Impacts of Utrecht University's Food Waste

4.3.1 Water Footprint

Water footprint (WF) calculations were based on the Water Footprint Network assessment in which the water footprint of a product is defined as the total volume of freshwater directly or indirectly used for the production of the product. For example, in the Netherlands, it requires 1,300 liters of water to produce a kilogram of wheat and 15,500 liters to produce a kilogram of beef (Chapagain & James, 2011).

The green, blue and grey water footprints of products are from the calculation of Mekonnen and Hoekstra (2010, 2011 & 2012). The WF of the products were then estimated from these calculation results and applied to the quantified food waste. The WF measurements are given in cubic metres of water per tonne of production, or liters per kilogram.

Mekonnen and Hoekstra (2010, 2011 & 2012) calculated the WF of the final product by summing up all the water footprints of each step, or process, required to produce that particular product. For example, a piece of bread will require wheat to be grown, milled, and processed to ultimately have the finished product. Each of the steps have a direct and indirect water footprint. The direct WF of one process becomes the indirect WF of the next process. By this, the WF of the product takes into account the full amount of water consumed or polluted by the product.

A number of products have been excluded for the analysis of the WF because of absence of proper data sets. For instance, fish is not included and several authors point out that no water consumption can be associated with marine fisheries and seafoods (Zimmer & Renault 2003). Also, it can be argued that brackish and marine aquaculture are not water consumptive because of the lack of demand of marine and brackish waters (Brummett, 2006). Tea is also not included because tea service by the caterers at UU consists of hot water and a tea bag. Thus, the tea bags are never used when the water is not use. The only quantification that can be done on this is on the footprint of the hot water intended for tea. However, it can be said that the footprint of hot water is more of an energy footprint than water footprint.

It should also be noted that in calculating the WF of complex products that had more than one ingredient, an estimation of the composition was made where possible and in cases where estimation was not possible, the waste was assumed to consist of a single ingredient with the most significant share of the product component. For example, the sandwiches are made of bread and toppings (e.g. beef). In this case the WF is the total of sandwich bread footprint and that of the beef topping. Chicken curry has been assumed to be made of chicken although other ingredients (e.g. broth, spices) are also used within this product.

4.3.2 Carbon Footprint

Calculating the carbon footprint (CF) of various products required a sophisticated life cycle analysis. In this report, only peer reviewed results of these life cycle analyses were used to calculate the footprint of the products served at lunches from Sodexo and Oud London. The CF is defined as: kg CO_2 equivalent greenhouse gases emitted per kg of product.

Hereafter follows a list of the studies that were used to calculate the CF of the products and a brief summary of their methods. An overview of the CF of each product can be found in Appendix 5.

Hamerschlag & Venkat (2011) calculated the CF of various protein rich foods of both animal and plant origin consumed in the United States. Their results represent the CF of pork, beef, chicken, salmon, milk, cow cheese and eggs. No life cycle analysis of goat cheese could be found, and therefore the CF of goat cheese is assumed to be equal to cheese produced from cow milk. For Tuna fish, no scientific peer reviewed results could be found, therefore the CF used here is derived from a general website ("Food's Carbon Footprint", 2016).

The CF of bread was derived from the analysis of Espinoza-Orias et al. (2011), which calculated the CF of white, brown and wholemeal bread produced and consumed in the United Kingdom. No distinction between white, brown and wholemeal bread was made during counting of the food waste. Here, the CF of white bread (thick slices, plastic bag) was used as most Sodexo sandwiches served were white. The CF of white bread is 7% larger than that of wholemeal bread.

Stoessel et al. (2012) provided the CF of a variety of fruits and vegetables handled by a Swiss retailer. The location of consumption (and therefore the transport emissions in the life cycle analysis) is Switzerland. Here, the CF of fruits often consumed in the Netherlands and served by Sodexo and Oud London were used: banana, orange, clementine, pear and apple.

Doublet et al. (2013) carried out a life cycle assessment (LCA) of orange juice, specifically on not-from concentrate juice produced in Spain. The LCA does not include emissions from distribution and selling by retailers.

Büsser & Jungbluth (2009) analyzed the CF of coffee produced in Brazil and consumed in Europe.

5. Results

5.1 Socio-Economic Context and Causes

Much of the literature on food waste focuses on food waste generation in the household as opposed to the hospitality sector. In addition, the research tends to be from a technological perspective without paying much mind to the much more subjective, cultural side. The "how

much" of food waste is fairly straightforward in terms of data collection. However, it is the "why" that involves a more convoluted form of research since it requires more than just numbers. The context of food waste is important because it is this area that needs to be addressed in order to reduce the generation in the first place.

One reason why this research is more convoluted is that there are many parties involved and each have their own motives and purposes. These stakeholders were identified along in the catering chain:

- Those organizing the event
- Those who actually submit an order for food
- Those who will consume the food
- Those who supply the food (caterers)
- Those who coordinate the interaction (if applicable; a facilities management of some type)

Papargyropoulou et al. (2016), concisely explains the major causes of food waste generation in the hospitality sector. They mentioned the main themes of concern to be the hospitality mindset and lack of communication among the various stakeholders. People tend to order too much as a display of hospitality and this can be applied to nearly everyone in the catering chain. If someone is holding a meeting with important clients, they will not want to appear stingy or as if they do not care about their guests. Often it is the secretaries and assistants who order for catered events and they do not want to order too little for the same reason as above. To an extent, they are responsible for the image of their bosses and do not want them to look bad. They also do not want to get into trouble with their bosses.

On the catering side, there is the attitude of "the customer is always right". Waiters/ caterers cannot be too pushy in telling their customers that they are ordering too much for the event, as ultimately it is the choice of the customer. Even if the caterer sees the order form and can tell the amount is going to be too large, they will be wary of pressing this point too far. In addition, food services in the hospitality sector are more concerned with food waste in the preparation phase. The food waste during production directly causes them loss in revenue due to wasted materials. Food waste after the food has been purchased doesn't matter as much from a business perspective because they have been paid for the amount of food regardless. Most caterers won't even consider this as waste at all.

Poor communication among these stakeholders is also an issue. There tends to be minimal contact between those who order, those who prepare, and those who will actually attend the event. For example, a boss could tell their secretary how many people will be at the event and then not update them if that number changes. Tied to this point is the fact that these stakeholders have different priorities. Continuing from the previous example, if the secretary is informed of a lower number of people coming to the event, the catering company may not allow them to decrease the amount in the order because that means that they will lose money. This means that the order will stay the same even though there aren't enough people at the event to consume it all.

Finally, there are strict rules tied to legal issues around food. It is an EU law that perishable food can only be left out of the refrigerator for a maximum of two hours before it needs to be thrown away. This is quite a conservative time limit, but caterers are not willing to experiment with it due to fear of a lawsuit from foodborne illnesses. The legal implications of food waste solutions will be further examined in the discussion section of this report.

