Food waste at the school level.

A case study on a food waste reduction project within school restaurants in Uppsala, Sweden

Justin Casimir
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Food waste in schools

JUSTIN CASIMIR


Abstract:

This thesis offers a case study analysis of the food waste in schools focusing on the pupils’ knowledge of food waste issues. The thesis uses a project initiated by the municipality of Uppsala which aims at reducing the amount of food wasted in the schools restaurants as a case study. The knowledge of food waste issues from pupils of Uppsala has been assessed with questionnaires. The amount of pupil’s food waste generation is also shown in the thesis. At first it is seen that older pupils waste more than younger ones. Looking at their knowledge, pupils in general ignore the environmental and ethical consequences of food waste but are aware of the economic consequences. The current food waste reduction project implemented by the municipality of Uppsala seems to work only for the schools where the pupils are aware of the incentive in place. This incentive aims to reward the pupils from the schools which reduce their food waste other time. The results obtained from the questionnaires, the results from current food waste reduction project and the interviews (with the person in charge of the food waste reduction project and a kitchen staff) are analyzed through a theoretical framework based on environmentally significant behavior theory. Later, suggestions are made in order to improve the current project. For instance, it is advised to review the current incentive depending on the schools by working in cooperation with the schools and the pupils. Also, the pupils need to obtain a better basic understanding of food waste issues through instruction in formal and informal ways. The project itself could be reviewed in order to better integrate the pupils’ opinions and their degree of understanding of the food waste issues but also to cooperate more with the different stakeholders in the project.

Keywords: Sustainable development, Food waste, Questionnaire, Schools, Environmental Behavior.

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Food waste in school

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Summary:
Currently, a project run by the municipality of Uppsala aims to reduce the amount of food wasted in the schools restaurants. Figures from this project show that schools with younger pupils waste much less than schools with older pupils. With questionnaires, the knowledge of food waste issues from pupils aged from 7 to 14 years old has been assessed. The questionnaires showed that most of the pupils did not know that wasting food might affect the environment and raise ethical issues. However, most of the pupils knew that food waste has economic consequences. The results from the questionnaires and the quantitative data collected through the municipality project showed that pupils knowing that an incentive (tasty food) will be awarded if less food is wasted are indeed throwing away much less food than pupils ignoring this award. Therefore, from these results and also by interviewing the person in charge of the food waste reduction project and the kitchen staff, some ideas have been suggested in order to improve the current project. For example, the award incentive needs to be reviewed and sometimes modified for some schools. It is advised to integrate the schools and in particular the pupils in this process. It is also advised that pupils should acquire a better understanding of the basics of food waste issues. This knowledge could be taught through formal (classroom) or informal ways like study trips or projects. Finally, this study shows that the project should adopt a more holistic approach by integrating all the different actors.

Keywords: Sustainable development, Food waste, Questionnaire, Schools, Environmental Behavior.

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1. Introduction

Food waste has been studied for many years and its consequences and reasons are well known. It has been shown that food waste causes environmental degradation (EC, 2010; Scholz, 2013), raises ethical concerns (Nellman et al., 2009) and has an economic cost (Quested & Johnson, 2009). These three interlinked consequences are becoming a major concern for our society because the quantity of food waste has increased with time; this increasing amount of food waste occurs at every level of the food supply chain (Göbel et al, 2012).

Other studies have been focusing on the reasons why pupils waste food in the school cafeterias or canteens. These reasons are often separated in three different categories: operational, situational and behavioral (Cordingley et al, 2011). For instance, it has been shown that food waste is reduced if the pupils have their break (i.e. a time for recreation that is not associated with academic activities) before eating lunch because otherwise the pupils rush during lunch in order to have more time to play (Cordingley et al, 2011). Indeed, an American study shows that 30% of food waste is avoided by moving the break before lunch (EC, 2010). Other reasons such as the attitudes of the students regarding food, the size of the portions, the students’ preferences, the logistics, the labeling of available food, the canteen environment, the availability of snack food as well as the students’ awareness and knowledge have been indicated as reasons for food waste in the schools (Cordingley et al 2011, EC, 2010).

The existing studies on school food waste do not focus in depth on the knowledge pupils have about food waste and the reasons food waste should be avoided. For instance, no clear relationships are demonstrated yet between the amount of food wasted and the pupils’ knowledge of food waste issues. Moreover, the theoretical framework developed in this thesis shows that knowledge is necessary in order to act pro-environmentally. In this case study, a lack of knowledge could make the food waste reduction project in the schools inefficient once implemented. Furthermore, as food waste is already recorded in the schools of Uppsala it is possible to assess if there is any relation between the pupils' knowledge of food waste issues and the amount of food waste generated at school.

The overall objective of the thesis is to understand the social aspect and barriers of the food waste system in the schools of Uppsala. This overall objective is reached by achieving more specific goals. The first goal is to assess to pupils' knowledge of food waste issues. These results are then compared with the amount of food wasted in the schools. This will help to reach the second goal which is to show if any relationship exists between the pupils' knowledge and the amount of food waste at school. Finally, the third goal is to suggest methods to improve the current food waste reduction project toward a more sustainable system. The goal is reached by analyzing the results through a theoretical framework. The theoretical framework is based on the theory of environmentally significant behavior (Stern, 2000) which can relate the three different categories of reasons for food waste at school expressed by Cordingley et al (2011).

1.1 Research questions

The following research questions are set as the guideline for the research and correspond to the three goals set above:

Research question 1: What knowledge have pupils in Uppsala about food waste issues?

Research question 2: What is the relationship between food waste generation at the Uppsala schools and the pupils’ knowledge of the issue of food waste?

Research question 3: How could the food waste reduction project implemented at the schools of Uppsala be improved?

In the methodology and theoretical framework part, the processes to answer these questions will be described in detail. The questions are answered in the discussion part.

1.2 Context of sustainable development

In the coming two paragraphs, arguments are developed to show how relevant the thesis subject and the thesis itself are regarding sustainable development.
While the term “sustainable development” is frequently used by politicians, researchers or the public, its definition is not totally set yet. Recently a new definition has been proposed by Griggs et al (2013, pp.306) as the: “Development that meets the needs of the present while safeguarding Earth’s life-support system, on which the welfare of current and future generations depends”. So far the most recognized, but also probably also the most criticized, definition of “sustainable development” was the one from the Brundtland report (Brundtland, 1987, pp. 40): “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Twenty-five years or a quarter of century of research have passed and the meaning of sustainable didn’t seem to have changed that much. In my opinion, the biggest change between these two definitions is that the most recent one emphasize even more on the pressure that present generation hold on the future generations and that important changes to our society is needed in order to be able to remove this sword of Damocles hanging above the future generations head but also our present moral. Therefore, I will briefly argue how this master thesis’ topic is related to the definition proposed by Griggs et al (2013). The food waste issue is seen as an inefficient use of ecosystem services or support systems (Nellemann et al, 2009). For instance, the production, transportation and processing of food require a considerable amount of water, land, minerals and energy. All these inputs rely on ecosystem services which are used in vain if food is not consumed at last. Therefore, the reduction of food waste in schools and more generally in the entire food supply chain will help to preserve the ecosystems services which will be available for future generations.

Regarding the Agenda 21 (1992), which is a document with action plans in regard to sustainable development for the 21s century signed by 173 states at the Earth summit of Rio in 1992, two chapters particularly apply to this thesis. Firstly, chapter 21 (A) which deals with waste minimization objectives and measures with a large focus on industrialized countries. Secondly, chapter 25 (B) which acknowledge that children have potentially an important role to play for sustainable development. More personally I also believe that integration of children in projects dealing with sustainability and changing habits is an important cause. Indeed, trying to change bad habits, as fastening your sit belt in a vehicle for instance, is more difficult to implement on adults than on children.

More than only discussing if the research topic is in accordance to some sustainable development definitions or principles, I wanted the make the research itself of interest for sustainable development. Waas et al (2010. pp. 629) have defined university research for sustainable development as “all research conducted within the institutional context of a university that contributes to sustainable development”. Waas et al (2010) identified 22 characteristics that university research for sustainable development embraces. From these characteristics, some are fulfilled by these research. For instance, the research is problem and action oriented, it has a local focus and it has a strong link with sustainability.

