



# Identifying Barriers and Promoters of Household Waste Sorting Among Students

Harigovind Mukundan

BACHELOR'S THESIS

May 2020

Degree Programme in Energy and Environmental Engineering

## **ABSTRACT**

Tampereen ammattikorkeakoulu  
Tampere University of Applied Sciences  
Energy and Environmental Engineering

**HARIGOVIND MUKUNDAN:**

Identifying Barriers and Promoters of Household Waste Sorting Among Students

Bachelor's thesis 51 pages, appendices 10 pages  
May 2020

---

The amount of municipal waste generated increases globally every year and has numerous negative impacts on the environment. To ensure availability of materials and sustainable production, recycling and reuse of materials are vital, which require segregation of waste based on the type of materials. Households generate a major portion of municipal waste, including many materials that can be reused and recycled. Therefore, the segregation of household waste, and especially source segregation becomes significant. Recycling rates in Finland have recently plateaued and more effort and resources are being put into increasing the recycling rates. The role of students in sorting of household waste and recycling was studied to identify the barriers and promoters towards source segregation and recycling behaviour. A survey study was carried out in order to assess the rate of sorting and recycling among students.

The data were collected from 106 students from two groups and predictions about various groups were made and factors that would promote source segregation of household waste among students were identified. The survey results as well as the predicted results show that the students sort and recycle the household waste at a rate higher than that of the region's average rate, but the current collection and infrastructure need improvement if the rates are to improve. Close to 90% of the participants sorted their household waste. The predicted rates of sorting household waste for various groups of students ranged from 73% to 81%, which were considerably higher than the average rate (63%) for the region.

The main factor that motivated students to engage in sorting and recycling was the knowledge about the significance of sorting and recycling. The convenience of having the mixed waste bin and in addition a lack of bins (both inside and outside the apartments) for different types of waste inhibit thorough sorting. A lack of space for bins inside the apartments is also a limiting factor. Providing more bins, especially separate bins for plastic waste along with easier ways to sort and store the waste can improve the recycling rates.

---

Key words: waste management, source segregation, municipal solid waste, household waste, recycling

## CONTENTS

1	INTRODUCTION .....	5
2	WASTE GENERATION AND MANAGEMENT .....	6
3	RESEARCH QUESTIONS AND DESIGN.....	10
	3.1 RESEARCH QUESTIONS .....	10
	3.2 RESEARCH DESIGN .....	11
4	RESULTS .....	17
	4.1 Group A (TOAS apartments).....	17
	4.1.1 Shopping habits and waste disposal (Group A).....	18
	4.1.2 Motivation for sorting and not sorting (Group A).....	22
	4.2 Group B (ENVE students).....	24
	4.2.1 Shopping behaviour and waste disposal (Group B).....	25
	4.2.2 Motivation for sorting and not sorting (Group B).....	29
5	ANALYSIS AND COMPARISON OF SURVEY RESULTS .....	31
	5.1 Analysis of results .....	31
	5.2 Self-reflection about the survey.....	35
6	CONCLUSIONS .....	37
	REFERENCES .....	40
	APPENDICES .....	42
	Appendix 1. Survey sent out to Group A.....	42

**ABBREVIATIONS AND TERMS**

EEA	European Environment Agency
MSW	Municipal Solid Waste
OECD	Organisation for Economic Co-operation and Development
PJH Oy	Pirkanmaan Jätehuolto Oy
TAMK	Tampere University of Applied Sciences
TOAS	Tampereen opiskelija-asuntosäätiö
UNEP	United Nations Environment Programme

## 1 INTRODUCTION

In contemporary economy, the consequences of increasing quantity and types of waste are plentiful, and the perils of enormous amounts and several types of waste generated threaten both humans- individuals and societies, and ecosystems equally (UNEP n.d.). Uncollected waste can lead to spreading of communicable diseases, which directly impacts human health and can exacerbate the effects of natural disaster such as floods. Practices such as open dumping and open burning of waste pollute land, water, and air, and accelerates climate change. The nature of societal impact varies from economic costs such as post-disaster remediation costs and increased health care expenditures to decrease in human productivity. (ISWA 2015)

The rapid urbanization and rising populations are seen as drivers of heightened waste generation in a 2018 report by World Bank. Another key reason attributed to waste generation, among other things, is the conventional linear model of 'take-make-waste' approach (Ellen McArthur Foundation n.d.). The EEA notes that the methods of production and consumption of materials also play a major role in the surge of waste generated (EEA 2016).

Amongst the many recommendations for reducing the impacts of waste generated, source segregation and separate collection is vital as it forms the base for utilisation of waste generated (WHO Europe 2016). It allows provision for reuse, recycling as well as recovery and lowers the necessity for discarding, in line with circular economy principles (EEA 2019). Sorting of waste facilitates the reuse of materials, thus conserving energy as well as resources.

The purpose of the study was to identify factors that act as barriers and the main promoting elements towards source segregation of household waste among students in Tampere, Finland. This would also shed light into the efficacy of the current waste management and collection methods employed in the buildings under study. Finally, the study also intended to identify prospective ways to stimulate and thus improve source segregation of household waste among the students.

## 2 WASTE GENERATION AND MANAGEMENT

Estimates indicate that the annual collection of solid waste amounts to a massive 11.2 billion tons globally (UNEP n.d.). In the summary of Global Waste Management Outlook (GWMO) published in 2015 by UNEP (United Nations Environment Programme) and ISWA (International Solid Waste Association), the Municipal Solid Waste (MSW) generation amounted to two billion tonnes per year, whereas the total urban solid waste (industries, construction, households) generation stood between seven to ten billion tonnes. A World Bank Report reckons a 70% growth in global waste generation if no urgent measures are employed (World Bank 2018).

The European Environment Agency estimates the increase in annual average rate of waste generated in the OECD European area to be around three percentage since 1985 (EEA 2016). According to European Commission, the amount of household waste produced by a single person averages to around half a tonne per annum (European Commission 2020).

In the European Union, the fundamental notions and definitions pertaining to waste management has been laid out in the Waste Framework Directive (Directive 2008/98/EC on waste). In addition to definitions, the framework also covers standards for sustainable and effective managing of waste (European Commission 2019).



FIGURE 1. Waste Hierarchy as per the Waste Framework Directive (European Commission 2008)

A waste management hierarchy has also been presented to aid the member states in producing legislation associated with waste management and policies pertaining to the management of waste. As seen in the Figure 1, the disposal of waste is to be considered as the last objective and the prevention of waste is given top priority in the hierarchy. (European Commission 2019)

The directive further presents key principles such as the "Polluter Pays Principle (PPP)" which transfers the responsibility of ensuring the acceptable state of the environment to the producers and "Extended Producer Responsibility (EPR)" in which the responsibility of the producers is extended to the end-of-use or the end-of-life stages of the product's life cycle. Additionally, recycling and recovery targets to be achieved by 2020 were also presented. The target for preparing for reuse and recycling of particular materials from household waste and wastes from similar origins was set at 50%, while for construction and demolition wastes, the goal was set at 70%. In a revision later, new goals for recycling and reuse of municipal waste were set in the new Circular Economy package. The goals are now set at 55% for 2025, 60% for 2030 and 65% for 2035 (Europarl 2018).

The municipal waste generated in Finland grew by eight percentage in 2018 in comparison with 2017, totalling more than 3 million tonnes. There were also increase in the generation of waste per inhabitant as well as the quantity of mixed waste generated. While the production of mixed waste grew by more than 20% compared to 2017, the quantity of waste generated per inhabitant increased by 50 kg to around 550 kg in 2018 compared to 500 kg/inhabitant in early 2010s. (Tilastokeskus 2020.)

In the Environmental Implementation Review published by European Commission in 2019, the current state of waste management in Finland was reviewed. According to the country report for Finland, there has been substantial decrease in landfilling since 2013, coming down to below 10 kg per capita in 2017 compared to more than 100 kg per capita in 2013. The amount of waste that was incinerated for energy production has stayed steady since 2014 until 2017 at nearly 60% (Figure 3).

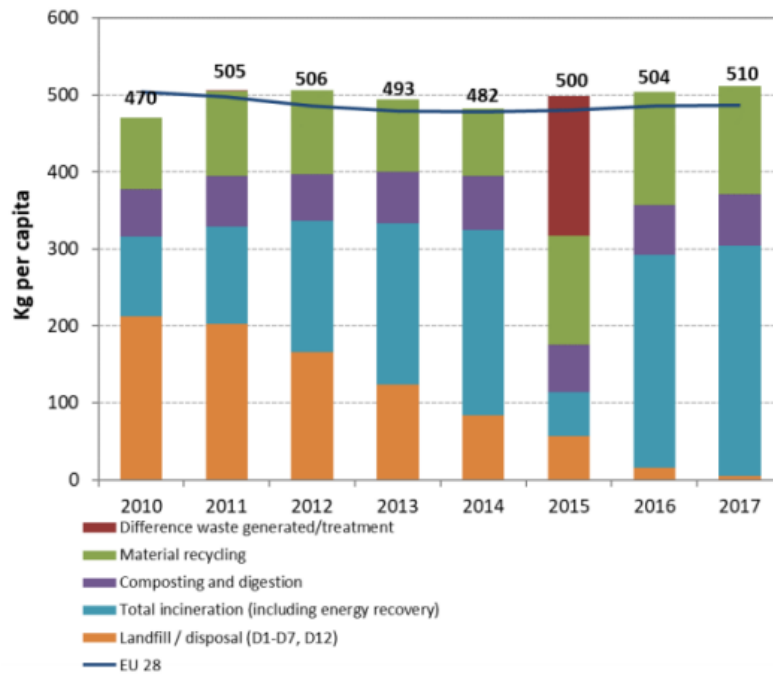


FIGURE 2. Treatment of municipal waste in Finland from 2010 to 2017 (European Commission 2019)

Significant rise in rate of recycling was also noted in the years 2015-2017 in comparison with the rates from 2010-2014 (Figure 4). The municipal waste recycling rates grew from 33% in 2013 to 42% in 2016 and went down to 41% in 2017 but appears to have remained at this rate which is below the EU average which is 46%.

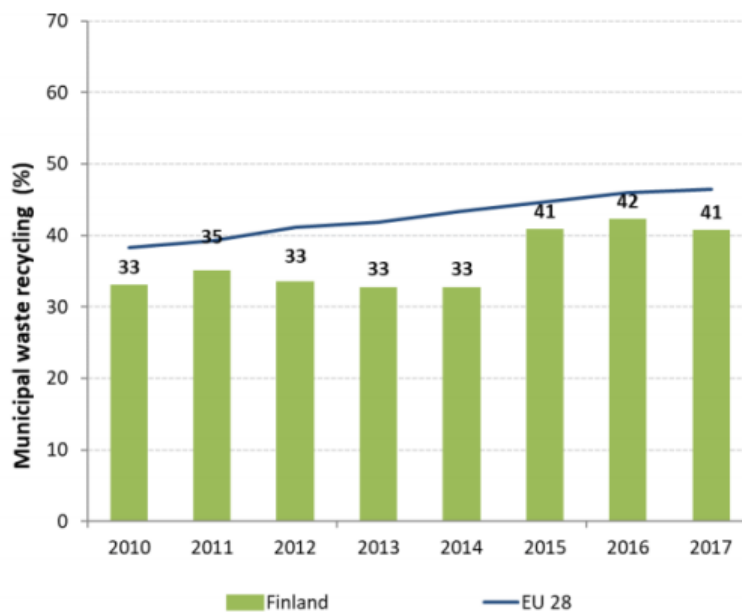


FIGURE 3. Municipal waste recycling rate from 2010-2017 in Finland (European Commission 2019)



The main reasons cited for this improvement include the focus on separate collection, the deposit refund scheme (Pantti system) for cans and bottles, and an increase in the rates of collecting biowaste separately (European Commission 2019).