As for the socio-economic context, this is different depending on the place. A lot of the literature on food waste generation focuses on places where food waste is very high for somewhat concrete cultural reasons. For example, in many Southeast Asian countries men feel that providing an extraordinary amount of food is the best way to show how much they have (Papargyropoulou et al., 2016). To be able to give a more specific context for UU, food culture in the Netherlands must be examined. Several interviews were conducted with secretaries at the Uithof and asked them about the food ordering process. Our conversations have yielded the following information on ordering and catering.

The Sodexo catering menu does not list the amount of food included in each lunch set. It will list the type of sandwiches and then the secretaries order a lunch set for a certain number of people. However, this means that Sodexo has decided the portion sizes. The ICT assistant at the Bestuursgebouw said that she would prefer the exact number of sandwiches to be included on the menu because she has been ordering food for training events for a long time and has identified patterns that help with her ordering. For example, events with more men tend to need more food. She knows the gender makeup of the events before ordering the food because the registration forms for the events are submitted to her.

This same assistant also said that she asks the attendees if they would like lunch provided for them at the event. This was originally for the purpose of giving them the option of bringing their own lunch due to preference/ dietary restrictions. However, it also serves the purpose of letting the attendees know that there will be food available. Thus, they will not eat beforehand and there will not be any unnecessary waste due to lack of knowledge that food would be available.

This assistant was particularly cognizant of food waste issues and said that it affects her ordering by being more conservative. She says that if she is on the fence with a particular event, she will order a little bit less because she would rather not waste food and money. She did acknowledge, however, that she was likely the exception and that most of the secretaries she knows have a concern with hospitality and will order on the more liberal end of catering needs.

The facilitaire organizer at the Uithof also had some interesting insights. She oversees a team of 24 exam facilitaires and orders food for them if they are proctoring evening exams. Her ordering is very specific and she essentially never has any waste. She is the one who organizes the placements of the facilitaires, so if she puts four facilitaires at an exam then she will order four sandwiches for them. Furthermore, she has worked with this team for a long time and knows their preferences. If there is an exam with facilitaires who are tea drinkers, she will not order any coffee. This is a particular type of catering ordering that allows for such specificity.

On the production side, two of the researchers of this group were able to talk to a Sodexo employee at an event where they were counting food waste. This employee said that he sees so much waste at most events and thinks it is a communication issue. He said that people order too much for events to be on the safe side, but that things like sandwiches can be adjusted last minute. He mentioned that people should order more conservatively and if more people show up to the event or if there is not enough, then the kitchen can be notified and more sandwiches made quickly. Secretaries likely do not know that this is an option, so there is a lack of communication at work here.

Interviewing the operational manager at Oud London yielded similar findings in terms of communication. He mentioned that 90% of their orders come from the University and because they have an agreement, the portion sizes and cost estimations are clearly laid out in the menu. However, most people do not read this information. When people place orders with Oud London through phone or email, the operational manager will try to give advice on adjusting the order if he thinks it is too much. Most people are not party planners and he has been doing this job for a long time, so he thinks it is part of his job to offer his expertise. However, he acknowledged that if the client really was adamant on their original amount, then he would not pursue with his advice.

5.2 Quantification

5.2.1 Food Waste through Oud London Catering

The waste amount generated from the Oud London study site are as summarized in Table 1. Only the amounts wasted are given for this study site because the ordered amounts were not available in time for a comparison with the waste.

Table 1: Quantity of food wasted in Oud London catered events and the resulting carbon and water footprints

Item	**Left uneaten Pieces/volume**	**Carbon footprint of waste (kg CO2)**	**Water footprint of waste (liters)**
Coffee (L)	141	38.49	522828
Tea (L)	76.5		
Juice (orange) (L)	7	4.676	7126
Milk (L)	17	18.05	17340
Sandwich meat	140	63.88	58243.5
Sandwich cheese	123	45.46	22441.4
Sandwich fish	6	1.37	

Sandwich vegan	37	7.05	6673
Hot snack	51		
Soup (L)	2.25		
Pastry	150		
Cookies	32		
Cake	121		
Total		179	634651.8

5.2.2 Food Waste through Sodexo Catering

5.2.2a At Bigger Events

Overall, 15 percent of the total food served at the big events was wasted (Table 2). Table 3 summarizes the descriptive data about the food waste patterns of these events as collected by the researchers. Out of the 15 percent waste, there are significant variations among different groups of food. Meat and fish together with the group of dairy products account for the most waste at around 44 percent and 35 percent respectively. The beverages together with fruits and vegetables are the groups with the least amount of waste.

Table 2: Food quantity ordered and estimates of food left at the big lunch events

Date	**Amount of food ordered per the intended group number**	**Amount of food left uneaten per person**
5/10/2016	60	26
7/10/2016	120	24
8/10/2016	250	25
10/10/2016	20	8
11/10/2016	45	14
12/10/2016	300	22
% of waste		14.97%

Table 3: The events' food waste patterns

	% of events left uneaten
General event food waste	15.00%
Fruit and vegetable waste	5.50%
Meat and fish waste	44.00%
Dairy Product waste	35.00%
Bread and other bakery product waste	11.50%
Beverages i.e Juices, Karne & normal milk	4.00%

The categories of the food waste for these events are shown in Appendix 5. The specific categories of food wasted as well as the resulting carbon and water footprints are given.

The higher values of general event food waste in comparison with the given food categories demonstrates that there is a possibility of the tendency to waste other food types that are not included in this event category survey. Perhaps items such as desserts, soups, pastries etc. contribute to the higher total food waste percentage.

5.2.2b At Smaller Events

Table 4 summarizes the results of the food counted by consumers of lunches at small events catered by Sodexo. For most of the products, the waste is around 20 percent. The waste percentage of fish and fruit is higher but the total amount of fish sandwiches served is notably lower than that of meat and cheese sandwiches, which may explain the higher percentage of waste. Leftover meat and cheese sandwiches are more or less equal, however, the CF of cheese sandwiches is almost twice as high while the WF of meat sandwiches is higher.

Table 4: Percentage of food wasted at small Sodexo events

Type of food	**Percentage wasted**	**Extrapolation of units Wasted**	**Carbon Footprint (kg CO_2)**	**Water Footprint (L)**
All sandwiches	21,4	877		
Meat sandwiches	20,8	358	79,1	64616
Cheese sandwiches	19,2	366	135,27	55559
Fish sandwiches	30	57	10,17	0
Krentenbol	20	57	-	-
Fruit	27,1	371	13,5	19715

Orange juice (L)	16,7	16	2,67	4072
Milk / Buttermilk (L)	21,5	59	15,66	15045
Total	**-**		**256**	**159007**

This waste was counted by consumers at the University who filled in the forms distributed by Sodexo at small lunch events of under 50 people. These percentages are used to estimate the total amount of food waste from basic and luxury lunches catered by Sodexo.

5.2.3 Previous Waste Audit Results

The waste audits on coffee and tea previously performed by FSC in conjunction with Sodexo for the period 1-12 February 2016 are also presented. This waste audit included both the ordered amount and the amount left at the end of the meetings. This audit was in an attempt to determine the percentage of an order that would potentially end up wasted. In this audit, the percentage of the coffee waste to what was ordered was estimated at 39 percent and 40 percent for coffee and tea respectively (Table 5). This result is only an indication of small fraction of the waste as the data is only for one University building.