2. Case study background

2.1 Food waste reduction project in Uppsala

At the moment in the municipality of Uppsala (Sweden), every child from 1st grade until 9th grade and often until the end of high school are granted a free lunch at the school canteen. About half the school kitchens are managed by the food and restaurant department of the municipality (“kost och restaurang”). Food is either prepared in the school or transported from another school kitchen. Therefore there exists two kinds of school kitchens in Uppsala, the ones that prepare and cook food and the ones that only serve food. From experience, the municipality of Uppsala has observed that the later practice generate more food waste than having kitchen on site in every school (Nygårdh, 2014). Even though more food is wasted in schools getting food from other kitchens, this practice is advantageous as the cost per plate is reduced. There is a conflict of interest in this case between reducing food waste, lowering the production cost and also feeding the pupils with quality food. Therefore, this conflict of interest is integrated into this research project.

In the school kitchens in Uppsala managed by the municipality of Uppsala, every pupil has the choice between three dishes for lunch. This illustrates the conflict of interest mentioned above. Offering the choice for three dishes render the planning for the amount of food to cook more difficult than having only one or two choices. In turn, having more dish choices generates more food waste as the kitchen needs to cook more food for each dish option in order to be sure that every child eats what they want. On the other hand, Uppsala offers three options for lunch because they want to be sure that every single pupil eats something they like.

Since autumn 2012, the municipality collects and records the food waste (food not served) from the school kitchens and the school canteens or plate scraps (food served but not eaten) during one week, twice a year. This
data collection has been done in 23 schools for pupils from first grade to the last year of high school, which represents pupils from age of 6 till 19 years old. In October 2013, eight more schools joined this data collection project and two more schools joined the project during spring 2014, meanwhile one schools dropped out from the project. During the data collection week in spring 2014, 32 schools were part of the project. During the food waste collection week, signs are placed in the canteen so the pupils know where to throw their food waste away. The pupils from the schools which succeed to reduce their food waste in comparison to the earlier food waste collection week are awarded with tasty food like ice cream, pizza or desserts. The choice of the award is decided by the kitchen staff. For the moment, except for recording the food waste from the schools, the municipality did not yet use these figures for proactive measures. Moreover, the municipality has not carried out workshops or classes with the pupils on food waste issues yet.

2.2 Definition of food waste issues

This part aims to define what are the food waste issues to be regarded in this case study. The definition is used to design the questions which would allow the research to assess the pupils’ knowledge of food waste issues,

The effect of food waste on different aspects like the environment, the ethics and the economics have already been studied for certain regions of the world. For instance it has been estimated that globally up to half of the produced food is thrown away at different stages of the food supply chain (Parfitt et al, 2010). Each year in Europe, 90 million tons of food is wasted (EC, 2010). In Sweden specifically, 2 053 million tons of food went to waste in 2006 or an equivalent of 226kg of food waste per capita and year which is much higher than the European average of 176kg per capita and year (EC 2010). At the same time, Ventour (2008) showed that 61% of food waste occurring in the UK is avoidable if it would have been better managed, there is therefore room for improvement. When it comes to food waste at schools this figure is even more chocking. Cordingley et al (2010) have shown that more than 80% of the food waste at schools could be avoided. In Sweden, school kitchens are responsible for about 26000 tons of food waste annually (Jensen et al, 2011). These figures remind us that the problem of food waste is colossal. This enormous amount of food waste isn’t without consequences.

Looking at the environmental point of view, food waste can be seen as an inefficient use of ecological services (Nellemann et al, 2009) as the production of food requires the use of finite natural resources which result in vain when food is wasted (Eriksson et al, 2013). For instance, the emissions due to food and drink waste in the UK alone, represent 5 million tons of CO2eq. Looking at the 27 members of the European Union (EU27), food waste contributes to an environmental impact estimated to 170 million tons of CO2eq per year. This figure corresponds to 3% of EU27 total emission of greenhouse gas (GHG) or the total emission of GHG of Holland in 2008 (EC, 2010). The European Commission (EC, 2010) estimated that if no additional measures are taken to prevent food waste, the global amount of food waste would reach in the EU (27 members) 126 million tons in 2020 compared to 90 million tons in 2006. However, the United Nations aim to reduce by half the food waste by 2020 compare to 2009 (Nellemann et al, 2009). Therefore, it is a fact that food waste pollute the atmosphere and plays a considerable role in the global warming.

Quested & Johnson (2009) further demonstrate the economic cost of food waste. Their study, undergone in the UK in 2007-2008, showed that avoidable food waste cost on average 480£ (580€ or 5500 SEK) per household every year. As the school kitchen are serving food for large groups the economic cost of food waste is in turn large.

As Eriksson (2012) stated, the food waste issue embraces 3 interlinked problems: environmental, economic, and ethics. The two first had already been covered above and the focus will now be on the ethical issues of food waste. In 2013, 842 million people are suffering from chronic hunger (FAO, 2013). Europe wasted on average 280kg of food per capita and North America wasted 300kg of food per capita (Gustavsson et al, 2011). Assuming that all this food waste could be transfer to the people suffering from chronic hunger, 363kg extra of food would be available per “hungry” every year or about a kilogram every day. (Population data for 2010 in Europe and Northern America from the department of Economics and Social Affairs of the United Nations). Therefore, food waste impacts on food security for the poorest (Gustavsson et al, 2011) and food waste reduction would mean food security for the people living at the threshold of food insecurity. To generalize, reducing food waste would increase food supply according to Nellemann et al (2009).

To summarize, food waste is an issue because of its high volume, which in turn impacts on the environment, the economy, and raises ethical concerns. However, in the municipality of Uppsala, food waste are segregated and recycled into biogas and fertilizer. The biogas is mainly used by the city buses for fuel and the fertilizer distributed to the local farmers. As recycling food waste helps mainly to mitigate the impact of food waste on the environment, the fact to not recycle could be seen as pollution as an alternative exists. Therefore, the
questionnaire has to cover the environmental, ethical and economical aspects as well as the recycling and the issue of food waste quantity.

3. Methodology

The methodology used in this thesis has been designed to answer the three research questions in section 1.1. The data are collected through three different methods. Once organized, the data are analyzed through two different methods. At this point, the first two research questions are answered. The results from the analysis are discussed in relation the thesis’s theoretical framework in order to answer the last research question.

3.1. Data collection methods

Three data collection methods are used in this thesis; questionnaires, interviews, and secondary data collection. The interviews and secondary data collection are discussed later while the questionnaires are further developed first.

3.1.1. Questionnaires

Preparing and interpreting the questionnaires consumed the most time in this thesis. First the questionnaires design is discussed, then the food waste issues are defined and, some comments on reliability and validity are made and finally the questions are set.

One of the aims of this research project is to define the correlation between the amounts of food wasted at the school canteens of Uppsala and the pupils’ knowledge of food waste issues. In order to be able to define this correlation the pupil’s knowledge is assessed through a survey. For this the pupils answer a self-administrate questionnaire (Bernard, 2006). In this case, the timing of the data collection need to be defined in this case. As the aim for the research is to have a still picture of the pupils’ knowledge at one moment, the method uses a cross-sectional design. Blaickie (2000) defines cross-sectional design to be used when at least two groups are measured, and time does not influence the results. The different groups to be compared in this research are the different classes form different schools of Uppsala.

The survey has been designed using mainly the works of Thayer-Hart et al (2010) and Bernard (2006). The goal of this survey is to assess what knowledge that the pupils have about food waste issues. Therefore, the meaning and definition of food waste issues dealt with in this research are clarified later.

The target population for this survey are the pupils eating lunch at school restaurants managed by Uppsala municipality. In order to have more reliable data, the survey is carried out only in some of the thirty-two schools where food waste has been collected during the spring 2014. Because the questionnaire is a self-administrative questionnaire, every pupil from 1st grade up to high school must be able to read and understand the questions. So the target population for the survey is pupils from 1st grade and onward eating lunch at a school restaurant managed by Uppsala municipality that has recorded its waste during the food waste collection week during the spring 2014. If the pupils’ knowledge plays a role on the generation of food waste in the canteen, it is then important to observe this phenomenon at both extremes. Therefore, ideally schools which waste the most and the least must be studied.