Even with all the endeavours and efforts put into recycling, Finland was placed in the 'Early Warning report' as it stands to miss out on the 50% recycling target by 2020. The main recommendations of the commission included setting compulsory recycling targets for municipalities corresponding to national target of 50% as well as introducing additional conditions for sorting waste. (European Commission 2019)

The key solution advocated by many to reduce the negative impacts and improve the efficiency of waste management practices is to minimise the waste. The EPA suggests reduction or prevention at the source, and recycling and composting as means to slash the amount of waste being disposed of, while the GWMO also sees the 3Rs (reduce, reuse, recycle) as opportunities to bring down the investment required for setting up treatment and disposal facilities. The GWMO further goes on to explain four groups of actions based on circular economy principles as means to reduce and handle waste. The World Bank report suggests similar solutions as well and sees financing, policy, and planning decisions as the key.

Even though preventing waste generation by designing out the waste seems to be the best way to tackle the issue, it will be a rather time-consuming process, depending on the capabilities of the companies, availability of alternative methods and materials, etc. In many EU countries, the rates of reuse and recycling are quite low and the percentage of household waste that is recycled and reused stands at 40% with more than 80% of municipal waste still going into landfills (European Commission/Eurostat 2018). Therefore, the best option at hand now is to reuse, recycle and recover materials from the waste streams. And to facilitate this, segregation of waste is quite important. Thus source segregation of household waste is vital if the recycling and reuse rates are to be improved.

### 3 RESEARCH QUESTIONS AND DESIGN

#### 3.1 RESEARCH QUESTIONS

Sorting waste can be complicated as the means of collection varies according to the type of waste and location. The lack of knowledge about what waste goes where also dissuades sorting of waste. Moreover, a variety of factors influence the decision to sort waste.

The initial idea for this study was inspired by the sights of overflowing mixed waste bins from time to time, as seen in the Picture 1 below.



PICTURE 1. Overflowing mixed waste bin in one of the TOAS buildings (Mukundan, 2019)

Even though the bins shown above are shared by the inhabitants of the apartment building together with at least 2 businesses (restaurants), there have been many occasions when the bins were full, and bags of waste were left outside. These occasions sparked curiosity as to whether the inhabitants sorted their waste or if they just utilised the mixed waste bin.

The study was done to understand the current level of source segregation of household waste and recycling among students in two groups based on location and field of study. The first group (hereafter referred to as Group A) consisted of inhabitants of seven TOAS apartments in Kaleva region in Tampere. The second study group (hereafter referred to as Group B) was the students of the Environmental Engineering degree programme at TAMK.

Furthermore, identification of key hurdles that lead the students to not sort or recycle as well as elements that promote source segregation and recycling was also a goal. By doing this, the efficiency of the current waste management systems, information provided about waste sorting and the employed collection methods could be analysed and it was expected to identify prospective ways to stimulate and thus improve source segregation of household waste among the students.

The study also intended to lay the foundation for future qualitative and quantitative studies to improve the waste management practices.

The main research questions were:

1. How efficiently do the students sort their household waste?
2. How efficient are the current waste management practices and infrastructure?
3. What are the promoters and barriers for sorting of household waste among the students?
4. What factors could improve the efficiency of waste collection and recycling among students?

### **3.2 RESEARCH DESIGN**

Tampere is a city in southern Finland and part of the Finnish region of Pirkanmaa. It is second largest Finnish city in terms of area with and the third largest city in Finland in terms of population (Statista 2018). It is also the biggest inland city in the Nordic countries (Visit Tampere). The population in 2018 was 235,239 (City

of Tampere 2019). As per the Tampere University website, there were about 30000 students studying in the new Tampere University and Tampere university of Applied Sciences combined. (TUNI 2018)

Separate collection of mixed waste that cannot be salvaged is a requirement for residential buildings. Similarly, facilities for collecting paper and biowaste are also mandatory (City of Tampere). The regional waste management company Pirkanmaan Jätehuolto Oy (PJH Oy) is in charge of collecting, moving, and handling household waste in Tampere, along with 16 other municipalities. In total, it serves 444,000 inhabitants in 17 municipalities (PJH Oy 2019).

The Kaleva district in Tampere is located on the eastern part of the city. According to the National Board of Antiquities (Museovirasto), Kaleva is "one of the most cohesive and extensive districts, implemented after the second world war in accordance with the zoning principles of functionalism" (rky.fi 2009). The proximity to many schools and all the university campuses makes it an ideal location for students.

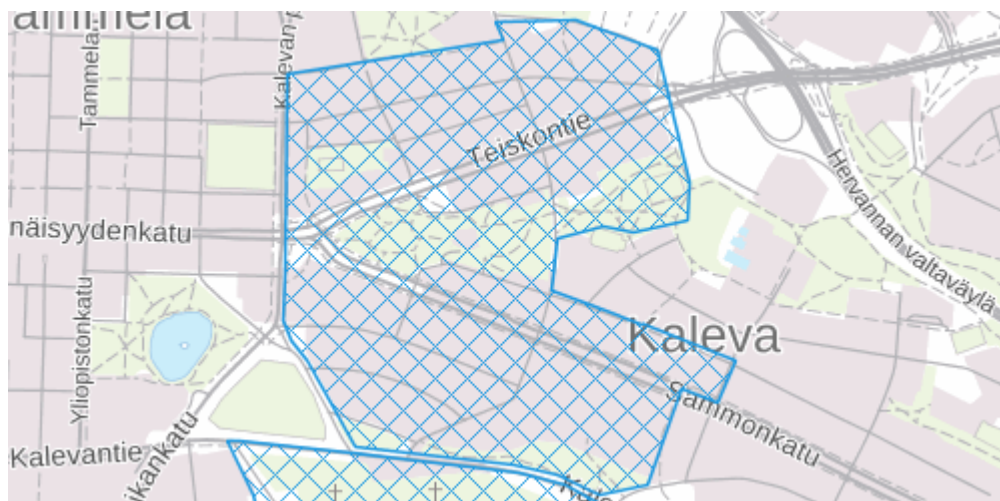


FIGURE 4. Map of Kaleva district (Museovirasto)

Founded 60 years ago, TOAS (Tampereen opiskelija-asuntosäätiö) is a student housing foundation in Tampere that provides student housing in various parts of the city. Besides renting student apartments, TOAS is also involved in construction and management of the properties. In Kaleva alone, TOAS has more than 15 apartments in ten locations. (TOAS 2019)

Two groups of potential participants were identified, and a survey study was carried out to understand the waste segregation and recycling practices among the participants as well as the perception of the participants towards segregation of waste and recycling. A survey was created for the purpose of the research and distributed through various online channels.

While creating the survey, a sort of pre-survey was done to gather information for the fifth section of the survey. This was done by asking the members of the student club of Environmental Engineering degree programme at TAMK, the alumni of the Degree programme in Energy and Environmental Engineering at TAMK (Tampere University of Applied Sciences) and a few Finnish friends of the author. This was done to ensure that all perspectives regarding waste sorting behaviour could be included in the survey and minimise the respondents' effort in filling it.

From the pre-survey, many reasons for sorting or not sorting waste were gathered, most of which were further grouped under one of the three categories- behavioural, knowledge or infrastructure related. While sorting was generally carried out owing to either environmental, behavioural, or knowledge-based reasons, the pre-survey strongly suggested that infrastructure or knowledge-related issues along with behavioural reasons was behind the decision to not sort.

The survey was distributed among two study groups, both consisting of students. To increase the number of responses, a reward was also included for the participants, which would depend upon the total number of responses received. The groups had two weeks to respond to the survey.

The first group (hereafter referred to as Group A) consisted of inhabitants of seven TOAS apartments in Kaleva region in Tampere. The survey was distributed through four Facebook groups for the inhabitants of the seven apartments. Although the primary intention was to also distribute printed versions of the surveys and/or printed version of appeal to fill the surveys and a link to the online survey, the unprecedented situation that arose due to the Corona virus situation meant that this would be impractical. Thus, the surveys were distributed only through Facebook groups, except for one apartment building where the author resides. In this building, a written note was also put on the notice board asking the residents

to respond to the survey. One major reason for choosing these apartments, other than the convenience of sending the survey to these apartments, was the location itself. The proximity of grocery stores of various sizes and high number of restaurants was a key factor. After the first post asking to fill out the survey, a reminder was sent out through the same Facebook groups.

The second study group (hereafter referred to as Group B) was the students of the Environmental Engineering degree programme at TAMK. The survey distribution was done through various channels, including a WhatsApp group for the members of GLOBE, the student club of Environmental Engineering degree programme at TAMK as well as WhatsApp groups for the various years. Another medium employed was emails sent out to the current students of all years of the degree programme through GLOBE. As in the case of the other Group A, reminders were sent out through the same WhatsApp groups and via emails to Group B prompting them about filling the survey.

Two separate surveys were made for groups A and B. Although the questions were mostly the same, there were a few differences in the content. Since most respondents in group A were assumed to be Finnish in comparison with the members of group B, the survey for group A had both Finnish and English text. This assumption was made mainly since group A consisted of residents of TOAS apartments and belonged to various fields of study. Whereas in case of group B, all the members were in the same degree programme and the language of instruction was English, and hence the text was in English. For group A, there was an option to choose the TOAS apartment they lived in, which was replaced by an option to choose between student housing apartments or private apartments in case of group B. The option to choose field of study was omitted for group B as all of them belonged to the same degree programme. The survey sent out to Group A can be seen in the appendices (Appendix 1). Since the survey for Group B was pretty much the same, this has not been included.

The survey was divided into six sections. The first section explained about the topic of the survey, the privacy and use of data provided by the respondents and the details of the prize draw. The second section provided instructions for filling the survey and gathered information about the household and the inhabitants. In

the third section, the questions were aimed at finding out the waste generation and disposal, and the fourth section consisted of questions related to the waste sorting and recycling. The fifth section delved into the sorting behaviour among the respondents, and finally in the sixth section the respondents had the chance to opt to take part in the prize draw. There were multiple-choice questions, questions that could be answered with more than one option and a few which warranted a written answer. The survey was made in such a way that it was easy to fill and consumed very little time to fill.

First section contained the information regarding the reason for the survey. In addition, the privacy of the data provided and the rules for the prize draw was also explained. In the second section the questions were designed to understand the details about the household and the inhabitants. Of particular interests were the demographics of the respondents including the age, sex, field and level of education, and nationality, and the average monthly income and the shopping habits of the respondents. The intention was to identify if any of these components significantly factored in the waste generation or disposal behaviours of the respondents.