Table 5: Coffee and tea ordered and estimates of the quantity left (For Bestuursgebouw)

Dates	Ordered coffee per liter	Coffee waste per liter	% coffee waste per liter	Ordered tea per liter	Tea waste per liter	%tea waste per liter
2/1/2016	30	14	47%	25	11	44%
2/2/2016	30.1	20	66%	23.1	12	52%
2/3/2016	5.6	2	36%	5.6	4	71%
2/4/2016	26.8	8	30%	22.8	8	35%
2/5/2016	5.6	1	18%	5.6	1	18%
2/8/2016	45.6	18	39%	38.6	15	39%
2/9/2016	56	18	32%	39	18	46%
2/10/2016	9.5	4	42%	21.5	5	23%
2/11/2016	48.1	17	35%	33.1	14	42%
2/12/2016	6.9	1	14%	6.9	1	14%
Waste coffee & tea			**39%**			**40%**

5.3 Environmental Impacts

5.3.1 Water Footprint

The water footprint of food waste from the Oud London audit is approximately 634,652 liters, 139,655 liters for bigger Sodexo events and 159,007 liters for smaller Sodexo events. From these, the WF of the total waste is approximated at 933,314 liters for the period of data collection. This total amount of the WF represents a cumulative picture of UU water consumption and pollution of freshwater resources.

The products with the biggest WF from the waste are meat products followed by the dairy products. This information is presented in Table 1, Table 4, and Appendix 5.

5.3.2 Carbon Footprint

The carbon footprint of food waste was 136 kg from Oud London, 179 kg for bigger Sodexo events, and 256 kg smaller Sodexo events. In sum, this amounts to 571 kg of CO_2 equivalent greenhouse gas emissions from the total food waste. This total amount gives an illustration of the magnitude of GHG emissions resulting from the production of food that remains uneaten.

As with the WF, the products with the highest CF per kg of products are beef and cheese and to a lesser extent, pork, chicken, and fish (See Appendix 5).

6. Discussion

6.1 Summary of the Results

The aim of this research was to indicate the amount and impact of food wasted in catering at Utrecht University, and to propose solutions to reduce this food waste. To guide this research, the following central research question was formulated: ‘How can food waste generation be reduced at Utrecht University?

First, the socio-economic context and causes were investigated. From this research, it appeared that the food waste procurement at the UU has multiple causes and it is important to see this in a wider context. Firstly, the involvement of different stakeholders and the lack of communication between them hinders solutions for food waste. For example, it appeared that some people who order are uncertain about the amount of food per person. Moreover, some orderers want to get more influence in what exactly will be ordered based on the characteristics of the attendees. Another example that shows the problem of the lack of communication is that it is unclear for many whether caterers can make extra food ‘on the fly’. Secondly, the attitudes and mindset of different parties play a role. Both the people who order and the caterers have a strong sense of need for hospitality, which is combined with

the ‘customer is always right’ attitude from the caterers. Lastly, some legal rules aggravate the amount of food wasted. This will be elaborated upon later in section 6.4.2.

The socio-economic context and the causes of food waste from UU procurement are important when finding solutions for the problem. The proposed solutions which are provided in the next section will use these causes and context as a starting point.

Secondly, leftover food was counted to get an overview of the amount of food wasted in catering at Utrecht University. It was seen that at both Oud London and Sodexo, a large amount of food was wasted. For example, at Oud London catering, a total amount of 306 sandwiches, 182 pastries and cakes, and 241,5 liter of various drinks was left over from catered events and meetings. At Sodexo, on average, 15 percent of the food at bigger events and 20 percent at smaller events was wasted. In addition, another previous waste audit showed that about 40 percent of coffee and tea was left over and wasted. This quantification of leftover food makes it apparent that food waste from UU procurement is a problem that is important to be tackled.

Thereafter, the environmental impacts from this food waste were calculated. Regarding the water footprint, it was found in this research that the total amount of water that was needed to produce the food that was eventually wasted was 933,314 liters. The food waste auditing did not occur at all the meetings and events and not all food products’ footprints were calculated because of difficulty in measuring the WF. This makes the total water footprint presented above not fully representative of the waste, which implies that the WF of the waste during the period of data collection was likely even higher. The calculation of the carbon footprint showed that in the time period of data collection, 571 kg of CO_2 equivalent greenhouse gas was emitted to produce the food that was eventually wasted. These calculations make the importance of the problem of food waste even more apparent. The environmental impact of producing food that is eventually thrown away should not be underestimated. These environmental impacts show that solutions need to be proposed which can help to reduce food waste and by that reducing the environmental impact.

6.2. Solutions

In this section the proposed solutions will be explained. These solutions are based on the outcomes from the different sub questions of this research. During the research it became evident that for both the caterers and the people who order, improvements could be made in order to reduce food waste at the UU. Therefore, the proposed solutions can be roughly divided in two sections: suggestions for the caterers and for those who order (customers).

6.2.1 Caterers

There are several aspects that caterers can change to contribute to reducing food waste. Firstly, it is recommended that the caterers carry on with the counting of the remaining food at the end of meetings and events. This is an effective way of gaining insights in the amount of food waste, identifying past patterns and creating awareness. Caterers can use these insights to make adjustments. For example, Oud London already noticed after the food

counting that 2,5 sandwich per person might be too much, and considered changing this to 2 sandwiches per person. In addition, identifying food waste patterns can give insights in what type of food is mostly wasted, which can lead to the probability that certain types of food should be removed or changed. For example, the results from the counting of food waste indicated that a substantial amount of pastries and cakes remained uneaten. Therefore, the quantity of such items which are served should be reduced. If bakery goods are to be supplied, consideration should be given to providing items that are suitable for serving in sealed packages. A limitation to this however is that this may not be the image that the caterers would like to portray. An alternative would be to provide a healthier option by substituting the sweet bakery selections with whole pieces of fruit. Another observation was that more coffee than tea remains after meetings and events. This is an area that can be difficult to predict, however a move away from pre-made coffee should be considered or were pre made coffee is required it should be served in smaller thermos jugs. Depending on the size and type of the event (where there are external attendees), the use of a mobile coffee bar may be an option. For smaller internal events, another possibility would be to encourage staff to bring their own coffee and to make use of the coffee machines already in the building.

Caterers could work together to exchange best practices regarding counting and reducing food waste. There is also some software that is available to aid, such as Leanpath. This software is designed to record food that will go to waste, but can track mostly any food that needs tracking. Once a structured way of counting is found, it is expected that the task might not be too hard or too time consuming. Furthermore, the food counting data might even be forwarded to the ones who ordered or organized the event as feedback and recommendations for ordering for future events.