The most recent data collection on the quantity of food wasted took place during week 14 (31st of March until 4th of April 2014). Therefore, it was important to carry out the survey at the same to obtain as relevant data as possible. The aim is to get a clear picture of the relationship between the amount of food waste and the pupil’s knowledge of food waste issues. It could happen that some schools hold workshops or classes in order to raise awareness about the food waste issues before the data collection week. If the survey takes place long time after this specific week or before, we might not be able to catch the true picture of pupils’ knowledge of food waste.

According to Bernard (2006), mails or dropped off questionnaires are a good option if, (i) the respondents are literate, (ii) the questions are self-explanatory and when (iii) we are confident to get a response rate of about 70% minimum. Face to face interviews do not seem to be applicable in this case as it would take too long time in order to gather enough data. Therefore, these three possible options seemed to be adequate for the thesis at first:

1- Distributing the questionnaires during the lunch break to the pupils and collecting it later the same day.
2- Creating an online questionnaire and give the link to every pupils.
3- Ask the teachers to hand in the questionnaire in their classes.
Unfortunately the two first option had to be abandoned as the headmasters of the twenty-three schools contacted either did not answer or refused to cooperate without clear explanation for it. Therefore, later, most teachers of Uppsala municipality have been contacted through e-mail, asking them to cooperate in the project by taking five minutes of their class to distribute the questionnaire to their pupils.

3.1.1.1 Reliability and validity

The biggest challenge concerning the reliability of the questionnaire is to make sure that the questions are understood the same way by every respondent which includes, in this thesis, pupils from 7 years old to 14 years old. When designing the questions it is important to bear in mind this challenge in order to have trustful results.

To be able to reach valid results it is necessary to remember the goal of the questionnaire. It helped to not ask irrelevant questions, for instance questions related to their habits which would better answer questions such as why food is wasted in schools.

Before distributing the questionnaires to the cooperating classes, the questionnaire had been tested with three children in order to make sure that the questions are understood, and to have an idea about the time needed to fill it in. Two of the testers were first graders which made the reading of the questions slightly slower than planned as they just started learning to read about seven months ago. However, the third tester from 5th grade answered the questionnaire in less than five minutes. These tests with the children helped the research to rephrase certain questions. For instance, the children were more comfortable with the term “biogas” than “fuel”. A short discussion was held once the questionnaire was filled in order to assess if the questions have been understood as expected. The younger pupils have been helped by their teacher in the classroom to read and sometimes understand the questions. Therefore, even though the teachers were asked to be as neutral as possible, the pupils could have been biased.

3.1.1.2 The questions

The questionnaire includes eleven questions. Nine of them are statements with the same three possible answers: “True”, “False”, “I don’t know”. As the aim of the survey is to assess the pupils’ knowledge on food waste issues, it was necessary to give them the option to do not know. If the pupils could not chose the “I don’t know” choice, even though they would not know the answer, they still would have 50% chance to answer correctly which would make the result from the questionnaire not reliable. These nine questions cover the environmental, economic and ethical issues of food waste discussed above. It also includes questions that cover the recycling of food waste once thrown away. Four fallacies are also integrated in the questionnaire. The fallacies are false statements which in this questionnaire aim to keep the respondent alert and sometimes entertained. These statements are questions 3, 5, 7 and 8 and deal with both the consequences of food waste and the food waste management. Here are the nine first questions translated from Swedish to English. In the question the Swedish term “skolmat” means the food served at the school restaurant. This term was included in every question in the Swedish version, therefore the questions only deal with the food served at the school restaurant.

1. If I throw away the food served at school, I pollute the nature.
2. If I throw away the food served at school, others will be hungry.
3. If I throw away the food served at school, I will be thinner.
4. If I throw away the food served at school, the school lose money.
5. The food I throw away at school is burnt behind the school.
6. The food I throw away at school is used to make biogas for the buses in Uppsala
7. The food I throw away at school is eaten by the dove at the Cathedral.
8. The food I throw away at school is used to make sausages (Falukorv).
9. The food I throw away at school is used to grow new food.

The 10th question asks the respondent to choose if in his/her opinion he/she throws too little, normal or too much food away at school.
Finally the last question is an open-end-question asking the respondent if he/she knows what happens if he/she throw away less food. The expected answer is that pupils get tasty food such as ice cream, desserts or pizza for instance.

3.1.2 Interviews

Once the questionnaires had been analyzed, interviews with the municipality and a kitchen staff were carried out. The aim of these interviews was to compare the results of the questionnaire with the interviewee’s opinion. This shows any knowledge gaps between what the pupils know and what adults think they know or ignore. The data collected through the interviews are qualitative data. The interviews carried out were semi-structured interviews. The questions were prepared in advance and depending on the answers follow up questions were asked.

3.1.3 Secondary data collection

As the timeline of this project does not necessarily allow to obtain reliable quantitative data showing the amount of food wasted in the schools of Uppsala, the figures measured by Uppsala municipality during the last four semesters are used. Therefore, for this part of the research, secondary data collection is used. The data have been shared by the person in charge of the food waste reduction project at Uppsala municipality. The figures include for some schools both the amount of food wasted by the pupils and the amount of food wasted in the kitchen. The amount of food is expressed both in absolute value for the school and in grams per portion served. For this thesis, only the amount of food thrown away by the pupils is the one of interest.

3.2 Data reduction technique

3.2.1 Questionnaires

The data collected through the questionnaires are used to show the percentage of correct and incorrect answers within the responding groups and also the share of the respondents who stated they did not know the answer. This helps to compare the different classes with each other, and also later to assess a relationship between the amount of food waste generated and the pupils’ knowledge. For the questions which can be answered “true”, “false”, and “I don’t know”, a scale shows the percentage for each option with color code as on figure 1.

![Figure 1: Example of data reduction from questionnaires.](image)

For the question asking the respondent if he/she thinks that he/she throw away too little/too much or the normal amount of food (question 10), the same approach is used. A scale shows the three options and the corresponding percentage of the population choosing each specific option.

As the last question is an open-ended question, no data reduction technique is used but the data are directly analyzed.
3.2.2 Secondary data collection

The quantitative data collected though the municipality of Uppsala have been combined into a single table (table 1) showing only the information of interest for this study which are the type of school and the amount of food wasted by the pupils expressed in grams per portion served.

3.3 Data analysis

To analyze the different kinds of data earlier for the project, different data analysis methods are used.

3.3.1 Descriptive method

First a descriptive method is used to analyze the results from the questionnaires, the secondary data collection and the interviews. A descriptive method can be used for both quantitative (questionnaires and secondary data) and qualitative data (interviews) (Blaikie, 2000). This method helps to organize what knowledge comes from what method. By analyzing the questionnaire this way, the first research question could be answered: What knowledge have pupils of Uppsala about food waste issues?

3.3.2 Associative method

Later, by using an associative method we are able to understand the relationship between food waste generation at school and the pupil’s knowledge of food waste and therefore answer the second research question: What is the relationship between food waste generation at school and pupils knowledge of the issue of food waste? The associative analysis technique consists of comparing two sets of quantitative data in order to assess if a covariance relation exists between the two sets of data (Blaikie, 2000). To assess the degree of covariance in this thesis no complex mathematical methods are used but a simple association. For instance, does higher knowledge of food waste recycling practices reduce the amount of food waste at school? Only the variables which co-vary are discussed in the results.

Even though associative methods are used to compare quantitative data, the method used to compare the results from the interviews (qualitative data) and the questionnaire (quantitative data) is inspired from the associative methods. By comparing the results from the interviews and the questionnaires potential knowledge gaps are highlighted.

The results from the empirical research obtained from the above methodology are discussed within the theoretical framework developed below. For this reason, the methodology part is placed before the theoretical framework.