It was also important to get a basic idea about the quantity of waste generated along with the quality of the generated waste. In addition, the interval between two consecutive disposals was also asked about. Hence, in the third section the respondents were asked to provide information such as the approximate time between two consecutive disposals, the approximate amounts of waste generated during this period and the common, the most common and least common types of waste generated in their household. To make it easier for the respondents, general definitions of terms that were repetitively used, such as 'waste', 'biowaste', 'sorting/segregation', 'collection', and 'separate collection' were provided. The definitions were taken from the EU Waste Directive 2008/98 (European Commission 2008).

The questions in the short segment of the fourth section of the survey were designed to gauge the respondents' waste management practices including sorting and other recycling practices (such as the use of 'pantti' system). Identifying the

underlying behavioural reasons that defined the perception towards source segregation of waste was the major objective of the research and the fifth section of the survey aimed at gathering information regarding the same. The main theme of this section was sorting behaviour and why or why not the respondent engaged in sorting their household waste. In addition, these respondents were also asked about how their friends or acquaintances perceived the subject of waste segregation. Finally, the factors that could motivate the respondent were provided to choose from, based on the other questions of this section as well as the pre-survey. If none of the options motivated them, they could also suggest options. In the final section, the respondents had the chance to opt in for the prize draw by providing their email address.

Based on the sample size and population size, confidence intervals were calculated for various groups. All calculations were done using the Sample Size Calculator by Creative Research Systems (Surveysystems.com 2012).



## 4 RESULTS

### 4.1 Group A (TOAS apartments)

A total of 46 responses were received from the residents of the seven TOAS apartments in Kaleva. The highest number of respondents were from TOAS Ni-nansampo (15) while there were only three and four responses were received from the residents of Vanha Domus and Jarinsampo, respectively. From other apartments, five (Nuoli), six (Uusi Domus and Keihäs) and seven (Pirjonsampo) responses were received. (Figure 5).

TOAS-rakennuksen nimi, jossa asut/ Name of the TOAS building you live in  
46 responses

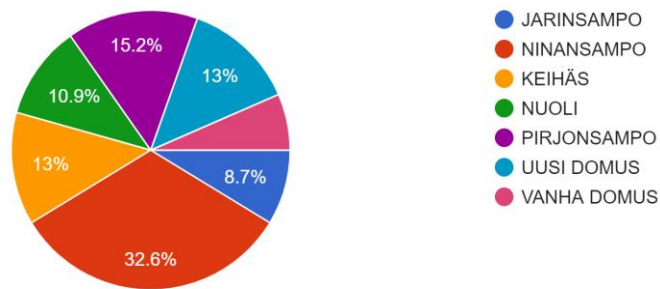


FIGURE 5. Percentage of residents from each of the toas apartments studied (Group A)

Of the respondents, 56,5% (26) lived in studio apartments, while 8,7% (4) lived in shared apartments, and 34,8% (16) lived in family apartments (Figure 6).

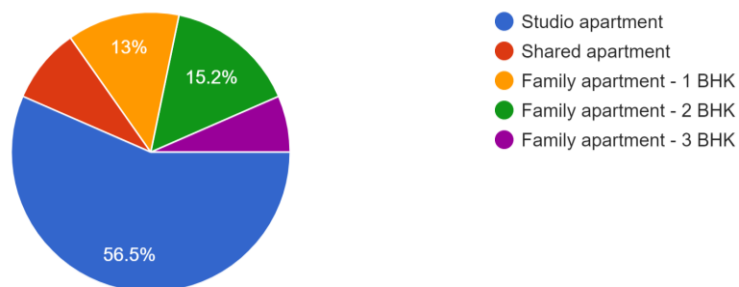


FIGURE 6. Types of apartments the respondents lived in (Group A)

There were 29 apartments where there was only one inhabitant, while 14 apartments had two residents and three apartments had three inhabitants..

#### 4.1.1 Shopping habits and waste disposal (Group A)

Most of the respondents shopped at least twice a week. Nearly 60% of the respondents shopped twice a week, while close to 35% shopped every other day. The rest shopped once a week (Figure 7).

Kuinka usein teet ostoksia?/ How often do you shop?  
46 responses

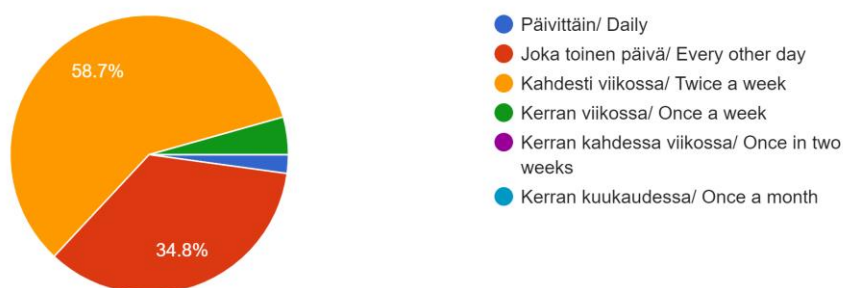


FIGURE 7. Frequency of shopping (Group A)

As seen in Figure 8, 50% of the respondents disposed of the household waste twice a week, while the waste disposal was done once a week by 37%.

Kuinka usein roskat viedään kotitaloudessasi? (Valitse yksi vaihtoehto)/ How often do you dispose of the waste generated in your household? (Choose one option)  
46 responses

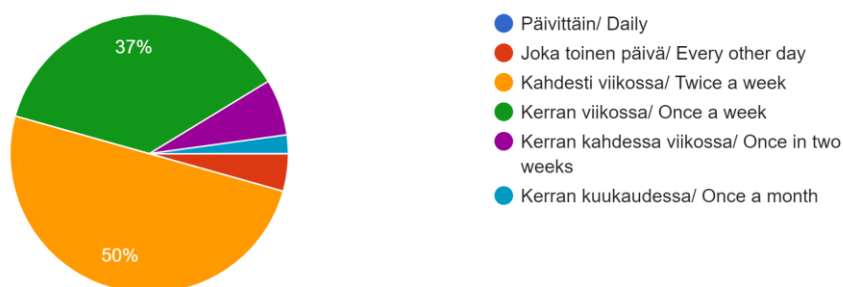


FIGURE 8. Frequency of waste disposal (Group A)

Only one respondent said that they carried out the waste disposal once a month, whereas the rest of the respondents did it once in two weeks or every other day. None of the respondents disposed of the waste generated daily.

Biowaste was disposed of once a week by more than 45% of the respondents and twice a week by more than 41% (Figure 9). The rest of the respondents did it either every other day or once a month.

Kuinka usein biojätteet hävitetään?/ How often is biowaste disposed of?

46 responses

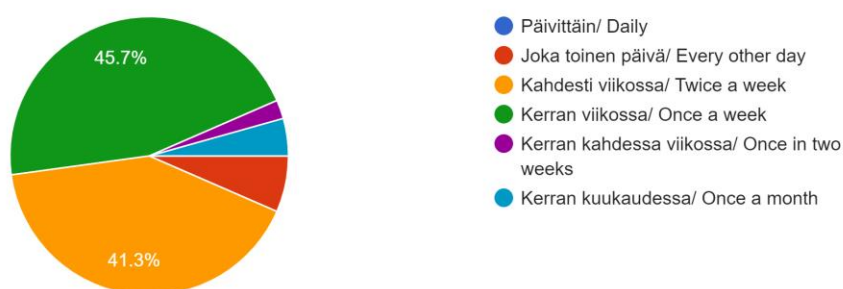


FIGURE 9. Frequency of biowaste disposal (Group A)

Nearly 72% of the respondents bought separate bags to store and carry the waste to the disposal site. 61% of the respondents used carry bags they bought from the stores to carry the waste, including some the respondents who bought separate trash bags. Only 15% of the respondents used their own trash bins to carry the waste and 28% used the bins provided by TOAS to carry the waste to the disposal site.

Biowaste and food packaging (plastic) were generated in the 90% and 95% of the households, while other food packaging (other than plastic) was produced more than 80% of households and paper in almost 75% of the households. Waste metal, glass and cartons were generated in less than 20% of the households.

Among the common types of waste generated, the most frequent type of waste generated was food packaging (plastic) with 63% of respondents choosing this option (Figure 10). For more than 20% of the respondents, biowaste was the most common waste, and 13% of the respondents chose food packaging (cartons).

Paper was the most common type of waste in only less than three percentage of the households.

Mitkä ovat kotitaloudessasi yleisin jäte?/ What is the MOST COMMON type of waste generated in your household?

46 responses



FIGURE 10. Most common type of waste generated (Group A)

Takeaway containers were the least common type of waste with 50% of the respondents selecting this option. Plastics other than food packaging was the second least common type of waste while more than 10% respondents said that paper was the least common type of waste generated in their household (Figure 11).

Mitkä ovat kotitaloudessasi harvinaisin jäte?/ What is the LEAST COMMON type of waste generated in your household?

46 responses

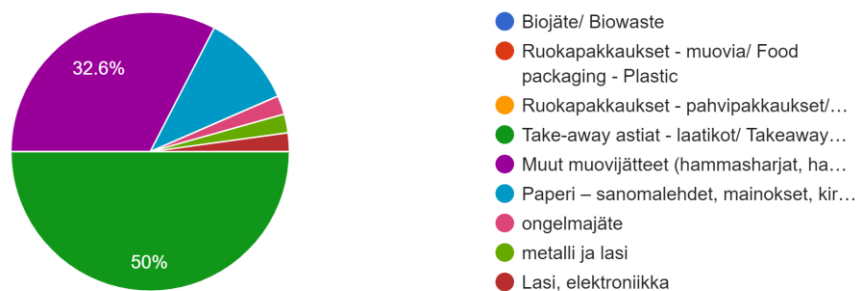


FIGURE 11. Least common type of waste generated (Group A)

More than 80% of the respondents said that they sorted their waste in the apartment itself, whereas nearly five percentage of the respondents collected the waste together and sorted it at the disposal site. Nearly nine percentage of the

respondents only sorted the waste at times while close to five percentage did not sort at all (Figure 12)

Lajitteletko jätteitä?/ Do you sort waste?  
46 responses

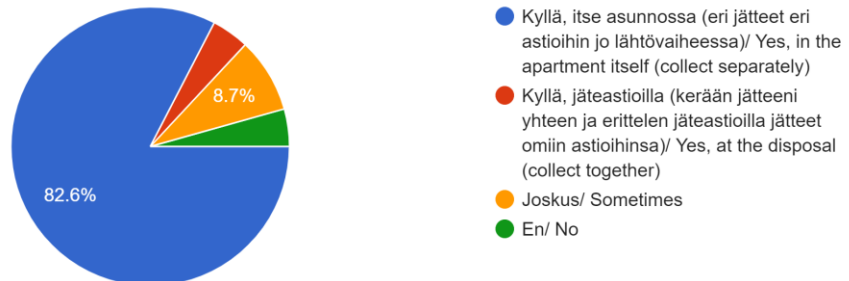


FIGURE 12. Sorting behaviour among the respondents (Group A)

While more than 90% of the respondents said that they used the mixed-waste bin, nearly 75% also separated biowaste. Paper was separately disposed of by 87% of the respondents and glass by more than 80%. Cartons were separately disposed of by nearly 70%, and cardboard packaging and metal by nearly 80%. Plastic bottles were also disposed of separately by nearly 85% of the respondents but e-waste was segregated by only about 46%.