Secondly, caterers are encouraged to be more transparent and communicative towards their clients. The menus or food books can be even more clear in terms of food quantity, as currently it is clear for only some lunch types exactly how much food is supplied per person. Moreover, the food ordering portals should be adapted to make use of data and best practice information on food waste. For example, it needs to be made clear how many sandwiches are normally ordered per person, with some suggestions on how many to order depending on the situation. This can then be used to provide information and create awareness about the amount of food waste, making people cognizant of the fact that often too much food is ordered. This makes it more likely that people who order are more aware of the amount of food they order and ordering too much food becomes a conscious decision. Furthermore, caterers could also be more proactive in using their experience and knowledge to give recommendations to their clients. Often caterers already expect that an order is going to be too much, but hesitate to advise the client to order less as ‘the client is king’. This also requires a change in mindset, putting the need for reducing food waste above the feeling of not wanting to be blunt.

There are also more practical solutions to be mentioned. Caterers could be encouraged to focus on food types that do not easily spoil. For example, fruit salad that must be thrown away after an event is often served, while whole pieces of fruit like apples or pears can be conserved. Milk and juices are currently served in jugs, so the leftover content can not be

used again. Caterers should consider investing in milk and juice that is already in nice looking containers or bottles, so it doesn't have to be poured into a separate jug. In this way, the leftover drinks can be used at a different event. However, these bottles are often more expensive, so the caterers need some external incentive or motivation to invest in these. Therefore, an interim step would be to start serving such beverages in smaller jugs. Another practical solution for caterers is to move away from buffet-style meals and focus on walking lunches and dinners. There is already a decrease in the amount of buffets, and this decrease should be continued. Serving less sandwiches to begin with, and making new ones on the fly if they are needed would also help to reduce food waste. However, it is understood that this is not always feasible, so it should be examined per situation if this is a possibility.

Lastly, it will be useful for caterers the have more insight into the needs and wishes of their users. Currently, the FSC has yearly questionnaires on customers satisfaction, though on the topic of catering only an average overall grade is provided. It would be informative to add more specific questions to price-quality, health and sustainability so the caterer can adjust their policy to the needs of their customers.

Currently, the caterers are somewhat reserved in taking measures concerning food waste as hospitality is seen as the most important aspect. Therefore, it is important that the University works closely with their current caterers, seeking their advice and encouraging them to consider advise on measures that could reduce the amount of food and beverages that is wasted.

6.2.2 Customers

A first important suggestion to reduce food waste is to create more awareness among people who order. The consequences of ordering too much food have to be clear and well understood by the customers. During this research, it became apparent that a lot of people order too much because they see a solution in giving the leftover food to other employees. Although this is better than throwing the food away, this is not a real solution. When employees who eat the extra lunch throw away their food they brought from home, or when they are eating more than they would normally do, the problem is just shifting but not solved. These things have to be made clear to those who order, so customers should be provided with knowledge and awareness of the whole food catering proces.

In a workshop that can be provided to people who order a lot, this awareness is created through hints and tips regarding the ordering process. For example, a tip for the customers could be to ask if people want lunch in the event invitations, or make clear that there will be lunch so that people don't bring their own food as well. Another tip could be that people ordering food for an event or meeting could look at the demographics of the attendees. For example, sex and age distribution can be indicators of consumption patterns customers could base their order on this instead of only on the amount of attendees. In general, a culture should be developed in which a meeting or event is seen as a success not only when the quality of the food was good, but also when there is no leftover food waste. A sample plan for the proposed workshop is detailed in Appendix 6.

In addition, there should be more awareness among those who attend the meetings or events. This can be achieved by measures such as making posters in meeting rooms that explain what Utrecht University is doing to reduce food waste.

Another suggestion is to appoint one person or a couple of people who are specialized in ordering food to consolidate the task. In this way, the orders can be based on previous experiences and best practices can be used to estimate the amount of food needed. When ordering is arranged in this way, it might even be possible to combine the catering for events or meetings which are around the same time. However, if this option is not feasible, it is at least encouraged that interaction and communication between people who order is stimulated, encouraging improvements based on best practices.

6.3 End Products Outcome

The following end products were delivered to the client. Firstly, a detailed plan to facilitate the running of a food waste awareness workshop was provided. The main aim of this workshop is to create greater awareness of food waste, why it is important to reduce it, which solutions are available, and how the people who order food can contribute. Its target audience are the employees of Utrecht University who are actively involved in ordering catering for meetings and events. The workshop is designed to be interactive, providing the opportunity for participants to discuss issues and learn from one another. The necessary tools to run the workshop were also supplied. These included a list of potential attendees, a presentation, and a spreadsheet which calculates the carbon and water footprint of typical lunch items. This latter item is supplied to facilitate one of the interactive sessions.

The second product delivered to the client was in the form of proposed modifications to the catering tender. The goal of these recommendations is two-fold. Firstly, to reduce waste directly by improving the criteria in terms of the quantity and types of food supplied. Secondly, it should easier for caterers to make adjustments in order to reduce food waste. By explicitly mentioning the importance that the University places on addressing issues of food waste in the tender, it becomes easier for the caterers to alter their way of thinking and to make significant changes.The recommendations for the tender are not included in the rapport but send to the client separately due to the confidentiality of the tender.

The final end product has been the creation of the website http://foodprint.ga. This simple website allows users to enter the details of the items they have had for lunch. From these details, the website calculates the carbon and water footprints of the foods specified. In order to put these figures into context, they then get converted to show how many kilometers in an average car they represent, as well as how many bathtubs of water they would fill. The aim of the website is to create awareness and make people think about the impact their lunch has.

6.4 Further Implications

6.4.1 Expected Changes in Environmental Impacts

The results from the data collection show the estimates of food waste quantities that occur at UU. These quantities reminds us that the problem of food waste still exists, the University plays a role, and that this amount of food waste comes with consequences. For example, the carbon footprint of all food wasted at small lunches events catered by Sodexo sums up to 256 kg CO_2, which is about the same as driving an average car for about 1600 km. The Water Footprint is about 160,000 L, which is about the same as 2000 bathtubs full of water.

From an environmental point of view, this food waste can be seen as an inefficient use of ecological services (Nellemann et al, 2009). This is because the production of food requires finite environmental resources which goes in vain when food is wasted. For example, the carbon and water footprints are attached to the amount of waste, so food waste pollutes the atmosphere and plays a role in global warming. This food waste can be said to also contribute to the problem of water scarcity as the amount of water attached to the waste is not directly available for use any more.

This calls for strategic actions to achieve sustainable and efficient resource use. This report has suggested several solutions in combatting food waste, and the following part will outline the expected changes in the environmental impacts of these solutions. Some of the proposed actions are a workshop, moving towards a more plant-based diet, and creating awareness.

The workshop will be held for the 20 people who order the most food for small events at Utrecht University, where on average 20 percent of the food is wasted. Most of them will be secretaries as they often order food for events in various departments. This workshop will help the people who order gauge a better estimation on how much they have to order if they know how many people are attending. It will also give them the opportunity to connect with the caterers, as lack of communication between customers and caterers was found to be an important cause in food waste. It is not possible to give an indication on the eventual reduction of the food waste once the customers have followed the workshop.

Moving towards a more plant-based diet is one of the pieces of advice given to Utrecht University to incorporate in the tender for catering. This can result in a decrease in greenhouse gas emissions from agriculture (Tilman & Clark, 2014). In the results of this study, it was found that especially meats and cheeses have large carbon and water footprints. Currently, the basic menu of sandwiches offered for lunch from Sodexo consists of one cheese and one meat sandwich. Changing the default option of meat and cheese to vegan options will significantly reduce the carbon and water footprint resulted from the served and wasted food.