4 Theoretical framework

The main theory used for developing this theoretical framework is the environmentally significant behavior theory. This theory aims to explain the reasons and ways people behave toward environmental issues. Stern (2000) defined environmentally significant behavior as any behavior inducing changes in the “availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself” (Stern, 2000, pp.408). Therefore, any behavior resulting in changing the availability of material or energy or the stability of ecosystems is seen as environmentally significant behavior. This definition is derived from an earlier work done by Stern (1997) which focused at first on the definition of environmentally significant consumption and which found that it was of importance for research to broaden the focus of the study to humans’ choices and actions, in other word to human environmentally significant behavior.

Stern (1997) further argues that behaviors can alter the environment directly or indirectly. For instance, cutting down large forests results in the direct reduction of the global CO2 assimilation on Earth and destruction of specific habitats. Indirectly, human behaviors can change policies which in turn could apply environmental
changing decision. Stern (1997) acknowledged that behavior which affect indirectly the environment can have a bigger impact on the environment than consequences of behavior affecting the environment directly. In general, it can be said that environmental impacts have been in human history a “by-product of human desires for physical comfort, mobility, relief from labor, enjoyment, power, status, personal security, maintenance of tradition and family, and so forth, and of the organizations and technologies humanity has created to meet these desires” (Stern, 2000, pp 408). Therefore, it can be argued that human made environmental impacts are shaped by the perpetual seek for better condition according to ones values and system of believes.

Even though the subject dealt with in the theory is severe, the theory tends to keep an optimistic vision. It focuses specifically on the reasons and ways humans take actions with pro-environmental impacts, for instance segregating waste at home, hiking to work rather than driving and in our case study reducing the quantity of food waste produced at school. By understanding the reasons humans behave this way, researchers could later implement systems or programs that aim to change environmentally negative behaviors to pro-environmental behaviors.

Several approaches and models have been developed in order to explain why people act in an environmentally friendly way. Before looking at the causal factors for environmentally significant behavior, different type of behaviors have been categorized by Stern (1997). He divided the environmentally significant behaviors into four groups: (i) environmental activism, (ii) non-activist behavior in the public sphere, (iii) private sphere environmentalism and (iv) other environmentally significant behavior. Regarding at the case study, the target population is pupils and the research looks at their behavior at the school canteen (amount of food waste). Therefore, looking at the above context, the research is focusing especially on the non-activist kind of behavior taking place in the public sphere.

Stern et al (1999) had developed the Value-Belief-Norm theory (VBN) which according to their findings is the most suitable theory adapted to understand the causal factor of non-activist environmental behaviors. The theory claims that values shape our beliefs, which in turn shape our norms. Depending on our norms (pro-environmentalist norms in this case) one behaves in a way or the other regarding environmentally significant matters. The belief level of the theory counts 3 sub-stages. One’s belief is constructed of three sub-parts which are (i) the new environmental paradigm (NEP), (ii) the awareness of adverse consequences (AC) and (iii) the ascription to responsibility (AR). The NEP could be expressed as the global awareness that human activities stress the environment in different ways. AC corresponds to the awareness and knowledge one has concerning the consequences of an environmentally significant behavior. For instance, if one knows that by reducing the amount of food waste less energy will be consumed in vain, there is higher chances that environmentally friendly behavior is observed. The last component of the belief system according to the VBN theory is one’s capacity to understand his/her responsibility regarding environmentally significant behaviors. There is less chance of pro-environmental behaviors if the subject does not feel responsible for its actions.

However more causal factors can explain environmentally significant behaviors. Stern (2000) has classify these causal factors into four groups: (i) attitudinal factors, (ii) contextual factors, (iii) personal capabilities and (iv) habit and routine. The four different kind of causal factors are explained briefly. The value-norm-belief (VBN) theory mentioned above is a component of the attitudinal factors. Personal commitment as well as the perceived personal cost or benefit of action are also part of the attitudinal factors. The contextual factors includes every social, economic, technological and political forces or constraints within the context. In this case study it could be the municipality policy, the physical infrastructures for food waste recycling or the economic situation of the schools’ kitchen for example. These causal factors are for most of the time out of control of the individual. The personal capabilities are the resource the subject has in order to behave or not pro-environmentally. It could be knowledge, skills, time, money, social status or power for instance. Finally, old habits and routines in most of the time explain environmentally significant behavior with negative impacts.

The Stern’s model claims that environmentally significant behaviors are shaped by the four following causal factors: Attitudinal factors, personal capabilities, contextual factors, Habits and routine. This model is completed by two other models developed to understand environmentally significant behaviors: Hines et al (1986) and Fietkau & Kessel (1981). The Stern model has been chosen as the base model because of its simplicity. The aim of the research is not to understand in depth every single mechanisms shaping environmentally significant behavior but to have a global idea about all the different determinants. The Stern model allows us to cluster these different determinants.

Hines et al. (1986) have proposed another model by analysis and synthetizing the research on responsible environmental behavior. According to their analysis, responsible environmental behavior (or environmentally
significant behavior or pro-environmental behavior) is shaped by situational factors as well as the intention to act. The situational factors are similar to the contextual factors in the Stern model. The intention to act is in turn shaped by some personality factors, the fact the subject has knowledge of the issues or not, and the knowledge that options for action exist assuming the subject has the skills to apply these options. Finally, the personality factors are influenced by (i) the subject attitude, (ii) the locus of control and (iii) the personal responsibility. The fact that the subject has knowledge of the issue and that option for action exist as well that the subject has the skill to implement these option can be included in the personal capabilities causal factor of the Stern model. The personal responsibilities from the Hines et al model can be assimilated to the ascription of responsibility (AR) from the Stern model. The locus of control represents the subject’s ability to perceive the influence of his/her action. For example, if one feels that recycling paper will not impact positively the environment then there is higher chance that the paper is not recycled. This causal factor is linked with the perception of cost and benefit developed in the Stern model. The locus of control focuses specifically on the perception of benefits and the degree of the benefits. Therefore, the locus of control is integrated to the attitudinal factors in the Stern model.

The last model used in this research is the one developed by Fietkau & Kessel (1981). However, as their work has been published in German, the review of this model from Kollmuss & Agyeman (2002) has been used. In their research, Fietkau & Kessel (1981) have shown four elements corresponding to the environmental determinants or causal factors for environmentally significant behavior. The possibilities to act pro-environmentally can be assimilated to the specific knowledge and skills developed in the Stern model and in the Hines et al model. It also can be integrated to the contextual factors as if infrastructures lack, pro-environmental actions become impossible. The perceived consequences of behavior are already mentioned in the Stern model as the perceived cost and benefit of action and as the locus of control in The Hines et al model. The third causal factor for environmentally significant behavior developed in Fietkau & Kessel (1981) is the incentive for pro-environmental behavior. From the Stern model this could be part of the contextual model in term of policy inducing monetary reward. At last, the environmental attitudes and values could be part of the attitudinal factors proposed in the Stern model. The Fietkau and Kessel model brings an element of importance for our case study as it showed that environmental knowledge, which could be included in the Stern model as a personal capabilities, and shapes the subject’s environmental attitudes and values.

At the first sight, the early US linear model (Kollmuss & Agyeman, 2002) which is both rather rationalist and simple could have been integrated to the Stern model. The three components of this causal chain are environmental knowledge, environmental attitude, and pro-environmental behavior. The first component causes the second which in turn triggers the third. However, this model has been proven to be wrong although NGOs and governmental agencies keep using this model and think that more knowledge will result in more pro-environmental behaviors. The connection between environmental attitude and pro-environmental behavior is not straight forward. The two main barriers to this linear relationship are the direct versus indirect experience and the normative influences. Direct experiences with environmental issues give stronger sense of responsibility and more pro-environmental behavior compared with indirect experiences. The social norms, the culture, or family and close friend influence the way one behaves. For instance, in order to reduce the environmental footprint alternative exists. The use of Japanese toilet or “super toilet” permit its user to stop using toilet paper and in turn reduce his/her water footprint. However, the European culture does not seem ready to adopt this toilet paper free toilet as stores struggle to sell this product. This model remind us that barriers exist and should be taken into account in the theoretical framework.