Interestingly, 100% of the respondents utilised the 'pantti' system (Figure 13) and returned the bottles and cans for recycling.

Palautatko pullot ja / tai tölkit? (Pantti-järjestelmä)/ Do you return bottles and/or cans? (Pantti system)  
46 responses



FIGURE 13. Percentage of respondents who utilised deposit refund scheme (Group A)

Nearly to 90% of the respondents used the return system to get the deposit back. For almost 46% of the respondents, the proximity of the return sites was also the reason and about 80% did so because they also wanted to recycle.

#### **4.1.2 Motivation for sorting and not sorting (Group A)**

As for the main reason for sorting their household waste, close to 95% of the respondents understood the importance of sorting the waste and agreed that it is good for the environment. Equal number of respondents cited the reason for them sorting the waste as their parents sorting and recycling waste as well as recognising the importance of segregating the waste themselves. Only in the case of less than 10% of the respondents each the reason for sorting was that their partner, roommate, or friends influencing them to do so.

When asked about reasons they have heard from someone else for sorting household waste, nearly 90% of the respondents said that the main reason was that the person knew it was good for the environment. 37% said that it was because the person's parents used to sort and recycle, while according to nearly 40% of the respondents, learning about the importance of segregation of waste from school was the reason. Close to 35% said that the person had learned about the importance of sorting waste on their own, and 37% of the respondents said it was because the person's friends sorted and recycled. 26% said that the reason they have heard is that the partner or roommate influenced the person's sorting behaviour.

The main reason for not sorting the waste pointed out by the respondents was that there was not enough space for separate bins to collect the waste separately in the apartment itself. The second most common reason was the convenience of dumping everything in the mixed waste bin. Not having enough bins provided for different types of waste was mentioned by nearly 20% of the respondents. Between five and ten percentage of the respondents provided reasons such as not being motivated, lack of knowledge regarding how to sort, convenience of not sorting waste, and generating only a small amount of waste for not sorting. Less than five percentage of the respondents cited reasons such as not wanting to spend time for sorting, their parents not sorting the waste or that a single person

sorting or not sorting does not make a difference. Many of the other respondents who sorted their waste wrote that they sorted in the 'other reasons' option provided. One respondent pointed out that even though they wanted to sort and recycle, since the waste is too dirty to be recycled, it made more sense to put it in the mixed waste than cleaning it. According to another respondent, the odour from biowaste kept them from sorting into separate categories, while one respondent said that they try to recycle.

As for the justifications the respondents heard from someone they knew who did not sort or recycle for doing so, the central one was that the person felt that it was easier to dispose everything of in the mixed waste bin. More than 50% of the respondents also heard that the person was not motivated to sort the waste. The time consumed for sorting as well as the lack of knowledge on how to sort the waste was selected by more than 30% of the respondents. Not having enough bins or enough space for separate bins was another key reason for someone not sorting their waste according to nearly 40% of the respondents. 37% of the respondents had also heard that a single person sorting or not sorting was not going to make a difference. More than 25% said that they had heard the reason to be that the parents not sorting or recycling whereas less than 20% of the time there was very little amount of waste generated. The convenience of not sorting was mentioned by more than 10% of the respondents as a reason they had heard from someone for not sorting.

More than 60% of the respondents said that having more bins inside the apartment would motivate them to sort the waste more thoroughly. Roughly 50% of the respondents were of the opinion that having more bins for different types of waste at the disposal site as well as an easier way to store the waste would encourage them to sort more thoroughly. Easier ways to sort and providing more information would persuade nearly 25% of the respondents. Less than 20% of the respondents said that having more information about the waste collected or having incentives for sorting waste would be a motivating factor. Roughly 10% said that more information on waste generation in the household or the significance of sorting and recycling would make them sort more thoroughly. Other than the provided suggestions, the main factor many of the respondents suggested was having a separate bin for plastic waste at the disposal site.

### 4.2 Group B (ENVE students)

A total of 60 responses were received from the group consisting of ENVE/IDEE students. Nearly 50% of the respondents lived in TOAS apartments, 25% in private housing and roughly 14% each in POAS apartment or own apartments as seen (Figure 14).

Do you live in a student housing apartment?  
60 responses

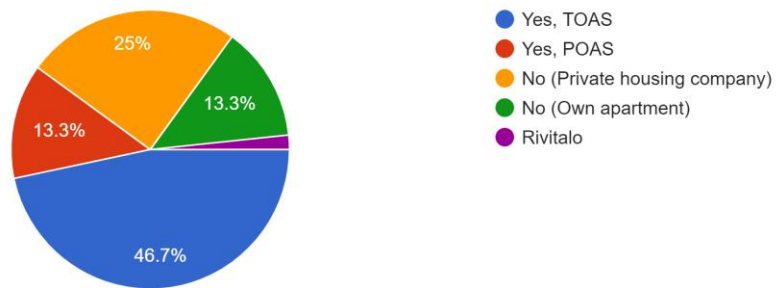


FIGURE 14. Ownership of apartments (Group B)

Thirty percent of the respondents lived in studio apartments and 23,3% lived in shared apartments. The rest of the respondents lived in family apartments of various sizes. The types of apartments and the percentage of respondents living in each type is shown in Figure 15.

Apartment type  
60 responses

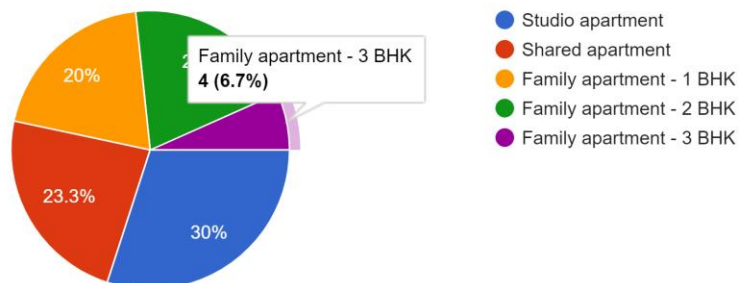


FIGURE 15. Types of apartments the respondents lived in (Group B)



#### 4.2.1 Shopping behaviour and waste disposal (Group B)

Around 45% of the respondents shopped twice a week, while 35% shopped every other day. Close to 10% shopped either once a week or once in two weeks, whereas one respondent each shopped either once a month or daily. The frequency of shopping by the respondents can be seen in Figure 16.

How often do you shop?  
60 responses

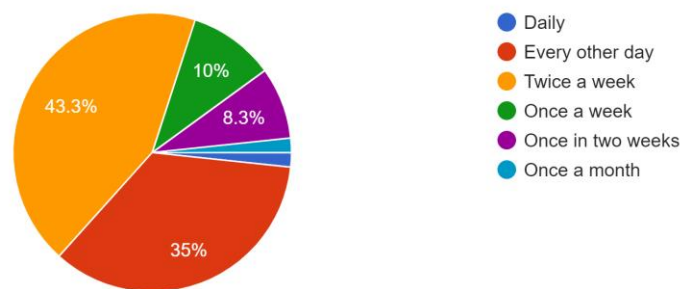


FIGURE 16. Frequency of shopping (Group B)

The waste disposal was carried out once a week by nearly 45% of the respondents whereas close to 30% did it twice a week. 10% did it every other day while more than 10% did it every other week. Five percentage of the respondents disposed of the waste daily and 1 respondent only did it once a month (Figure 17).

How often do you dispose of the waste generated in your household? (Choose one option)  
60 responses

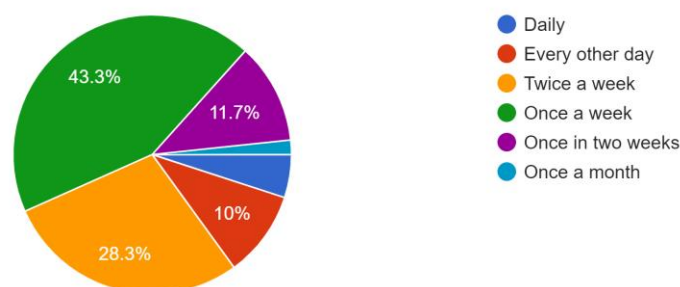


FIGURE 17. Frequency of waste disposal (Group B)

Between 50-60% of the respondents said they bought separate trash bags. The same percentage, including some of the respondents who bought separate trash

bags also used carry bags to dispose of the waste. While 30% of all the respondents used their own trash bins, 20% used the trash bins provided by the housing company for carrying the waste to the disposal site.

In the case of biowaste, the frequency of disposal is shown in Figure 18. The disposal of biowaste was carried out once a week by 41.7% and twice a week by more than 30%. 10% of the respondents said they disposed of the biowaste only once a month and close to 10% did it every other day. The rest of the respondents did it once every other week or daily.

How often is biowaste disposed of?  
60 responses

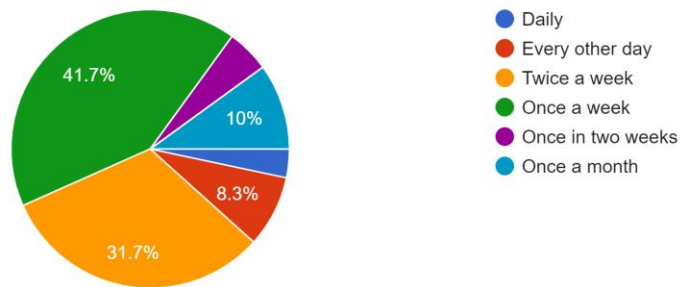


FIGURE 18. Frequency of biowaste disposal (Group B)

More than 90% of the households generated food packaging waste, both plastics and cartons and 80% generated biowaste, while nearly 60% of the households also generated paper waste.

What is the MOST COMMON type of waste generated in your household?  
60 responses

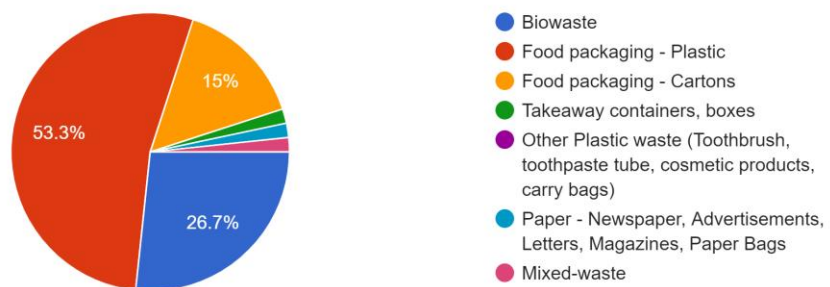


FIGURE 19. Most common type of waste generated (Group B)

The most common type of waste generated was plastic food packaging and second most common type of waste generated was biowaste. Figure 19 shows the most common types of waste generated in case of Group A. The least common waste was paper and other plastic waste not including the food packaging. From Figure 20, it can be seen that takeaway containers were the third least common type of waste generated.