The publication of the results of this research will raise awareness among employees of the university and the caterer. This awareness will result in a more conscious use of food and a reduction of food waste not only at the University, but people will also apply it in their further life.

6.4.2 Legal Restrictions

Once food is prepared and serviced, it does not necessarily have to go to waste. The reuse of the produce could mean potential waste can get a second life. In this section, the (legal) restrictions on the reuse of excess food are set out. Consequently, this might strengthen the focus on the reduction of food waste rather than reuse in this research.

The restrictions on the reuse of food waste can be categorized in distribution, transport and legal obstacles.

One of the main legal restrictions on the reuse of food stems from the Regulation of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuff, indicating strict rules on hygiene and responsibility for food safety. The law also states “All food waste is to be eliminated in a hygienic or environmentally friendly way(...)”, though this is complicated by the strict regulation set in the very same law.

In addition, the HACCP states that food, both unpackaged and packaged, which has been unrefrigerated for two hours, has to be discarded. The last major restriction on flexible use of food is the ‘best before’ labeling, which is the cause of many still-edible foods being thrown in the bin.

During an interview with sustainable caterer Peter Pan, it was mentioned that people at food banks are often reluctant to accept foods which are not sealed and labelled. Even though the soup is freshly made, he has experienced suspicious behaviour when arriving at the collection centers and consequently is less likely to donate foods in the future.

Altogether, these European and national laws as well as behavioural consequences make the reuse less likely. Therefore, the focus of this research on the reduction of food waste occurring in the first place seems to be more effective as well as more probable to implement.

6.5 Limitations of the Research

There are a few limitations of this study that need to be mentioned and explained. First, the food chain includes many stakeholders, but this study chose to focus on the consumption stage of wastage in order to measure the magnitude of the food waste problem. The focus on consumption stage stakeholders ignored the role of the other participants in the food waste process. This limitation is likely to prevent the understanding of the food waste problem in its entirety. Focusing on consumption stage only, however, should be considered as a first important turning point to understand the intended groups’ habits.

Secondly, assessing the exact extent of the food waste problem at UU suffers from subjectivity due to the imperfections of food waste measuring. The measurement methods’ imperfections were a major problem for assessing precise reality and it was most evident in the counting of food waste at smaller Sodexo lunch events. Here, the people consuming the lunch had the chance to fill out the form after the lunch, however only 16 of these forms were filled out and returned. This represents 13 percent of the total of 123 lunches that were served during this period. Besides this low response, the quality of the responses is highly

uncertain, as there was no supervision as to whether people filled out the form completely and honestly. On one occasion, two researchers of this group arrived at a lunch location to count the leftover food and a form distributed by Sodexo was already filled out. However, the numbers given on the form were incomplete and didn't represent all the leftover waste. Therefore, the food waste percentage and total amount are likely to be underestimated in the results.

Finally, the current research paper employed a limited period of data collection in an attempt to measure the broader University food waste. When making inferences based on sample results, there is always a risk of obtaining results that are far from reality. The methodological chapter of the study outlines the practices and techniques used, but even when a flawless methodological design is applied, there is a risk of acquiring outcomes that deviate from the norm. Sufficient efforts have been made to get valid results, but the risk of not being completely objective will still always remain.

Due to limited time and the amount of data required for a product water footprint calculation, the use of average WF values were used to account for the WF of the food waste. A shortcoming of the use of global averages for the calculation of the WF is that it vaguely accounts for the internal and the external WF and since the products are produced in different regions, the water footprint may differ among regions and the global averages might not tell the exact footprint. This also limited the calculation of the imported WF by UU food waste.

In several ways, the carbon footprint calculations of specific products can be uncertain.
Firstly, the calculation of the CF requires a sophisticated life cycle analysis (LCA). Therefore only a limited amount of different products have gone through such a calculation. There is, for example, no LCA done of goat cheese, and thus in this research the CF of goat cheese has been assumed to be equal to cow cheese. The same applied to more processed and less known products (such as krentenbollen, frikandellen or egg salad). Because of the lack of LCA data, these had to be excluded from the CF calculations.

Secondly, LCA often also includes the transport to the consumer. Because of the limited amount of conducted LCAs, results from LCAs that consider the consumer to be located in the US, UK and Switzerland had to be used, as no data was available for the Netherlands.

Thirdly, the CF can differentiate for one product according to the origin of the raw food product and the method of processing and packaging. Therefore, the CF of a liter of orange juice can vary per brand or season. Again, due to the limited LCAs conducted, this research used the best known information published in scientific articles, but the results may deviate from reality.

6.6 Proposed Further Research

Due to the time limitations of this research, food waste was counted on only a limited amount of events and meetings. It is suggested that food counting continue in order to have a better sample size. This is important for two reasons. Firstly, an exhaustive overview of the food

waste can give further insights into possible solutions. For example, if it appears that specific types of food are wasted more often, adjustments could be made to reduce the waste of that specific product. Secondly, counting food waste is important as it can help in creating and keeping awareness among caterers and employees. Awareness is even more widespread when this data is shared with people who are attending the meetings and events.

Moreover, it is also proposed that the impact from the awareness-raising measures and the workshop be monitored. This follow-up can help to improve these measures. When it appears that not enough awareness is created, it should be considered to increase the measures or to make adjustments.

Another recommendation regarding the follow-up of this research is to interview or survey attendees from meetings and events. Due to time limitations, the views from these stakeholders were researched in this particular study, but it could be worthwhile to get information from these people as well. Attendees could give their view on the amount of food ordered, giving feedback and provide insights to improve the catering process. An additional benefit from interviewing or surveying attendees is that this could enhance the creation of awareness of food waste at the university even more as well.

7. Conclusion

In conclusion, it can be said that food waste is an environmental, economic, and ethical challenge. Its generation creates unnecessary destruction of the earth's finite resources. It is however, an issue that can be addressed by changing the mindset of individuals and creating awareness around the subject.

The findings of this research reaffirm those of other studies. They suggest that the choices made about food and waste are entrenched in the environment where the waste takes place, rather than in the attitude or motivation of actors involved. None of the stakeholders involved in the processes surrounding food ordered for meetings, lunch service and banqueting at the University, intentionally wanted to waste food. The research has shown that its occurrence was often the result of previous decisions or actions.

Based on the findings of this research a number of solutions have been highlighted. Their aim is to help both caterers and those who order food improve the daily routines through which food waste can arise. Utrecht University is already committed to adopting more sustainable practices, so the reduction of food waste should be very feasible with better communication and concentrated efforts.

References

Allan, J.A. (1993) 'Fortunately there are substitutes for water otherwise our hydro-political futures would be impossible' In: Priorities for water resources allocation and management, ODA, London, pp. 13-26.