Kollmuss & Agyeman (2002) have reviewed different models which are used to understand the reasons people act pro-environmentally and the existing barriers to pro-environmental behaviors. In order to include these barriers to the model, each factor need to be seen as positive and negative. For instance, the lack of specific infrastructures (convenient recycling center for example) would decrease the chance for environmentally significant behavior while the presence of infrastructure would encourage this kind of behavior.

A model for environmentally significant behavior has been developed and is reproduced below (fig2).
The model above shows that four main causal factors affect the ability of someone to act pro-environmentally. In this part each causal factors are associated to the thesis case study. But before starting with this, it is important to clarify that the reduction of food waste at schools in Uppsala is the environmentally significant behavior of interest in this thesis case study.

The attitudinal factors are the pupils’ attitude towards reducing their amount of food waste at school. These factors are shaped mainly by the pupils’ values, their perception of the consequences of food waste reduction and their locus of control.

In this case study, the personal capabilities include every personal knowledge or skills that enables or disables the pupil to waste food. For example pupils’ knowledge of food waste issues and the fact the pupils know about the food waste reduction project. The model above (fig2) shows that the pupils’ knowledge can influence also the attitudinal factors.

The contextual factors can be seen as all the factors external to the pupils. It can be the canteen environment as a noisy room might alter their eating habits. It can be the food options or the serving system used. If the pupils are allowed to get second or even third servings, or if they are allowed only to get their food once. It is also the tasty food incentive in place already in the schools of Uppsala. As already expressed in the introduction, the amount of food waste at school can be reduced if the lunch is taken after a break instead of straight after the class (Cordingley et al, 2011) therefore this kind of policy is also an important part of the contextual factors in the model developed for the thesis.

The habit and routine can affect the amount of food wasted by pupils. Therefore, it is important to set new routines in order to reduce the amount of food waste at school, or keep the current one if effective.

Fig2: Environmentally significant behavior model inspired from Stern (2000).
The results obtained through this thesis are analyzed through the model above (fig2). The output of the analysis is discussed in the discussion part.

5 Results

5.1 Descriptive method

5.1.1 Questionnaires

The questionnaires have been answered by 100 respondents from different classes and schools of Uppsala municipality. The responding classes were a 7th grade class (AA7, n=30) and a mixed 4th and 5th grade class (AA4-5, n=6) from school AA, and a 7th grade class from school AC (AC7, n=23), a mixed 1st and 2nd grade class (D1-2, n=15) and a mixed 4th and 5th grade class from school D (D4-5, n=26). The letter-number codes are used to anonymize the schools and classes in the report. The questionnaires have been handed in to the pupils during the weeks 18 and 19.

In general, each responding class answered relatively correctly to the fallacies (questions 3, 5, 7 and 8). However, interesting results can be observed in the remaining question.

As the group AA4-5 only counts 6 pupils, their results are only showed but not analyzed as one respondent corresponds to about 17% of the group. However, their results are added to the overall results (TOTAL). Moreover, their results are within the same range as the other responding groups.

Figures 3 to 12 show the results for the different responding classes and all the respondents combined for each question.

Concerning the environmental impact of food waste at school, on average, 23% of the respondent seemed to know about it (fig3). This also means that on average 77% of the respondent ignore the consequences of food waste on the environment or think that food waste does not harm the environment. Looking at the different responding classes, it seems that the older the respondent is the more knowledge he/she has about the environmental impact of food waste.
Fig 4: Results for question 2: “If I throw away the food served at school, others will be hungry”

The same results are observed regarding the ethical consequences of food waste (fig4). On average 32% of the respondents knew about the ethical impact of food waste while 58% ignored it or though that food waste does not have ethical issues. As for the environmental consequences, it seems that older pupils are slightly more aware of the ethical impact of food waste.

Fig 5: Results for question 4: “If I throw away the food served at school, the school lose money”

Regarding the result from question 4, (fig5) which aimed to show if the respondent knew about the economic consequences of food waste at school, it seems that mostly the respondent knew about it as on average 75% of the respondent answered correctly. With the results shown in figure 5, it is not possible to highlight differences between older and younger pupils.
Fig6: Results for question 6: “The food I throw away at school is used to make biogas for the buses in Uppsala“

The question number 6 aimed to reveal if the respondent knew that food waste is recycled into biogas which is used by the city buses in Uppsala. On average only 20% of the respondent knew that food waste from the school restaurant are recycled into biogas in the municipality of Uppsala (fig6). However, the youngest respondents of the questionnaire have a really high correct-answer-ratio of more than two third. This result contrasting with the other classes cannot be explained at this stage.

The respondents have answered relatively correctly to the four fallacies which are false statements covering both the impacts of food waste at school (question 3) and the way food waste is managed in the municipality of Uppsala once in the bin (questions 5, 7 and 8).

Fig7: Results for question 3: “If I throw away the food served at school, I will be thinner”

The school restaurants in Uppsala municipality have a policy that every pupils should only take the amount of food he/she can eat at first. Once the plate is empty, the pupils can come for a second serving. Therefore, pupils are encouraged to only take what they are able to eat. In turn, if for some dieterian reason a pupil need to eat less than average, he/she does not have to take as much food in his/her plate at first. With this kind of policy it becomes false that throwing away food from your plate makes you eat less and might make you thinner. However, it seems that some of the younger pupils still have this idea (fig7).
This fallacy aimed to raise wonder within the respondents to think about what actually happen to the food waste once it ends up in the food waste bin. On average 74% of the respondent knew that food waste is not burnt at the back of the school (fig8). Younger pupils were much surer than the older respondents about this question as about 10% of the younger respondent (D1-2 & D4-5) stated they did not know the answer while more than 30% of the older respondents answered the same.

Question 7 also tried to give misleading track to the respondent concerning the food waste management in Uppsala by suggesting that food waste is eaten by the pigeons by the cathedral of Uppsala. With only 4% wrong answer on average most of the respondents figured out that this statement was false (fig9). In general, older respondent answered more correctly to this question, however this might be due to geographical reason. Indeed, school D is located outside the city of Uppsala, therefore the respondents might have had harder time to be sure about the answer as there are less familiar with the cathedral of Uppsala cited in the question and its potential strange practices.
The last fallacy suggests to the respondent that food waste are used to make Swedish sausages (Falukorv). Beside the fact that we still do not really know what these sausages are made of, only 3% of the respondents think that statement is true (fig10). There is not real differences to be observed between the different age group.

The aim of question 9 at first was to figure out if the respondent knows that food waste is used as fertilizer which in turn helps in the production of “new food”. However, the results of question 9 might not be usable for this research as it seems that question 8 induced the respondent to answer to the question 9 in a similar way. Question 8 is asking if food waste is used to make a special kind of sausage from Sweden (Falukorv). Question 8 is a fallacy as explained above. Then question 9 is asking if new food is made from food waste. However it seems that the question has been understood as food waste is used directly to make new food like for the sausage example above (fig11). Therefore, the answer from question 9 is not further analyzed.
The aim of question 10 was to figure out if the respondent could independently state if he/she wastes more food than the average. The respondents from school D believe they waste just under the average amount of food. On the other hand, more respondents from schools the AA and AC believe they throw away more food than average.

The question 11 is an open-end question aiming to check if the respondents know about the tasty food incentive implemented under the food waste collection project. The results differ extensively between the classes from school D on one side and the responding classes from schools AA and AC on the other side.

First the results from the 7th graders from schools AA and AC are analyzed as they are quite similar. Surprisingly, a large part of the respondents either did not know or thought they would not get anything from diminishing their food waste generation. From school AC grade 7, 26% of the respondent think they get nothing from throwing away less food while 35% stated they did not know. From school AA grade 7, 23% of the respondent answered they did not know and 23% believe they would not get anything from reducing the amount of food they waste. 20% of the respondent from school AA grade 7, and 22% from school AC grade 7 mentioned in their answer the fact to get better food, tasty food of example of such. Other interesting comments were found in some answers. For instance, 13% of the respondent from the school AA grade 7, and 4% from school AC grade 7 explained in their answer that the school would save money which often could be used for “funnier” activities like school trips, outdoor activities or more serious suggestions like getting better school material. 13% of the respondent from school AA grade 7 believe that reducing their food waste would make more food available at school. The comments from some of the respondent caught particularly my attention. For example, a respondent from school AC grade 7 answered to this question that by reducing the amount of food thrown away, less “environmental damage” will be caused. From the same class, another respondent answered to: “hope for better food… but I don’t think so if I know well the municipality”. This comment could reflect a discourse where the role and efficiency of the municipality is criticized. This kind of remarks might have been heard by the respondent from familial environment for instance. The main conclusion to draw from the answers of these two classes is that only a few respondents knew (or hoped) that by reducing their amount of food waste at school, they would receive a tasty food as a reward.