What is the LEAST COMMON type of waste generated in your household?  
60 responses

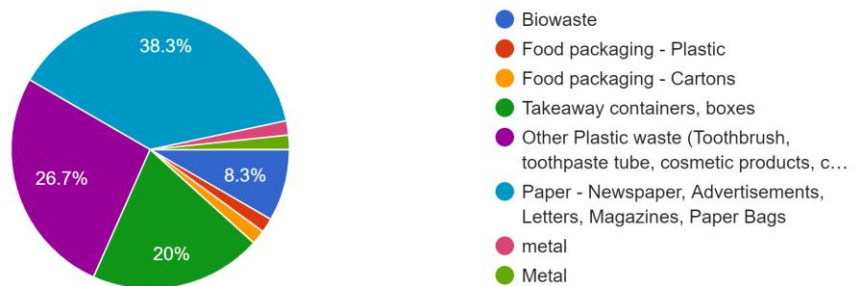


FIGURE 20. Least common type of waste generated (Group B)

80% of the respondents collected the different types of waste separately while 11,7% separated the waste at the disposal site. Four respondents said they sorted occasionally, and one respondent did not sort at all as can be seen from Figure 21.

Do you sort waste?  
60 responses

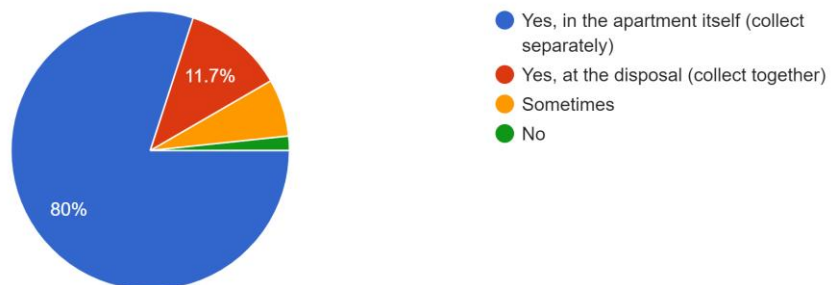


FIGURE 21. Sorting behaviour among the respondents (Group B)

Nearly 90% of the respondents produced mixed waste and 83.3% sorted the bio-waste. 75% of the respondents sorted glass and paper separately, and 78,3%

separately disposed of cartons. Around 70% of the respondents also separately disposed of metal, cardboard packaging and plastic bottles. Electronic waste was separated by 45% of the respondents. Very high percentages of sorting were observed in all categories of waste. Figure 22 shows the categories into which waste was sorted into.

Kuinka moneen eri luokkaan lajittelet jätteesi. (Valitse kaikki luokat joita itse käytät lajittelussa, jos  
How many categories is the waste sorted into? (Tick...s that apply. If you don't sort select mixed waste)  
60 responses

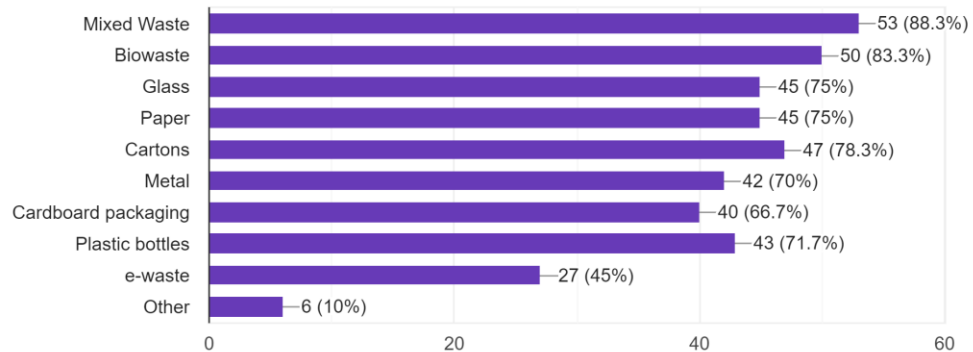


FIGURE 22. Categories into which waste was sorted (Group B)

More than 90% of the respondents used the bottle/can return system while the rest did it infrequently as seen from Figure 23. More than 75% did it to get the deposit back and because they wanted to recycle.

Do you return bottles and/or cans? (Pantti system)  
60 responses

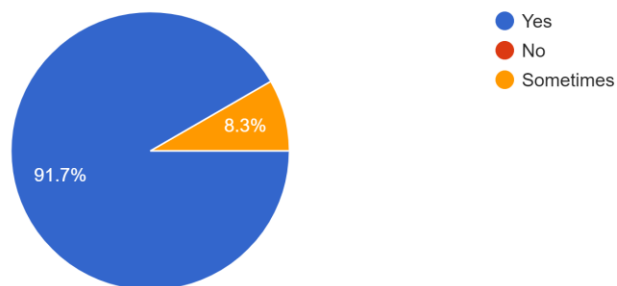


FIGURE 23. Percentage of respondents who utilised deposit refund scheme (Group B)

#### 4.2.2 Motivation for sorting and not sorting (Group B)

More than 90% of the respondents sorted the household waste as it was good for the environment. While almost 50% said they learned the importance at school, more than 60% said they learned the importance themselves. Close to 35% said that their parents sorting, or recycling was a reason.

The respondents were asked about reasons they had heard from people they knew for sorting their waste. Almost 90% of the respondents heard from someone they knew that they sorted waste since it was good for the environment. Nearly 50% said that the reason they had heard was because the person's parents recycled, and 45% said that the person learning the importance of sorting and recycling at school was cited as a reason for engaging in sorting. More than 50% said learning the importance was also a factor while close to 40% and 30% respectively said it was because either their roommate/partner made them recycle or because their friends sorted waste.

The main deterring factor that led to not sorting or having mixed waste was either small amount of waste generated or the convenience of putting everything in the mixed waste. Lack of enough bins for different kinds of waste as well as lack of space for different bins in the household was also cited by many.

As for the reasons the respondents had heard from someone they knew, the most common one was the convenience of using the mixed waste bin instead of sorting. Second most common reason was the perception that sorting or not sorting by a single person was not going to change anything. Lack of motivation, time taken for sorting, lack of knowledge, convenience in not sorting, etc were common justifications that the respondents had heard from someone who did not sort.

With between 40 and 50% of the respondents choosing these options, the main factors that would encourage more thorough sorting and recycling appears to be:

- More bins inside the apartment
- More bins at the disposal site
- Better waste collection method
- More information on how to sort

- Easier way to sort

25-30% of the respondents also mentioned that an easier way to store the waste, more information about the waste collected and more information on why sorting is important would encourage them to sort more efficiently. The main suggestion other than this was to have a separate bin for plastic at every disposal site.

## 5 ANALYSIS AND COMPARISON OF SURVEY RESULTS

### 5.1 Analysis of results

A variety of demographic information were collected, including age, nationality, gender, income, type of apartment, number of inhabitants in the apartment, education, and employment status. But no distinctive relations were found between the sorting behaviour and the demographics of the respondents in either groups. This could be due to the fact that very high percentages of respondents in both the groups sorted their household waste.

According to a study commissioned by PJH Oy, it was found that 63% of people in Pirkanmaa sorted the waste and recycled. The rate of recycling was quite high in case of paper with 98% of recycling achieved. The rates of biowaste and plastic packaging are on the lower side and needs improving at 67% and 43% respectively. The 2019 survey was answered by 867 people between the ages of 15 to 79 from various parts of Pirkanmaa. This means a confidence interval of less than four percentage at 95% confidence level (PJH Oy 2020).

Nearly 87% of the respondents in Group A sorted their household waste, with close to 83% collecting the waste separately in the apartment itself and the rest separately disposing of the waste. Only two respondents (4,3%) said that they did not sort at all. Statistically, at a confidence level of 95% the confidence interval was found to be 13.8%. Thus, in case of group A it can be assumed that the answer reflects the sorting behaviour of at least (87-13.8) % of the total number of inhabitants, which was more than 73%. This is higher than what PJH Oy's study had found (PJH Oy 2020).

The main types of waste generated was food packaging. This is in line with the frequency of shopping as close to 95% of the respondents shopped at least twice a week and spending an average of 72 euros/week on food. It was interesting to see that the income and number of inhabitants only in very few cases had an effect on the weekly average expenditure on food. Even though most households generated biowaste, it was the most common waste in only about one-fifths of the households. This could mean that food wastage is quite low, but also might

be the result of the diet followed by the inhabitants as most vegetables and fruits come without a packaging.

Even the ones who sorted their waste had to make use of the mixed waste bins. This could be representative of most of the inhabitants of the apartments as it is very hard to properly separate each kind of waste and not utilise the mixed waste bin at all. In addition to effort to sort, it would also largely depend on the availability of bins for different kinds of waste at the point of disposal. Similarly, it can be assumed that most of the inhabitants return cans and bottles to the return points as not only will they get the deposit back, but there are many return points close by.

The reasons for not sorting, mostly from the respondents who sorted pointed at the lack of space for more bins inside the apartment as well as lack of more bins, and the convenience of putting everything in the mixed waste bin as the main reasons for not sorting. Having more bins provided both inside the apartment and at the disposal site would motivate the majority of the respondents. In case of the people who did not sort at all or sorted sometimes, lack of motivation and the convenience of not sorting and using the mixed waste bin stood out as the main deterrents. The main motivating factors for these people would be easier way to sort and store.

With 60 responses, the survey results can be said to represent the views of  $\pm 10\%$  of the total number of ENVE/IDEE students with a confidence level of 95%. More than 90% of the respondents recycled and sorted their household waste, with 80% of the respondents collecting the waste separately and the rest disposing it separately after collecting together. Food packaging and biowaste were the most common types of waste generated. Again, this is in line with the frequency of shopping as more than 70% of the respondents shopped at least twice a week. Biowaste was produced and segregated in 80% of the households but was the most common type of waste generated in only one-fourths of the households.

It was very interesting to see that even though 88% of the respondents used the mixed waste bin, only in the case of about two percentage was the amount of waste that went into the mixed waste bin substantial. This shows that the students



in Group B tend to sort and recycle quite thoroughly. The percentages of all the categories the household waste is sorted into also reflects this. Interestingly, about eight percentage of the respondents only returned bottles and cans to the return points. Between 75-80% did it to get the money back, but also wanted to recycle.

The main reason for sorting the waste was because the respondents thought it was good for the environment. Learning the importance as well as watching the parents sorting and recycling also seems to have influenced at least half of the respondents. The small amount of waste generated and the convenience of throwing everything in the mixed waste bin were the main deterrents when the respondents chose not to sort. Like Group A, the lack of bins was also a major deterrent in case of Group B. Similarly, more bins inside the apartment and at the disposal site would motivate the respondents to sort more thoroughly. In addition, better waste collection method, more information on how to sort and easier way to sort would also encourage better sorting practices.

The total number of customers served by PJH Oy as per their website is 444,000 in Pirkanmaa. Although this includes non-students and people from outside Tampere, we can see how the students in Tampere sort and recycle in comparison with Pirkanmaa. Table 1 shows how the survey results compare to the PJH Oy study.

TABLE 1. Survey results compared to PJH Oy study

Group	Sorting and recycling (%)	Sample size	Population	Confidence Interval ( $\pm\%$ )
Pirkanmaa	63	867	444000	3.3
Group A	87	46	500	13.8
Group B	92	60	115	10

In Table 2, the minimum percentage of students from various groups who sort and recycle is predicted relying on the data obtained from the survey. The confidence intervals have been calculated at a confidence level of 95%.