Brummett, R.E. 2006. Role of Aquaculture in Increasing Water Productivity. Challenge Program on Water and Food - Aquatic Ecosystems and Fisheries Review Series 4. Theme 3 of CPWF. Worldfish Center, Cairo

Büsser, S., & Jungbluth, N. (2009). The role of flexible packaging in the life cycle of coffee and butter. *The International Journal of Life Cycle Assessment*, *14*(1), 80-91.

Carbon Trust (2007) Carbon Footprint Measurement Methodology, Version 1.1. *The Carbon Trust*, London, UK. http://www.carbontrust.co.uk.

Chapagain, A. K., & Hoekstra, A. Y. (2004). Water footprints of nations. Value of Water Research Report Series No. 16. UNESCO-IHE, Delft, the Netherlands.

Chapagain, A., & James, K. (2011). The water and carbon footprint of household food and drink waste in the UK. *Waste & Resources Action Programme (WRAP), Banbury, Oxon, UK & WWF, Godalming, Surrey, UK*

Cole, C. V., Duxbury, J., Freney, J., Heinemeyer, O., Minami, K., Mosier, A...& Zhao, Q. (1997). Global estimates of potential mitigation of greenhouse gas emissions by agriculture. *Nutrient cycling in Agroecosystems*, *49*(1-3), 221-228.

Doublet, G., Jungbluth, N., Flury, K., Stucki, M., & Schori, S. (2013). Life cycle assessment of orange juice. *SENSE-Harmonised Environmental Sustainability in the European food and drink chain, Seventh Framework Programme: Project no. 288974*. Funded by EC. Deliverable D 2.1 ESU-services Ltd.: Zürich.

Food and Agricultural Organisation (2013). Food wastage footprint-Impacts on natural resources: summary report.

Food and Agriculture Organization (2012). FAO Statistical Yearbook 2012 http://www.fao.org/docrep/015/i2490e/i2490e03a.pdf

Food's Carbon Footprint (2016, November 4) retreived from: http://www.greeneatz.com/foods-carbon-footprint.html

Espinoza-Orias, N., Stichnothe, H., & Azapagic, A. (2011). The carbon footprint of bread. *The International Journal of Life Cycle Assessment*, *16*(4), 351-365.

European Parliament Council (2008) Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 Concerning Integrated Pollution Prevention and Control

Ganglbauer, E., Fitzpatrick, G. & Comber, R. 2013, "Negotiating food waste: Using a practice lens to inform design", ACM Transactions on Computer-Human Interaction, vol. 20, no. 2.

Goonan, S., Mirosa, M. & Spence, H. 2014, "Getting a taste for food waste: a mixed methods ethnographic study into hospital food waste before patient consumption conducted at three New Zealand foodservice facilities", Journal of the Academy of Nutrition and Dietetics, vol. 114, no. 1, pp. 63-71.

Halloran, A., Clement, J., Kornum, N., Bucatariu, C. & Magid, J. 2014, "Addressing food waste reduction in Denmark", Food Policy, vol. 49, pp. 294-301.

Hamerschlag, K., & Venkat, K. (2011). *Meat Eater's Guide to Climate Change+ Health: Lifecycle Assessments: Methodology and Results 2011*. Environmental Working Group.

Hoekstra, A. Y., Chapagain, A. K., Aldaya, M. M., & Mekonnen, M. M. (2011). *The water footprint assessment manual: Setting the global standard*. Routledge

Lipinski, B., Hanson, C., Lomax, J., Kitinoja, L., Waite, R., & Searchinger, T. (2013). Reducing Food Loss and Waste. Working Paper, Installment 2 of Creating a Sustainable Food Future Washington, DC: World Resources Institute.

Mackenzie, J., Tan, P., Hoverman, S. & Baldwin, C. 2012, "The value and limitations of participatory action research methodology", Journal of hydrology, vol. 474, pp. 11-21.

Marthinsen, J., Sundt, P., Kaysen, O., & Kirkevaag, K. 2012, ‘’Prevention of Food Waste in Restaurants, Hotels, Canteens and Catering’’. Nordic Council of Ministers: Copenhagen

Mekonnen, M.M. and Hoekstra, A.Y. (2011) The green, blue and grey water footprint of crops and derived crop products, *Hydrology and Earth System Sciences*, 15(5): 1577-1600.

Mekonnen, M.M. and Hoekstra, A.Y. (2012) A global assessment of the water footprint of farm animal products, *Ecosystems*, 15(3): 401-415.

Nellemannn, C., MacDevette, M., Manders, T., Eickhout, B., Svihus, B. & Prins, A.G., 2009. The environmental food crisis – the environment’s role in averting future food crises. United Nations Environment Programme (UNEP), Norway.

Pahlow, M., P.R. van Oel, M.M. Mekonnen and A.Y. Hoekstra (2015) Increasing pressure on freshwater resources due to terrestrial feed ingredients for aquaculture produc Θon, Science of

Papargyropoulou, Effie et al. (2016). Conceptual framework for the study of food waste generation and prevention in the hospitality sector. Waste Management. Volume 49, p.326-336.

Rockström, J., Steffen, W. L., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., ... & Nykvist, B. (2009). Planetary boundaries: exploring the safe operating space for humanity.

Röös, E., Sundberg, C., Tidåker, P., Strid, I., & Hansson, P. A. (2013). Can carbon footprint serve as an indicator of the environmental impact of meat production?. *Ecological Indicators*, *24*, 573-581.

Sonnino, R. & McWilliam, S. 2011, "Food waste, catering practices and public procurement: A case study of hospital food systems in Wales", Food Policy, vol. 36, no. 6, pp. 823-829.

Stoessel, F., Juraske, R., Pfister, S., & Hellweg, S. (2012). Life cycle inventory and carbon and water FoodPrint of fruits and vegetables: application to a Swiss retailer. *Environmental science & technology*, *46*(6), 3253-3262.

Taylor, R. C., Omed, H., & Edwards-Jones, G. (2014). The greenhouse emissions footprint of free-range eggs. *Poultry science*, *93*(1), 231-237.

Tilman, D., & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, *515*(7528), 518-522.

Utrecht University 2016, Strategic Plan, 2016

Wiedmann, T., & Minx, J. (2008). A definition of 'carbon footprint'. *Ecological economics research trends*, *1*, 1-11.

Weidema, B. P., Thrane, M., Christensen, P., Schmidt, J., & Løkke, S. (2008). Carbon footprint. *Journal of industrial Ecology*, *12*(1), 3-6.

Zimmer, D. & Renault, D. 2003. Virtual water in food production and global trade: Review of methodological issues and preliminary results. In Proceedings of the international Expert Meeting on Virtual Water Trade,Value of Water Research Report Series No. 12. The Netherlands, A. Hoekstra Ed.

Websites

Voedingswaardetabel.https://www.voedingswaardetabel.nl - accessed on 20-10-2016

Sodexo Menu: http://www.uu.sodexoeducation.nl/uploads/BQT_map_UU_klein.pdf

Appendices

Appendix 1: Interview questions

Interview with people who order, e.g. secretaries.