The answers from AA4-5 are quite similar to AA7 and AC7. From six respondents four did not know, one answered that more food will be available for others at school and the last one said that if he/she throw away less food the environment will be better and money will be saved and invested in the playground area. In general none of the respondent mentioned the incentive in place at the moment.

Answers from both classes from school D are totally different from the previous ones. 65% of the respondent from the mixed 4th and 5th grade class and 73% of the respondent from the mixed 1st and 2nd grade class mentioned that if they throw away less food they would get an ice cream. In the remaining answers, 7% of the respondent from school D answered they will get good food and only 12% stated they did not know the answer. Contrary to the other responding schools, it seems that the respondents from school D know much better about the tasty food incentive.

The main results of interest from the questionnaires are:

![Fig12: Results for question 10: “In your opinion, to you throw away more/as much/less food than average at school”](image-url)
• In general pupils do not know the consequences of food waste at school regarding the environmental and the ethical dimensions.

• In general pupils know the economic consequences of food waste at school.

• The tasty food incentive is really popular in only one of the responding school. Only few respondents of other schools know about it.

• Only one responding class know that city buses in Uppsala run on biogas recycled form food waste.
5.1.2 Secondary data collection

Table 1 compiles the data obtained from the person in charge of food waste collection project at Uppsala municipality.

Table 1: Food waste quantity in the schools Uppsala in g/portion. N/A = not available.

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The figures above correspond to the amount of food wasted in the canteen by the pupils in grams per portion. In the left column is the code of the different schools. The color shows what grade are taught in the school. The green cells correspond to schools with classes from 1st grade up to 6th grade, the yellow cells to schools with classes from 1st grade up to 9th grade, the orange cells to schools with classes from 5th grade up to 9th grade, and the red cell corresponds to a high school. The higher the school is in the table, the least food it wastes on average according to the result observed in the last two years. At first, it seems quite clear that older pupils waste more
food than younger pupils. Surprisingly, the opposite behavior was observed in the UK according to Cordingley et al (2011) where younger wasted more than older pupils.

The four middle columns show the amount a food thrown away by the pupils for the four different data collection weeks. A grey cell (with N/A) means that the school has not recorded its food waste for the corresponding period. Looking at the last line, we see that on average pupils of Uppsala schools waste less food throughout time, especially during the last data collection week. It seems therefore that the food waste reduction project started by the municipality begin to pays off.

The three schools responding to the questionnaires are schools D, AA and AC. These three schools represent the three main type of school being part of the food waste reduction project in Uppsala. The only type of school missing is a high school. School D has pupils from 1st grade till 6th grade and is the school which has the youngest respondents. The pupils from this school wasted on average 15 grams of food per day during the last food waste collection week, and is one of the schools wasting the least in the food waste reduction project. School AA has classes from the 1st grade till the 9th grade. On average, pupils wasted 27 grams of food during the last food waste collection week. School AC is the responding school which has the oldest pupils and which waste the most food too. This reflect the general behavior observed that older pupils waste more food. During the last food waste collection week, the pupils of school AC wasted 40 grams of food every day.

5.1.3 Interviews

Two semi-structured interviews have been carried out for the purpose of this thesis. The results from the interviews are developed in this part.

5.1.3.1 Uppsala Municipality

The first interview was carried out with interviewee A which is working for the municipality of Uppsala at the food and restaurant department (“kost och restaurang”). This person is also responsible for the food waste reduction project in Uppsala. The interview took place the 7th of May 2014. The questions were sent to the interviewee few days prior to the interview.

The aim of the interview was first to (i) have access to background information about the food waste collection week in schools, (ii) learn what are the goals and future plans for this project and (iii) to know what the municipality think the pupils know about food waste issues.

Only the school restaurants managed by the municipality are concerned by the food waste collection project. It represents about half the primary schools in the municipality of Uppsala and a total of 33 schools (Nygårdh, 2014).

Every school which is managed by the municipality of Uppsala has to participate to this project. However, it happened for the last data collection that a school could not do it due to specific reasons (Nygårdh, 2014). The food waste data collection happens twice a year during a week each time, once during the autumn and once during the spring. The schools are informed by the municipality four weeks prior to the food waste collection week with the dates of the food waste collection week (Nygårdh, 2014). Informative signs concerning the week to be placed in the school canteen are sent to the schools kitchen (Nygårdh, 2014). Schools have the responsibility to weigh separately the food waste from the pupils’ plates and the kitchen production waste every day. They also have to show every day during this particular week, the result from the prior day (Nygårdh, 2014). The municipality provide the schools with examples for showing the results for different age groups and ask the schools to share the way they present their results. However, it has been observed that the schools are not very good at sharing their ideas and creativity with the municipality (Nygårdh, 2014).

Once the food waste collection week is over, the schools compare their results with the figure form the previous collection week. If the pupils have thrown away less food, they get as a reward tasty food like ice cream, pizza, or deserts for instance paid by the saving made by not throwing away the food. The choice of the reward is made by the school kitchen (Nygårdh, 2014).

The municipality believe that the pupils know that food waste is weighed during this specific week. In general, the municipality thinks that pupils throw around the same amount or a bit more outside the data collection week. However, it has been observed at the only high school part of this project that the pupils actually throw away more food during this specific week than during the rest of the year. The school has been weighing the food waste without noticing the pupils and realized that less food was thrown away by the pupils. The municipality thinks that it is a typical teenager behavior to try to break the rules (Nygårdh, 2014).
The municipality acknowledges that the pupils’ ability to know and understand the food waste issues highly depends on two factors: their age, and their teachers (Nygårdh, 2014). The municipality thinks the pupils know that wasting food is bad but they doubt they know the consequences of food waste. They also think that pupils know that food waste is recycled into biogas for buses in Uppsala as classes visit often the biogas plant facility (Nygårdh, 2014). Moreover, the municipality thinks that the pupils know about the bonus food incentive. The person in charge of this project mentioned that it is important to talk about the food waste issues at school and that the issues of food waste were mainly environmental and economic (Nygårdh, 2014).

The project has been running for about 5 years. However, at first the amount of food thrown away was not communicated back by the schools to the municipality. It is only since the autumn 2012 the data are recorded by the municipality (Nygårdh, 2014). The aim at first was to observe if the amount of food waste reduce in Uppsala. The main message sent by the municipality was that wasting food is costly. The environmental message is harder to be spread to the pupils without access to the classrooms according to Nygårdh (2014). The results have shown on average a slow decrease of the amount of food waste for the past two years and a sharp decrease during the last data collection week. However, the municipality could not explain why the amount of food waste decreased so much during the last data collection (Nygårdh, 2014).

The person in charge of this project would like for the future to scale up the project, not in term of number of schools but in term of time. Indeed, the aim is to record the food waste all year round in order to better understand the reasons for food waste in the schools of Uppsala. Meanwhile, the municipality also wishes to collaborate more with schools and the kitchens in order to reach one of the 8 environmental goals for Uppsala. The goal is to serve 100% organic food in the schools canteens by 2023 (Nygårdh, 2014). By reducing the amount of food waste the municipality could save money and in turn afford cooking with organic food which is generally more expensive than conventional food. The municipality aim for this environmental goal is to overcome health and environmental problems related to the use of conventional food (Nygårdh, 2014).

5.1.3.2 Kitchen staff

The second interview was carried out with interviewee B which is the chief manager for a school kitchen (school AC) in Uppsala. The interview took place on the 7th of May 2014. The kitchen serves food for pupils from 11 years old till 16 years old.