TABLE 2. Percentage of students who sort and recycle in Tampere

	Group	Population	Confidence Interval ( $\pm\%$ )	Projected minimum %
PJH Study	Pirkanmaa	444,000	3.3	63
Survey results	Group A	-	-	87
	Group B	-	-	92
Predicting the minimum percentage who sort and recycle based on survey results	Group A	500	13.8	73.2
	Group B	115	10	82
	TOAS	5000	11.6	80.4
	TAMK	10000	12.6	79.4
	All (AMK and University) students in Tampere	30000	9.5	80.5

Assuming the number of students at TAMK to be around 10,000 and the number of students in Tampere University and TAMK to be around 30,000, we can use the data collected to get a general picture of recycling and sorting among students (AMK or University) in Tampere. With 106 responses in total from both the groups, for a population of 30,000 at 95% confidence level, the confidence interval is less than 10%. Therefore, we can assume that close to 80% of all the students (AMK or University) in Tampere sort their household waste and recycle. In case of students from TAMK, the confidence interval increases to 12%, so a little below 80% of the students from TAMK can be assumed to be engaged in sorting and recycling of their household waste.

Similarly, assuming the total number of TOAS student apartments to be approximately 5000 (Opiskelijantampere n.d.), and combining the number of TOAs residents from Group B (a total of 28 students, out of whom 27 engaged in sorting and recycling) with that of Group A, the confidence interval found to be 11.6%.

But it has to be noted that these might not be the actual cases since most of the people who attended the survey seemed to sort and recycle. The confidence in-

tervals may be off by few percentages as there could have been duplicate answers even though there were efforts to prevent this. The results are displayed in the increasing order of percentage of students who sort and recycle in Figure 24.

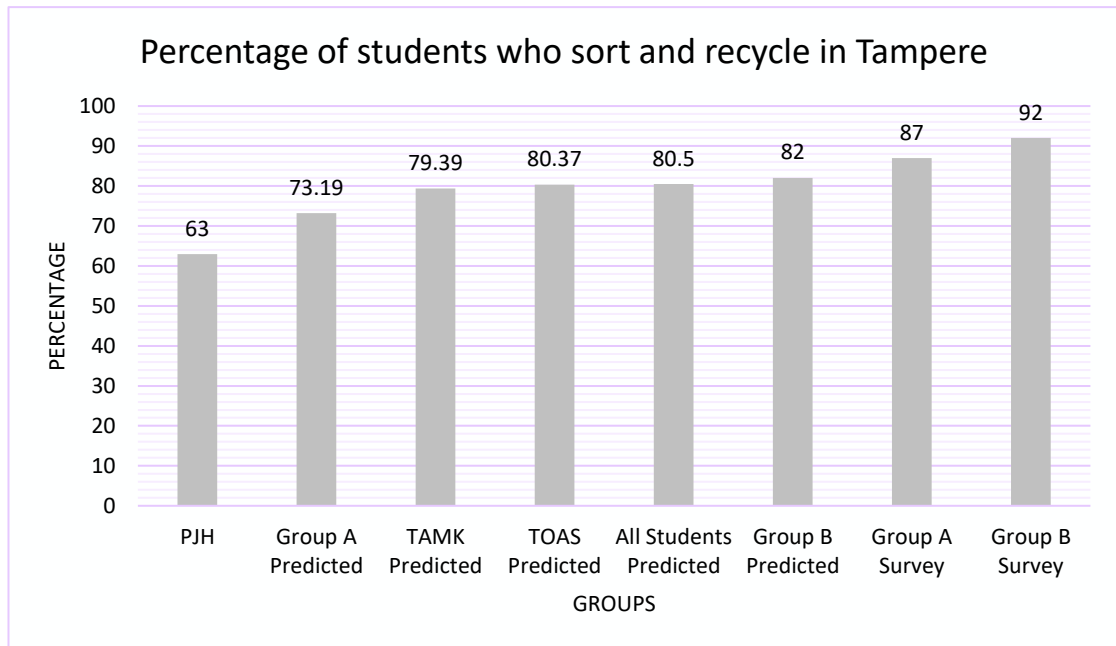


FIGURE 24. Percentage of students from various groups who recycle in Tampere

The higher percentages of recycling among the students could be due to reasons such as proximity to disposal sites as well as comparatively higher level of knowledge about waste sorting and its significance.

Even though the students engage in recycling, the level and extent to which they recycled cannot be estimated from the results of this study as it became clear from the responses that even the respondents who sorted thoroughly had to utilise the mixed waste bin owing to various reasons. Getting rid of the mixed waste bin or making the size smaller as well as providing more types of bins at the disposal site appears to be one solution that would improve sorting and recycling rates.

## 5.2 Self-reflection about the survey

The total number of responses received from Group A was 46 out of a total of around 500 members in the four Facebook groups used to distribute the survey. All the current inhabitants of these seven apartments might not be members of

these groups. It is also possible that only the people who sorted and recycled chose to answer the survey with the exception of a few people.

The survey was done based on research that the author thought was sufficient, but that was not the case. There were also criticisms (from 4 respondents) about the limitation of some of the options provided. One of the main criticisms was that by making two of the questions that negated each other mandatory, the results of the survey would not reflect the true nature of the situation. The questions were 'Why do you sort?' and 'Why do you not sort?'. It would have been better to provide an option to state that the respondent had answered one of the questions and therefore did not have to answer the other question thereby avoiding the contradictory situation. But the reason why this was in fact the case, was the assumption that it would be impossible to sort and recycle 100% for a number of reasons. This, again, was not proper since the options to choose from if the respondent did not sort did not include this reason.

Even though the collection of data about waste generated in the households was attempted, the compilation of results was difficult due to the various scales at which the results were provided. This was one of the downsides of the survey, that there was no uniform scale (by weight or by volume) provided. The different types of bins that each apartment had as well as the different volumes of the shopping bags available were not considered properly. On retrospection, the survey should also have included questions regarding the diets and cooking habits of the respondents as many of the students would eat at school and infrequently cook at home. There was also possible confusion due to how some of the questions were worded, or perhaps a lapse in concentration of the respondents as some of the responses did not seem realistic. There were also a few duplicate answers, with one person filling the survey twice, or two people from the same apartment answering the survey with the same data. Finally, it needs to be pointed out that future surveys should include the number of meals cooked at home as well as the ingredients to get a clearer picture about the waste generated. This is because, as previously mentioned, most fruits and vegetables does not come with a packaging and this would affect the amount of plastic waste generated to a large extent. In addition, in future studies, collection of data about the amount of waste generated can also give a clearer picture of the situation.

## 6 CONCLUSIONS

The study was performed to understand the current level of source segregation of household waste and recycling among students in Tampere, from two groups based on location and field of study. The first group (Group A) consisted of inhabitants of seven TOAS apartments in Kaleva region in Tampere. The second study group (Group B) consisted of the students of the Environmental Engineering degree programme at TAMK.

The main research questions were:

1. How efficiently do the students sort their household waste?
2. How efficient are the current waste management practices and infrastructure?
3. What are the promoters and barriers for sorting of household waste among the students?
4. What factors could improve the efficiency of waste collection and recycling among students?

In both the groups, the majority of the students recycled. In group A, 87% of the students who responded to the survey sorted and recycled, which allows us to assume statistically that at least 73% of the inhabitants in the seven TOAS apartments studied do sort and recycle. Close to 13% of the respondents from Group A did not sort or recycle or only did so occasionally. With this data, it can be assumed that up to 27% of the total number of residents in the seven TOAS apartments may demonstrate similar approach towards sorting and recycling. Moreover, the percentage of people who sort and recycle in Group A are higher than that of the percentage of people who recycle in the whole Pirkanmaa region.

In the case of Group B, more than 90% of the respondents claimed that they sorted and recycled the household waste. With more than half of the total number of students responding to the survey, it can be assumed that this would be the case for more than 80% of the total number of ENVE/IDEE students. This is again higher than the percentage of people who recycle in Pirkanmaa region.

Similarly, the percentage of students who sorted the household waste and recycled from TAMK as well as TAMK and Tampere Universities combined were calculated (Table 2) and these were again higher than the value for Pirkanmaa.

Thus, in answering the first research question, most of the students sort their household waste and it can be concluded that even though there is room for improvement, the current sorting and recycling rate among the study groups are above average and highly satisfactory.

Furthermore, identification of key hurdles that lead the students to not sort or recycle as well as elements that promote source segregation and recycling was also a goal. By doing this, the efficiency of the current waste management systems, information provided about waste sorting and the employed collection methods could be analysed and it was expected to identify prospective ways to stimulate and thus improve source segregation of household waste among the students. These points were the basis for the rest of the research questions.

The results did not indicate any particular relations between the demographics and the sorting behaviour of the respondents, even in the case of respondents who sorted occasionally or those who seldom sorted their household waste. But other factors related to the sorting behaviour were evident from the survey results.

From the results of both the groups, similar promoting elements could be identified. The main promoting factor for sorting of waste was realising the significance of sorting household waste and its effect on the environment. Learning about this significance from school or by themselves was an important reason for many, while parents indulging in sorting and recycling behaviour was also quite influential on many. Similar answers were received when asked for the reasons the respondents had heard from someone they knew who sorted and recycled. As for the deterring factors, the key reason for not sorting was a lack of space in the apartment or lack of separate bins for collecting the waste separately. The convenience of disposing everything of in the mixed waste bin also discouraged many of the respondents from sorting the waste thoroughly. The convenience of the mixed waste bin was also cited as the main reason the respondents had heard from someone who did not engage in sorting their household waste.

Finally, the main factors that would motivate the students to sort their household waste more thoroughly were identified. These were to have more bins inside the apartment as well as at the disposal sites, and easier way to sort and store the waste generated. One main proposal from many of the respondents in Group A was to have a separate bin for plastic waste at the disposal site which would improve the waste sorting and recycling considerably. This is quite important as in both the groups, the most common type of waste generated was the plastic food packaging. Hence, although effective, it appears that there are opportunities for improvement in the current waste management practices and infrastructure.

In conclusion, it can be said the survey results as well as the predicted results show that the students sort and recycle the household waste at a rate higher than that of the region's average rate of sorting and recycling. Even though this is the case, the current collection and infrastructure needs improvement if the rates are to increase. The main motivating factor to engage in sorting and recycling is the knowledge about the significance of sorting and recycling. Thus ensuring that this knowledge is conveyed efficiently could lead to an increase in the recycling rates, at least among the students. The convenience of having the mixed waste bin and in addition a lack of bins (both inside and outside the apartments) for different types of waste keep the people, even the ones who sort, from sorting thoroughly. A lack of space for bins inside the apartments is also a limiting factor in TOAS apartments especially. By tackling these issues that deter people from sorting, not only can the rates of recycling and sorting be increased, but also the motivation levels of people to engage in sorting and recycling of household waste can be boosted. This means providing more bins, both inside and outside the apartments along with easier ways to sort and store the waste, for instance. Addition of separate bins for plastic waste will also improve the recycling rates.