- How often do you make an order?
- What aspects are you taking into account when ordering food?
- Are you conscious of the amount of food you order? / Do you feel you order too much?
- How do they find the process of ordering food?
    - Difficulties they may have?
    - Is there too much/too little choice?
- Do you (the secretary) communicate with the person you are ordering food for? Or do you mainly make an estimation of the wishes yourself?
- Do they receive feedback on orders they have placed?
- Are they aware of what happens to any food/beverages that remain?
- What do they think should happen to any remaining food/beverages?
- Do you have any suggestions for improving the ordering or serving process?

Interview with employees from Sodexo and Oud London.

- What are your views on the amount of food that remains at the end of events?
- Are there differences depending on the type of event?
- What do you do with the food/beverages that remain?
- Do you notice if more of a particular type of food/beverage is left?
- Do you have any suggestions for improving the serving process?

Appendix 2: Oud London registration form

Registratieformulier overgebleven voedsel Oud London

Beste medewerker van Oud London,

Heel erg bedankt voor het meewerken aan het onderzoek om voedselverspilling op de Universiteit Utrecht tegen te gaan. Wereldwijd wordt ongeveer één derde van het geproduceerde voedsel weggegooid, en dat terwijl er op de wereld nog zo'n miljard mensen honger lijden. Het tegengaan van voedselverspilling is ook belangrijk omdat het produceren van voedsel veel impact heeft op de aarde, zo is er bijvoorbeeld voor het produceren van één kilo biefstuk ongeveer 15,000 liter water nodig.

We hopen met uw hulp inzicht te krijgen in de voedselverspilling op de universiteit, zodat we uiteindelijk met ideeën kunnen komen die kunnen bijdragen aan een oplossing voor dit probleem.

Het formulier werkt als volgt:

Het voedsel is onderverdeeld in drie categoriën: dranken, broodjes en overig. Elk van deze categorien zijn weer onderverdeeld in productsoorten, bijvoorbeeld broodjes met kaas en broodjes met vlees. Hierachter kunt u opschrijven hoeveel eenheden hiervan overgebleven zijn, bijvoorbeeld 1 kan of liter melk en 8 broodjes met vleeswaren.

Datum:..... **Aantal personen:.....**

Locatie: ..... **Type evenement:.....**

Product	**Aantal**	
Koffie		L
Thee		L
Sap (sinaas)		L
(Karne-) melk		L
Broodje vleeswaren		Per stuk
Broodje kaas		Per stuk
Broodje met vis		Per stuk
Broodje zonder vlees/zuivel		Per stuk
Warme snack		Per stuk
Soep		L
Patisserie		Per stuk

Heeft u suggesties voor manieren waarop de universiteit de hoeveelheid voedsel die wordt verspild kan beperken?

Appendix 3: Sodexo registration form

Registratieformulier overgebleven producten Sodexo

Wereldwijd wordt ongeveer een derde van het voedsel dat geproduceerd wordt voor menselijke consumptie verspild. Door voedselverspilling wordt ook water, bodem, energie, arbeid en kapitaal verspild dat nodig is tijdens productie, transport en bereiding van het voedsel. Tevens worden hierbij broeikasgassen uitgestoten, die bijdragen aan de opwarming van de aarde en resulterende klimaatverandering. Als slechts een kwart van het mondiaal verspilde voedsel gered kon worden, zou het genoeg zijn om 870 miljoen hongerige mensen te voeden in de wereld.

Masterproject UU

Als onderdeel van een project voor het Facilitair Service Centrum (FSC), doen wij - Master studenten aan de UU - onderzoek naar de hoeveelheid voedsel en dranken die overblijven na elke vergadering. En U kunt ons hierbij helpen! Wij zouden uw hulp erg waarderen.

Wat kunt u doen?
Aan het eind van elke vergadering kunt u op dit formulier aangeven hoeveel van elke categorie levensmiddelen is overgebleven. Na afloop kunt u het formulier op tafel achterlaten of meegeven aan een medewerker van Sodexo. We zullen deze informatie gebruiken om te zoeken naar manieren om de hoeveelheid voedsel die wordt verspild aan de Universiteit te verminderen.

Verder willen we benadrukken dat het van belang is om dit onderzoek voor hoe ver mogelijk niet openlijk kenbaar te maken bij de aanwezigen van het evenement, om het consumptiegedrag zo min mogelijk te beïnvloeden.

Alvast bedankt voor uw medewerking!

Het formulier werkt als volgt:
Het voedsel is onderverdeeld in drie categorieën: dranken, broodjes en overig. Daarachter kunt u opschrijven hoeveel eenheden hiervan overgebleven zijn.
Na afloop kunt u het formulier op tafel achterlaten. Bedankt voor uw medewerking!

Datum:	**Tijd:**	**Locatie (gebouw):**
Aantal personen:	**Kamernummer:**	**Type evenement:**

	Achtergebleven om op te ruimen			**Weggenomen voor gebruik elders**	
Product	**Aantal**			**Aantal**	
Sap (sinaas)		**liter**			**liter**
(Karne-) melk		**liter**			**liter**
Broodje met vlees		**stuks**			**stuks**
Broodje met vis		**stuks**			**stuks**
Broodje met kaas		**stuks**			**stuks**
Broodje vegan (zonder vlees/zuivel)		**stuks**			**stuks**
Fruit		**stuks**			**stuks**
Andere items					
		stuks/liter			**stuks/ liter**
		stuks/liter			**stuks/ liter**

Wat kan je doen?

Heeft u suggesties voor manieren waarop de universiteit de hoeveelheid voedsel die wordt verspild kan beperken?

Appendix 4: Information on lunches

Specified contents of the basic lunch packages offered by Sodexo. All products are for an order for 1 person (Sodexo menu).

Contents of lunch services						
products\Type lunch	Basic lunch A	Basic Lunch B	Basic Lunch C	Luxury Lunch A	Luxury Lunch B	Luxury Lunch C
meat sandw	1	1,5	1,5	1,275	1,275	1,275
cheese sandw	1	1,5	1,5	1,5	1,5	1,5

fish sandwich	0	0	0	0,225	0,225	0,225
krentenbol	1	0	0	0	0	0
fruit	1	1	1	1	1	1
orange juice (L)	0	0	0	0	0,2	0,2
Milk (L)	0,2	0,2	0,2	0,2	0,2	0,2

Appendix 5: Specific quantity of food wasted in Sodexo bigger events and the resulting carbon and water footprints

In calculating the carbon and water footprints of the sandwiches, both the footprints of the toppings and the bread are taken into consideration by considering the percentage of product on the sandwich.

The footprints of chicken curry and that of egg salad are calculated with the assumption that the products are solely chicken or egg respectively. Also, the footprint calculation of sausage and cheese rolls assume the footprints are equal to the main content that is pork and cheese respectively.