The main aim of the interview was to acquire practical data concerning the food waste collection week in a school. A secondary aim was to obtain the opinion from an adult working in a school kitchen about what he/she would think pupils know about food waste issues.

Before the food waste collection week, the kitchen staff inform the school by disposing notes in the canteen and sending e-mails to the teachers (Holmgren, 2014). In the school restaurant, the pupils’ food waste coming from their plates is weighed separately from the unserved food and kitchen waste. The kitchen staff has try to show the results in terms of weight of food wasted, but it seemed that the pupils did not care so much about the quantity of food waste. Therefore, this year they decided to show the results in term of money loss due to food waste. For instance, it was shown how many energy drinks could have been bought if food waste was avoided (Holmgren, 2014).

The chief manager of the school kitchen has been clear that pupils do know that they would get “popular food” if they succeed to throw away less food than during the latest food waste collection week. For instance, the Monday following the food waste collection week this spring, pupils asked for their ice cream. Unfortunately, this school did not succeed to waste less. This also shows that the pupils know that the food waste is weighed during a specific week (Holmgren, 2014).

The interviewed chief manager of the school kitchen acknowledged that pupils did not know as much as wished about food waste issues while she was well informed and concerned about the environmental, economic as well as ethical impacts of food waste. It has been acknowledged that a better communication between the kitchen staff and the teachers would help the pupils to understand the issues of food waste.

It could not be said if more food was wasted outside the food waste collection week. However, from experience, the kitchen staff has observed that popular food such as hamburgers or pizza generate more food waste from the pupils (Holmgren, 2014). The interviewee explained that pupils take too much food at first, fearing that no food will be left for a second serving even though the interviewee never saw food lacking. According to the kitchen staff observation, this behavior results in a bigger quantity of food thrown away by the pupils.

It is believed by the chief manager of the school kitchen that probably older pupils know that food waste recycled into biogas in Uppsala.
Some interesting suggestions have been proposed by the interviewee. For instance, the creation of a set of lectures and field trips to show the cradle to grave life cycle of food, which could help to raise awareness within pupils. Moreover, as the daily routine to weigh the waste only takes about two minutes a day, the interviewee would be willing to pursue the effort all year round. Finally, the interviewee believe that other prices or incentives than the tasty food should be awarded to the successful pupils. For example, competition between classes or even schools could be more motivating and engaging for the pupils according to the interviewee (Holmgren, 2014).

The main results from the interviews are compiled into Table 2.

**Table 2: main results from interviews**

<table>
<thead>
<tr>
<th>UPPSALA MUNICIPALITY</th>
<th>KITCHEN STAFF</th>
</tr>
</thead>
</table>
| **Pupils knowledge of food waste issues** | - Think that pupils know food waste is bad but ignore the consequences  
- Depend on pupils’ age and teachers | Not as much as wished |
| **Pupils knowledge of biogas** | Think that pupils know | Older pupils probably know |
| **Pupils knowledge of the tasty food incentive** | Think that pupils know | Quite sure that pupils know |
| **Plan for the future or suggestions** | - All year round recording  
- More cooperation with schools | - Willing to record all year round  
- Better communication with the teachers for more environmental knowledge  
- New incentives  
- Lectures and field trip to raise awareness |

Table 2 shows that in general the interviewees believed the pupils knew about food waste issues, the tasty food incentive and that food waste is recycled into biogas. They also thought that older pupils know more. Both interviewees were seeking for a better cooperation with the schools’ kitchens and municipality in general and willing or wishing to record the food waste all year round.

**5.2 Associative method.**

In this part, the results from the three different data collection methods are compared and analyzed.

From the interviews it is possible to conclude that the interviewees were quite confident that the pupils knew about the tasty food incentive which is in place in order to reduce the amount of food waste in the schools. The respondents from school AC who did not seem to know about the tasty food incentive get their food prepared by interviewee B who thought that pupils know about the tasty food incentive. This shows that a knowledge gap exists between pupils and adults concerning the perception of the incentive. However, the results from the respondents from school D showed that most of the respondent in this particular school know about the tasty food incentive.

Comparing the results from the question 11 of the questionnaire and the amount of food waste produced by every school (Table 1), it seems that the more the respondent knows about the tasty food incentive the less food is wasted. However, information from the interview with the chief manager of a school kitchen (Holmgren, 2014) could give a more complex answer. The interviewee expressed that the current “tasty food” incentive is maybe not motivating enough the pupils. For younger pupils, getting an ice cream for lunch has probably a great value. But for older pupils who might have the opportunity to go to the neighboring store to buy any snack, an ice cream at the school restaurant probably has lower value.

The results from the question 10 of the questionnaire (Figure 12) are also compared to the amount of food waste produced by every school (Table 1). Globally it seems that the pupils are aware of the quantity of food they throw...
It has been said in the interview with the person in charge for the food waste collection project that the aim of this project was to save money in order to able to support 100% organic food in the schools (Nygårdh, 2014). Even though no results have shown how much money have been saved so far, the message seemed to have reached the pupils. Indeed, the question dealing with economic consequences is the question to which the respondents answered the best in comparison to the other questions regarding the consequences of food waste (environmental, and ethical).

Overall, the responding pupils did not know the issues related to food waste except its economic consequences. Interviewee A believed that older pupils would know better than younger pupils (Nygårdh, 2014). This behavior can be observed regarding the questions concerning the environmental and ethical consequences of food waste even though the difference between younger and older respondents is slim and still a majority of the older pupils do not know these consequences.

Interviewee B believed that older pupils would know better that food waste is recycled into biogas in Uppsala (Holmgren, 2014). However, the respondents from the mixed 1st and 2nd grade class from school D know much more that buses in Uppsala run on biogas from food waste. The teacher from this class said that the pupils have not been visiting the biogas plant which make the results even more interesting.

The results showed that the respondents do not know as much as the interviewees expected. At the same time, both interviewees have expressed interesting thoughts concerning this subject. Interviewee A has stated to wish the project to develop through a stronger collaboration with the schools and the kitchens. Interviewee B has suggested to develop lectures and field trips to explain to the pupils the food flow, from the farm to the recycling facility. Even though it seems that pupils do not know as much as expected by some parties, creative solutions exists and could be implemented with the collaboration of the municipality, the schools kitchens and the schools themselves (Holmgren, 2014).

The main results from this research are that:

- Pupils know much less about food waste issues than the interviewed adults would think.
- The more the tasty food incentive is known from the pupils, the less they waste food at school.
- Both interviewees are willing to develop the current project though a more holistic approach.

## 6 Discussion

The discussion first focuses on answering the three research questions. The answers from the two first research questions have been discussed in the results part but are summarized in the discussion part. In order to answer the final research question, the results obtained through the research are integrated into the model developed in the theoretical framework (fig2).

The first research question was: What knowledge have pupils of Uppsala of food waste issues? The results from the questionnaires show that most of the responding pupils of Uppsala knew about the economic consequences of food waste. However, it seems that the pupils of Uppsala are lacking the knowledge concerning the environmental and ethical consequences of food waste at school. Except for one of the responding classes, in general the pupils of Uppsala do not know that food waste is recycled into biogas which is used by the city buses. In regards to the theoretical framework developed in this thesis, pupils’ basic knowledge of food waste issues is one of the causal factor influencing the environmentally significant environmentally significant behavior of reducing the pupils’ food waste quantity. This point is discussed further as part of the answer of the third research question.

The second research question was: What is the relationship between food waste generation at school and pupils knowledge of food waste issues? Regarding the results, the only clear relationship is that the more the pupils
know about the tasty food incentive, the less they waste food. However, no clear relationship has been observed between the knowledge of the consequences and the amount of food wasted. As shown in the answer on the first research question, the global level of knowledge is relatively low and similar for every responding group. As developed in the theoretical framework, the tasty food incentive is one of the contextual factors affecting the pupils’ environmentally significant environmentally significant behavior to reduce their amount of food waste. The results from this case study show that a well-known incentive has a great impact on the pupils. Therefore, as a part of the third research question, suggestions regarding this aspect of the food waste reduction project are made.