The study also intended to lay the foundation for future studies to improve the waste management practices. With a more comprehensive study and better design of survey, more underlying elements can be identified, and the source segregation of household waste and higher recycling rates can be achieved.

## REFERENCES

City of Tampere. 2015. Jätevalvonta. Updated on 16.11.2015. Read on 17.04.2020. <https://www.tampere.fi/asuminen-ja-ymparisto/ymparisto-ja-luonto/ymparistonsuojelu/jatevalvonta.html>

City of Tampere. 2019. Information on Tampere. Updated on 23.05.2019. Read on 17.04.2020. <https://www.tampere.fi/en/city-of-tampere/information-on-tampere.html>

Country Report – FINLAND. [PDF]. Released on 04.04.2019. Read on 12.04.2020. [https://ec.europa.eu/environment/eir/pdf/report\\_fi\\_en.pdf](https://ec.europa.eu/environment/eir/pdf/report_fi_en.pdf)

Directive (EU) 2018/851. Directive of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste. EUR-Lex. Released on 14.06.2018. Read on 15.04.2020. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32018L0851>

Directive 2008/98/EC. Directive of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. EUR-Lex. Released on 22.11.2008. Read on 15.04.2020. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098>

Ellen MacArthur Foundation. N.d. What is a circular economy? Read on 11.04.2020. <https://www.ellenmacarthurfoundation.org/circular-economy/concept>

European Commission. 2019. Directive 2008/98/EC on waste (Waste Framework Directive). Updated on 07.08.2019. Read on 16.04. 2020. <https://ec.europa.eu/environment/waste/framework/>

European Commission. 2019. Waste Statistics. Updated on 06.2019. Read on 12.04.2020. [https://ec.europa.eu/eurostat/statistics-explained/index.php/Waste\\_statistics#Total\\_waste\\_generation](https://ec.europa.eu/eurostat/statistics-explained/index.php/Waste_statistics#Total_waste_generation)

European Commission. 2020. Waste. Updated on 15.05.2020. Read on 11.04.2020. <https://ec.europa.eu/environment/waste/index.htm>

European Commission. The early warning report for Finland. [PDF]. Released on 24.09.2018. Read on 12.04.2020. [https://ec.europa.eu/environment/waste/pdf/early\\_warning\\_report\\_FI.pdf](https://ec.europa.eu/environment/waste/pdf/early_warning_report_FI.pdf)

European Commission. The EU Environmental Implementation Review 2019 European Environment Agency. 2016. 36. Waste Production and Management. Updated on 20.04.2016. Read on 11.04.2020. <https://www.eea.europa.eu/publications/92-826-5409-5/page036new.html>

European Environment Agency. 2018. Waste Generation. Released on 29.11.2018. Updated on 26.11.2019. Read on 12.04.2020. <https://www.eea.europa.eu/airs/2018/resource-efficiency-and-low-carbon-economy/waste-generation>



International Solid Waste Association. 2015. Global Waste Management Outlook Summary for Decision-Makers. [PDF]. Released on 07.09.2015. Read on 12.04.2020. [https://www.iswa.org/fileadmin/galleries/Publications/ISWA\\_Reports/GWMO\\_summary\\_web.pdf](https://www.iswa.org/fileadmin/galleries/Publications/ISWA_Reports/GWMO_summary_web.pdf)

Opiskelijan Tampere. N.d. Housing companies and student living. Read on 17.04.2020. <https://www.opiskelijantampere.fi/en/housing-companies-and-student-living/>

Pirkanmaan Jätehuolto Oy. 2020. Näin pirkanmaalaiset kierrättävät. Released on 18.02.2020. Read on 20.04.2020. <https://pjhoy.fi/nain-pirkanmaalaiset-kierrattavat/>

RKY. N.d. Read on 05.05.2020. Kalevan kirkko ja kaupunginosa. [http://www.rky.fi/read/asp/r\\_kohde\\_det.aspx?KOHDE\\_ID=1253](http://www.rky.fi/read/asp/r_kohde_det.aspx?KOHDE_ID=1253)

Statista. 2020. Largest cities in Finland in 2019, by number of inhabitants. Released on 15.05.2020. Read on 18.05.2020. <https://www.statista.com/statistics/327469/largest-cities-in-finland/>

Statistics Finland. 2019. Amount of municipal waste has not grown and recovery has replaced disposal at landfill sites. Released on 09.01.2019. Updated on 11.01.2019. Read on 12.04.2020. [https://www.stat.fi/til/jate/2017/13/jate\\_2017\\_13\\_2019-01-09\\_tie\\_001\\_en.html](https://www.stat.fi/til/jate/2017/13/jate_2017_13_2019-01-09_tie_001_en.html)

Tampere Student Housing Foundation. N.d. Tampere Student Housing Foundation. Read on 17.04.2020. <https://toas.fi/en/about-us/>

The World Bank. 2018. Global Waste to Grow by 70 Percent by 2050 Unless Urgent Action is Taken: World Bank Report. Released on 20.09.2018. Read on 11.04.2020. <https://www.worldbank.org/en/news/press-release/2018/09/20/global-waste-to-grow-by-70-percent-by-2050-unless-urgent-action-is-taken-world-bank-report>

TUNI. 2018. Facts and figures. Released on 13.12.2018. Read on 25.04.2020. <https://www.tuni.fi/en/news/facts-and-figures>

United Nations Environment Programme. N.d. Solid Waste Management. Reads on 12.04.2020. <https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/cities/solid-waste-management>

Visit Tampere. N.d. Tampere. Finland. Read on 17.04.2020. <https://visittampere.fi/en/>

World Health Organisation. 2015. Waste and human health: Evidence and needs. [PDF]. Released on 06.11.2015. Read on 12.04.2020. [http://www.euro.who.int/\\_data/assets/pdf\\_file/0003/317226/Waste-human-health-Evidence-needs-mtg-report.pdf?ua=1](http://www.euro.who.int/_data/assets/pdf_file/0003/317226/Waste-human-health-Evidence-needs-mtg-report.pdf?ua=1)

## Appendix 1. Survey sent out to Group A

## Final Thesis Survey - Waste Generation and Recycling

(You can find the English version below/after the Finnish text in each section)

Tämä kysely on osa Harigovind Mukundanin insinööriopintojen opinnäytetyötä. Kyselyn tarkoituksena on tutkia asukkaiden jätteiden lajittelu- ja kierrätykäyttämistä Tampereen opiskelija-asuntosäätiön kohteissa. Lisäksi kartoitetaan mitkä tekijät vaikuttavat vastaajien asenteisiin kotitalousjätteiden lajittelussa. Havaintoja hyödynnetään lajitteluprosessin parantamisessa.

Kyselyyn vastaaminen kestää noin 10-15 minuuttia.

Kyselyn laatija: Harigovind Mukundan  
Sähköposti: [harigovind.mukundan@tuni.fi](mailto:harigovind.mukundan@tuni.fi)

This survey is done by Harigovind Mukundan, as part of his Final Thesis towards the completion of his Bachelor's Degree, and intends to understand the waste sorting and recycling behavior among residents of TOAS buildings listed below, and in the process try to identify the factors that play a role in the respondent's outlook towards sorting household waste and utilize the findings to simplify the waste sorting process.

The survey takes approximately 10-15 minutes to complete.

Name of the author: Harigovind Mukundan  
Contact: [harigovind.mukundan@tuni.fi](mailto:harigovind.mukundan@tuni.fi)

### Privacy and Use of Data provided

Vastaamalla kyselyyn sallit kyselyn laatijan käyttää antamiasi tietoja opinnäytetyössään. Antamiasi tietoja ei käytetä muihin tarkoituksiin kuin tämän opinnäytetyön suorittamiseen.

Jos osallistut arvontaan ja annat yhteystietosi kyselyn ohessa niitä käytetään vain ja ainoastaan mahdollisesta voitosta ilmoittamiseen ja niitä ei julkaista tai paljasteta kenellekkään tutkimuksen ulkopuolella ilman erillistä suostumustasi.

By answering the survey you allow the author to use the information you've provided in their thesis. Your information will not be used for other purposes than finishing this thesis.

If you take part in the prize draw and give your contact details in the survey, they will only be used to inform you of your potential winnings and will never be published or disclosed without your separate consent.

### About the prize draw

Kiitoksena kyselyyn vastaamisesta arvomme vastaajien kesken 1-3kpl lahjakortteja, joiden arvo on enintään 20€

Arvonnän edellytys: 30 Vastaajaa. Syöttämällä vastaukseesi sähköpostisi osallistut automaattisesti arvontaan. Mikäli arvonta toteutuu, sinulle ilmoitetaan siitä kun kysely on suljettu. Lahjakorttien määrä riippuu vastaajien määrästä. 30 vastaajaa, 1 Lahjakortti. 50 Vastaajaa, 2 lahjakorttia. 100 vastaajaa, 3 lahjakorttia. Arvonta tapahtuu, mikäli vastaajamäärä täyttyy, kun kysely suljetaan.

As a token of gratitude for filling out the survey, 1-3 lucky people will be provided gift-cards worth up to €20.

Condition for the prize-draw to happen: Minimum 30 responses received in total

Entering the prize-draw: By providing your email address, you automatically enter the draw. If the draw happens, you will be informed about it after the survey is closed.

The number of winners will depend on the total number of responses received.

1. More than 30 responses - 1 winner
2. More than 50 responses - 2 winners
3. More than 100 responses - 3 winners

The draw will happen once the survey is closed.

[Next](#)

Page 1 of 6

## Final Thesis Survey - Waste Generation and Recycling

\*Required

### Kyselyn täyttäminen/ Filling the survey

Jos asukkaita on enemmän kuin yksi, täytä vastaukset pilkulla erotettuna osoitetulla tavalla

Tietojen päällekkäisyyksien vähentämiseksi varmista, että jokaisesta asunnosta on annettu vain yksi vastaus.

Jos asut jaetussa huoneistossa ja haluat tehdä kyselyn yksin, varmista, että annat tietoja vain omasta jätteenlajittelukäyttäytymisestäsi.

Jos vastauksia on enemmän kuin yksi, kirjoita ne erotettuna pilkuilla.

If there is more than 1 inhabitant, please fill in the answers separated by a comma as indicated

To reduce the duplication of data, please make sure that only one response is made from each apartment.

If you live in a shared apartment and prefer to do the survey alone, please ensure that you provide information only about your sorting behavior.