Item	**Pieces & Volumes**	**weight per unit served (kg)**	**Carbon footprint (kgCO2/kg product)**	**Water footprint (liters/kg product)**	**carbon footprint of waste(kgCO2)**	**Water footprint of waste(liters)**
Sandwiches:		0.075				
Salami/Pastrami	36				7.02	6914.7
Tuna Salad	13				2.96	-
Salmon	2				0.357	-
Cheese	49				15.7	7700.4
Egg Salad	25				2.88	2806.9
Chicken Curry	26				3.47	3608.15
Sandwich bread/ slices of bread	72	0.05	1.5	613	5.4	2206.8
Slices of chicken meat	83	0.025	2.33	4325	4.84	8974.4
Slices of pork	18	0.025	4.62	5988	2.08	2694.6
Slices of beef	57	0.025	15.23	15415	21.7	21966.4
Slices of goat cheese	44.5	0.03	9.82	5060	13.11	6755.1

Slices of cow cheese	141	0.03	9.82	5060	41.54	21403.8
Salami/Pastrami			4.6	6457		
Tuna Salad			6.1	-		
Salmon			4.14	-		
Egg Salad			2.1	3265		
Others:						
Sausage Roll	16	0.025	4.62	5988	1.85	2395.2
Cheese Roll	11	0.03	9.82	5060	3.24	1669.8
Apple	28	0.125	0.26	822	0.91	2877
Pear	1	0.1	0.3	922	0.03	92.2
Orange	7	0.15	0.32	560	0.336	588
Tangerine	2	0.045	0.32	748	0.0288	67.32
Chocolate bar	22	0.1	-	17000	-	37400
Beverages (liters)						
Orange Juice	1.45	1	0.668	1018	0.976	1476.1
Milk (Normal & Karne)	7.9	1	1.062	1020	8.39	8058
Total footprints					136.8	139654.7

Appendix 6: Workshop Plan

Food Waste at Utrecht University
Workshop plan

This workshop is designed to last 2 - 3 hours, with timings based on between 15 - 20 participants.

The **aims** of the workshop are to raise awareness about food waste and give the knowledge and tools to order more efficiently.

The target group of this workshop consists of employees of the Utrecht University who order most catering. A list of employees based on the amount of catering ordered is available.This target group is selected as it is expected that these people, besides the caterers themselves, have most influence in reducing food waste from catering at the UU.

At the end of the workshop participants should have ***a greater awareness of food waste, why it is important to reduce it, which solutions can contribute to this, and how the people who order food can contribute.***

The recommended **personnel** to run this for this workshop are:

- A facilitator, to lead the workshop and guide activities.
- A guest speaker, to share knowledge and insight into the area of food waste.
- A representative(s) from the caterers currently contracted to the University, to provide insight and perspective from the food preparation and serving side.

The recommended **location** for this workshop is an area suitable for participants to organise themselves into small groups for discussion. Necessary equipment includes blackboard/wipe board, access to a computer to run presentations and internet access.

A major challenge for this workshop is to make people enthusiastic to attend in the first place. It is important that employees see the value of reducing food waste. This can be achieved by making posters and creating general awareness before people are invited to this workshop. Moreover, this workshop should be advertised as a nice learning experience that is also fun to attend. The Green Office Utrecht can help to achieve this with digital communication targeting the audience.

Time	**Activity**	**Materials**
20 mins	**Introductions:** **Aim** To share information about the content of the workshop. Used to check against participants expectations. **Facilitation note:** This section involves the facilitator presenting the first 3 slides. **Activities** Ask participants: In a couple of sentences tell us your name, the role you play in relation to food ordering at the university and what you hope to get of the workshop. The facilitator can start by introducing themselves	Presentation - **Workshop Presentation.pptx** showing name of workshop, aim.
15 mins	**Icebreaker:** **Aim** To help people relax, feel comfortable and engage their brains to the issue of food waste. **Activity:** To easy participants into the workshop the following 2 short movies may be shown. **Facilitation note:** After the introductions run the movies below to ease them	

	into the quiz. **Movie** The following short movies can be shown: https://www.youtube.com/watch?v=IoCVrkcaH6Q - food waste footprint (3.15min) https://www.youtube.com/watch?v=btH6KlbLr4M - don't spoil the party - showing what happens when someone doesn't show for an event - it is part of a charity initiative (1.23min) **Facilitation note:** For the first question faciliator will need to open the Foodprint spreadsheet or access the Foodprint.ga website and start entering the quantities of food each participnat had. Show the results and take time to discuss what they notice. **Quiz** **a)** Get participants to think about they had for lunch yesterday (or that day - depending on when workshop is held) Find out how many had - cheese sandwich, meat sandwich, piece of fruit, what they drank etc. Feed this information into the spreadsheet **FOODPRINT.xlsx** or use the website **FoodPrint.ga** This will show the carbon & water footprint. But to give meaning to the numbers produced - the spreadsheet and the website also will also how many km and bathtubs this is equivalent to. **Facilitation note:** The answers to each question are displayed on the click of the mouse. **b)** This next question is based on the results of the research carried out into the amount of food waste at events/meetings at the University. Ask the participants: Based on the amount of waste counted during a two week period: ● How far do they think they could they get based on the amount of food that wasted? ● How many baths could they have?	Presentation: Slide 4 Spreadsheet: FoodPrint calculator.xlsx or the website FoodPrint.ga Presentation: Slide 5
10 mins	**Food waste at the University:** **Aim** To give some background into how this workshop came about. I.e. Provide an explanation of the project that led to this point and some of the results that it provided.	Presentation slides from slide 6 to 9

	Facilitation note: This section involves the facilitator presenting to participants **Presentation**	
15 mins	**Food waste the bigger picture:** **Aim** To provide insight from an expert in the area of food waste **Facilitation note:** This section involves a presentation from an expert in the field of food waste. *(optional element)* **Presentation**	Presentation supplied by guest speaker
30 mins	**Discussion - food waste:** **Aim** To gain a shared understanding of ways to tackle food waste at the University **Activity** Organize participants into groups of 3 - 4 people to discuss the following questions: ● What are your thoughts of food waste (how important is it? – why /why not?) ● Do you feel it would be easy to cut down the amount of food that is wasted? ● What are the challenges about doing so? ● How would they impact your role/day to day activity? ● How can you balance being hospitable while reducing food waste **Feedback** Allow the groups 10 minutes at the end of the discussion to choose the key points they want to feedback to the other groups	Slide 10 to display questions Blackboard/ wipe board to record key points
10 mins	**What happens to the order once placed** **Aim** To give the group an understanding of challenges that caterers face **Facilitation note:** This section involves a presentation by a representative from Sodexo and or Oud London. **Presentation**	

	Some suggested points that should be covered in the presentation: ● Provide a run through of the whole menu ● What happens once an order is placed ● How are orders put together ● What happens to the left over food	
30 mins	**Discussion - ordering food:** **Aim** To allow participants to share their experiences of ordering food. **Activity** Organize participants into groups of 3 -4 people (different groups) to discuss the following questions: ● What do you think about when placing orders? ● What information do you put into the portal? ● Do you have any hints/tips in terms of what to pay attention to? **Feedback** Allow the groups 10 minutes at the end of the discussion to choose the key points they want to feedback to the other groups.	Slide 12 to display questions Blackboard/ wipe board to record key point
5 mins	**Evaluation:** **Aim** To help learning ways in which the workshop could be improved. **Activity** Ask participants: ● One thing which worked well for them and why. ● One thing which didn't work so well for them and why. ● Something which they learnt.	Slide 13 to display questions Blackboard/ wipe board to record key points