The third research question was: How could the food waste reduction project implemented in the schools of Uppsala be improved? This research question is answered by analyzing the results through the model developed in the theoretical framework (fig2). In order to improve the existing food waste reduction project, the current problems are obtained from the results of this thesis.

Regarding the personal capabilities causal factors for environmentally significant behaviors, the questionnaires showed that pupils’ knowledge concerning food waste issues is relatively low. According to the theory, the lack of knowledge influence the pupils’ environmentally significant behavior (Stern, 2000). Therefore, it is necessary to improve the pupils’ basic knowledge of food waste issues in order to observe more reduction of the food waste in schools. However, at this stage the problem is only partially solved. Indeed, the mean to improve the pupils’ knowledge still need to be decided. Regarding the results from the interviews, both the kitchen staff interviewed and the person in charge of the food waste reduction project have wished to have a better collaboration between the schools, the kitchens and the municipality. Therefore, the teachers could help by teaching basic knowledge of food waste in their classes and pupils could visit the kitchens in order to understand where the food comes from. Moreover, external organization could join the project to bring their own piece of the puzzle. For instance, the municipality own the company which recycles food waste into biogas and fertilizer (Uppsala Vatten) could help organizing study trips or workshops. The aims would be to reduce the pupils’ amount of food waste and also increase the share of food waste segregated. Indeed, only 40% of the food waste in Uppsala end are recycled by Uppsala Vatten (Uppsala Vatten, 2014). The remaining 60% are either thrown away in the wrong bin or the toilets, or cannot be thrown in the right bin because of lack of infrastructure (Uppsala Vatten, 2014). By implementing field trips, the pupils are more likely to obtain direct experience with environmental matters (Stern, 1997). According to Stern (1997) direct experience have more impact on one’s values and therefore modify one’s attitudinal factors which in turn have more influence later on environmentally significant behavior than indirect experience which can be acquired through videos for instance.

According to the theory used for the research, the pupils’ knowledge of food waste issues do not only influence the pupils’ personal capabilities but also affect the attitudinal factors by introducing new values to the pupils Fietkau & Kessel (1981). Therefore, increasing the pupils’ basic knowledge on food waste issues is crucial in order to reduce the amount of food wasted at the schools of Uppsala.

The food waste reduction project can also be improved by implementing changes to the contextual factors defined in the theoretical framework. The theory claims on this point that modifying elements external to the pupils influence the pupils’ behavior toward throwing away food at school. In this research, one of the main finding is that pupils knowing about the tasty food incentive waste much less food than pupils which do not know. The reasons for pupils not knowing about the incentive could be either a poor communication or a lack of motivation from the pupils. If the incentive is not encouraging enough for the pupils to waste less food, it is necessary to change it. However, the new incentive should be decided in consultation with the pupils. By integrating the pupils into the decision making process there is more chance that the incentive will work and it could also give more responsibilities to the pupils. Looking at the theoretical model, the subject responsibility influences his/her environmentally significant behavior. Therefore by including the pupils as part of the project could result in reducing the overall food waste at school.

Another contextual factor to be changed concerns the schools policy. As Cordingley et al (2011) showed, moving the lunch time after the leisure time can decrease considerably the amount of food waste. Therefore, the schools policy could encourage the pupils to eat after playing. However, the pupils’ point of view should not be forgotten for this decision. As research for sustainable development often use holistic approaches, the aim to reduce the amount of waste should not influence the pupils’ wellbeing.

Meanwhile, the current “do not take more than you can eat” policy must be conserved as it help reducing the pupils’ amount of food waste. However, as observed by one of the interviewee, this policy has its limits. For instance when popular food is served, pupils tend to take much more than what they can actually eat as they fear lacking food during the second serving. Popular food should not be banned but measures must be taken in order to reduce this behavior.
In order to summarize the answer of the third research question, the current food waste reduction project can be improved by:

- Increasing pupils’ basic knowledge of food waste issues through formal and informal education.
- Modifying the incentive in some school with the pupils’ participation.
- Reviewing school policy concerning lunch time (break and serving method).

In order to change environmentally significant behavior, Stern (2000) advises not to focus only on one possibility but develop several strategies at the same time. Focusing extensively on one intervention shows often less results than implementing several interventions. Therefore, it is important to learn from the failure of the old US linear model (Kollmuss & Agyeman, 2002) and do not focus only on increasing the pupil’s knowledge.

Other points concerning the difficulties encountered during the research or even other relevant information have to be discussed before concluding the thesis.

The limited time for the thesis made it difficult for the research to engage teachers and schools. Out of more than five hundred teachers contacted only nine answered from which six accepted to cooperate and only four actually collaborated till the end. From 23 headmasters contacted only one answered negatively. Uppsala being an academic city, some schools might sometimes feel overwhelmed by the constant demand from university students to engage them for diverse projects or theses. If the project has to be re-done, I would suggest to engage with the municipality of Uppsala from the beginning in order to have more legitimacy regarding the schools. However, I believe that it would slow down the research but once implemented the results would be more consequent. With more respondents and also by having responses from each classes of several schools, more information could be revealed in the results. Moreover, in order to engage with the municipality it is better to come up with an interesting and useful idea for them too.

Concerning this particular project, the municipality has a great interest to pursue the effort in order to reach one of the eight environmental goal set by themselves. The money saved by reducing the amount of food waste would help the municipality to implement and finance menus which are only made from organic food in the schools of Uppsala. Therefore, a successful food waste reduction project would make the new organic menu as expensive as the older conventional menu even though organic is more expensive in fact.

Assuming the food waste reduction project would collect data about the quantity of food waste all year round in the future, it would be easier to figure out with more accuracy the reasons for food waste in the schools of Uppsala. Therefore, the food waste reduction project must integrate in its framework the current known reasons for food waste in schools according to research (Cordingley et al, 2011; EC, 2010) and investigate the degree of importance of each determinants for the schools of Uppsala. Except knowledge, other factors influence the amount of food waste in the schools like the canteen environment, the logistic, the portion size, the pupils’ tastes, the labeling of available food, and the availability and accessibility of snack. This thesis has been focusing mainly on the pupils’ knowledge but further researches could focus on the other reasons for food waste at school and evaluate the degree of importance of each of them.

7 Conclusion

The pupils of Uppsala have in general low basic knowledge of food waste issues except concerning the economic consequences of food waste. The results of the research showed that the pupils knowing about the tasty food incentive waste much less food than others. In order to improve the results of the food waste reduction project advices are given in regard to the theoretical framework used in this research. The pupils’ knowledge of the basics of food waste issues should be taught both in the classroom and during study trips. The current incentive system should be reviewed integrating the pupil’s point of view in order to optimize its power. The schools policy concerning the lunch time need to be reviewed and more holistic approach need to be adopted in order to include every stakeholders in the project and its decision making.

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9 References


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Appendix

Questionnaire in Swedish:

Om jag slänger skolmat, smutsar jag ner naturen.
Rätt ............... Fel ............... Vet inte

Om jag slänger skolmat, blir andra personer hungriga.
Rätt ............... Fel ............... Vet inte

Om jag slänger mer skolmat, blir jag smalare.
Rätt ............... Fel ............... Vet inte

Om jag slänger skolmat, förlorar skolan pengar.
Rätt ............... Fel ............... Vet inte

Skolmaten som jag slänger, eldas upp bakom skolan.
Rätt ............... Fel ............... Vet inte

Skolmaten som jag slänger används för att göra biogas/bensin till Uppsalas bussar.
Rätt ............... Fel ............... Vet inte

Skolmaten som jag slänger äter duvorna vid Domkyrkan upp.
Rätt ............... Fel ............... Vet inte

Skolmaten som jag slänger används för att göra falukorv.
Rätt ............... Fel ............... Vet inte

Skolmaten som jag slänger används för att göra ny mat.
Rätt ............... Fel ............... Vet inte

Jag tror att jag slänger:
för lite mat ........... lagom mängd mat ............... för mycket mat

Vad kommer du att få om du slänger mindre mat i skolan tror du?