If there's more than one answer, please write them separated by commas, as indicated

### Tietoja Asunnosta ja asukkaista/ Details about the household and inhabitants

TOAS-rakennuksen nimi, jossa asut/ Name of the TOAS building you live in \*

- JARINSAMPO
- NINANSAMPO
- KEIHÄS
- NUOLI
- PIRJONSAMPO
- UUSI DOMUS
- VANHA DOMUS

Huoneistotyyppi/ Apartment type

- Studio apartment
- Shared apartment
- Family apartment - 1 BHK
- Family apartment - 2 BHK
- Family apartment - 3 BHK

## Asukkaat (Valitse 1 vaihtoehto)/ Inhabitants (Choose 1 option) \*

	0	1	2	3
Asukkaiden kokonaismäärä/ Total number of inhabitants/	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Miesten lukumäärä/ Number of male inhabitants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Naisten lukumäärä/ Number of female inhabitants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Muunsukupuolisten lukumäärä/ Number of inhabitants of other genders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alle 18-vuotiaita asukkaita/ Number of inhabitants whose age is less than 18	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18-25-vuotiaita asukkaita/ Number of inhabitants whose age is 18-25	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26-35-vuotiaita asukkaita/ Number of inhabitants whose age is 26-35	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Yli 35-vuotiaita asukkaita/ Number of inhabitants whose age is above 35	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kansallisuuksien lukumäärä/ Number of nationalities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Opiskelijoiden lukumäärä/ Number of students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Kansallisuus (jos useampia kuin yksi kansalaisuus, kirjoita pilkulla erotettujen maiden nimet)/ Nationality (If there's more than one nationality please write the name of the countries separated by comma)

Your answer \_\_\_\_\_

Koulutusala (Jos useampi kuin yksi asukas on opiskelija, kirjoita opintokentät pilkuin erotettuna)/ Field of study (In case more than one inhabitant is a student, please write fields of study separated by comma)

Your answer \_\_\_\_\_

Opintotaso (kandidaatin, maisterin ym. ; jos useampi kuin yksi asukas on opiskelija, kirjoita opintokentät pilkuin erotettuna)/ Level of study (Bachelor's, Master's, etc; In case more than one inhabitant is a student, please write fields of study separated by comma)

Your answer \_\_\_\_\_

Työala (Jos useampi kuin yksi asukas työskentelee, kirjoita työalat pilkulla erotettuna. Jos et työskentele, vastaa vain EI)/ Field of work (In case more than one inhabitant works, please write fields of work separated by a comma. If you don't work, just answer NO)

Your answer \_\_\_\_\_

Kotitalouksien kuukausitulo, noin (euroina)/ Total approximate monthly household income (in Euros)

- < 1000
- 1000-2000
- > 2000

Keskimääräiset viikoittaiset ruokamenot (koko kotitalouden, euroina)/ Average weekly expenditure on food (total household, in Euros)

Your answer \_\_\_\_\_

Kuinka usein teet ostoksia?/ How often do you shop?

- Päivittäin/ Daily
- Joka toinen päivä/ Every other day
- Kahdesti viikossa/ Twice a week
- Kerran viikossa/ Once a week
- Kerran kahdessa viikossa/ Once in two weeks
- Kerran kuukaudessa/ Once a month

Missä kaupoissa teet ostoksesi?/ What stores do you shop at?

- Prisma
- S-Market
- K-Market
- Lidl

Back

Next

Page 2 of 6

## Final Thesis Survey - Waste Generation and Recycling

\*Required

### Waste generation and disposal

#### Definitions

Waste: Any substance or object which the holder discards or intends or is required to discard

Bio-waste: Bio-waste is defined as biodegradable food and kitchen waste from households

Sorting/segregation: Collecting (or disposing of) different types of waste separately. See 'Separate collection' below.

Collection: the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport to a waste treatment facility

Separate collection: means the collection where a waste stream is kept separately by type and nature so as to facilitate a specific treatment

Kuinka usein roskat viedään kotitaloudessasi? (Valitse yksi vaihtoehto)/ How often do you dispose of the waste generated in your household? (Choose one option)

\*

- Päivittäin/ Daily
- Joka toinen päivä/ Every other day
- Kahdesti viikossa/ Twice a week
- Kerran viikossa/ Once a week
- Kerran kahdessa viikossa/ Once in two weeks
- Kerran kuukaudessa/ Once a month

Kuinka kuljetat jätteet jäteastiaan?(Valitse kaikki soveltuvat vaihtoehdot)/ How do you carry the waste to the disposal? (Choose all options that apply) \*

- Ostan erilliset roskapussit/ I buy separate trash bags
- Käytän ostokasseja/ I use carrier/shopping bags that I buy from the stores
- Käytän TOASin tarjoamia roska-astioita/ I use bins provided by TOAS
- Minulla on omat roska-astiat/ I have my own bins

Mikä on jätteiden kokonaismäärä tänä aikana? (Arvioitu tilavuus litroina, jos tiedät. Jos käytät ostokasseja jätteiden hävittämiseen, mainitse pussien lukumäärä. Jos käytät roskakoria, kirjoita kuinka paljon - täynnä, puoli, kolmasosa jne.)/ What is the total amount of waste generated in this period? (Approximate volume in liters if you know. If you use shopping bags to dispose of the waste, mention the number of bags. If you use bins, write how much - full, half, one-third, etc.)

Your answer \_\_\_\_\_

Kuinka usein biojätteet hävitetään?/ How often is biowaste disposed of? \*

- Päivittäin/ Daily
- Joka toinen päivä/ Every other day
- Kahdesti viikossa/ Twice a week
- Kerran viikossa/ Once a week
- Kerran kahdessa viikossa/ Once in two weeks
- Kerran kuukaudessa/ Once a month

Kuinka paljon biojätettä syntyy tänä aikana? (Arvioitu tilavuus litroina, jos tiedät. Jos käytät biojätepussia, mainitse pussien lukumäärä. Jos käytät roskakoria, kirjoita kuinka paljon - täynnä, puoli, kolmasosa jne.)/ How much biowaste is generated during this period? (Approximate volume in liters if you know. If you use biowaste bags, mention the number of bags. If you use bins, write how much - full, half, one-third, etc.)

Your answer \_\_\_\_\_

Mitkä ovat kotitaloudessasi yleisiä jätteitä?/ What are the common types of waste generated in your household? \*

- Biojäte/ Biowaste
- Ruokapakkaukset - muovia/ Food packaging - Plastic
- Ruokapakkaukset - pahvipakkaukset/ Food packaging - Cartons
- Take-away astiat - laatikot/ Takeaway containers, boxes
- Muut muovijätteet (hammasharjat, hammastahnatuubit, kosmetiikka, laukut)/ Other Plastic waste (Toothbrush, toothpaste tube, cosmetic products, carry bags)
- Paperi - sanomalehdet, mainokset, kirjeet, aikakauslehdet, paperipussit/ Paper - Newspaper, Advertisements, Letters, Magazines, Paper Bags
- Other: \_\_\_\_\_

Mitkä ovat kotitaloudessasi yleisin jäte?/ What is the MOST COMMON type of waste generated in your household? \*

- Biojäte/ Biowaste
- Ruokapakkaukset - muovia/ Food packaging - Plastic
- Ruokapakkaukset - pahvipakkaukset/ Food packaging - Cartons
- Take-away astiat - laatikot/ Takeaway containers, boxes
- Muut muovijätteet (hammasharjat, hammastahnatuubit, kosmetiikka, laukut)/ Other Plastic waste (Toothbrush, toothpaste tube, cosmetic products, carry bags)
- Paperi - sanomalehdet, mainokset, kirjeet, aikakauslehdet, paperipussit/ Paper - Newspaper, Advertisements, Letters, Magazines, Paper Bags
- Other: \_\_\_\_\_

Mitkä ovat kotitaloudessasi harvinaisin jäte?/ What is the LEAST COMMON type of waste generated in your household? \*

- Biojäte/ Biowaste
- Ruokapakkaukset - muovia/ Food packaging - Plastic
- Ruokapakkaukset - pahvipakkaukset/ Food packaging - Cartons
- Take-away astiat - laatikot/ Takeaway containers, boxes
- Muut muovijätteet (hammasharjat, hammastahnatuubit, kosmetiikka, laukut)/ Other Plastic waste (Toothbrush, toothpaste tube, cosmetic products, carry bags)
- Paperi - sanomalehdet, mainokset, kirjeet, aikakauslehdet, paperipussit/ Paper - Newspaper, Advertisements, Letters, Magazines, Paper Bags
- Other: \_\_\_\_\_

## Final Thesis Survey - Waste Generation and Recycling

\*Required

### Waste Sorting and Recycling

Lajitteletko jätteitä?/ Do you sort waste? \*

- Kyllä, itse asunnossa (eri jätteet eri astioihin jo lähtövaiheessa)/ Yes, in the apartment itself (collect separately)
- Kyllä, jäteastioilla (kerään jätteeni yhteen ja erittelen jäteastioilla jätteet omiin astioihinsa)/ Yes, at the disposal (collect together)
- Joskus/ Sometimes
- En/ No
- Other: \_\_\_\_\_

Kuinka moneen eri luokkaan lajittelet jätteesi. (Valitse kaikki luokat joita itse käytät lajittelussa, jos et lajittele valitse sekajäte.)/ How many categories is the waste sorted into? (Tick all the options that apply. If you don't sort select mixed waste) \*

- Sekajäte/ Mixed Waste
- Biojäte/ Biowaste
- Lasi/ Glass
- Paperi/ Paper
- Kartongit/ Cartons
- Metalli/ Metal
- Pahvipakkaukset/ Cardboard packaging
- Muovipulloja/ Plastic bottles
- E-jätettä/ e-waste
- Muut/ Other

Palautatko pullot ja / tai tölkit? (Pantti-järjestelmä)/ Do you return bottles and/or cans? (Pantti system) \*

- Kyllä/ Yes
- En/ No
- Joskus/ Sometimes

Miksi käytät pullo/tölkki palautus järjestelmää?/ Why do you use the bottle/can return system? \*

- Saadaksesi pantin takaisin/ To get the deposit back
- Palautus on vaivatonta/ Proximity of return points
- Haluan kierrättää/ I want to recycle

Back

Next

Page 4 of 6



# Final Thesis Survey - Waste Generation and Recycling

\*Required

## Sorting Behaviour

Miksi lajittelet ja kierrätät jätteesi?/ Why DO you sort and recycle? \*

- Se on hyväksi ympäristölle/ It is good for the environment
- Vanhempani lajittelevat jätteesä ja kierrättävät/ My parents (used to) sort and recycle
- Minulle opetettiin koulussa lajittelun ja kierräsen tärkeys/ I was taught at school the importance of sorting and recycling
- Olen itse oppinut lajittelemaan ja kierrättämään/ I learned the importance of sorting and recycling myself
- Kumppanini / kämppikseni saa minut lajittelemaan/ My partner/roommate makes me sort
- Ystäväni lajittelevat jätteet/ My friends sort waste
- Other: \_\_\_\_\_

Mitä mielipiteitä olet kuullut lähipiiriltäsi kierrätykseen ja lajitteluun liittyen?/ What are some reasons you've heard from people you know about sorting the household waste? \*

- Se on hyväksi ympäristölle/ It is good for the environment
- Vanhempani lajittelevat jätteesä ja kierrättävät/ My parents (used to) sort and recycle
- Minulle opetettiin koulussa lajittelun ja kierräsen tärkeys/ I was taught at school the importance of sorting and recycling
- Olen itse oppinut lajittelemaan ja kierrättämään/ I learned the importance of sorting and recycling myself
- Kumppanini / kämppikseni saa minut lajittelemaan/ My partner/roommate makes me sort
- Ystäväni lajittelevat jätteet/ My friends sort waste
- Other: \_\_\_\_\_

Miksi et itse lajittele ja kierrätä?/ Why do you NOT sort and/or recycle? \*

- En ole motivoitunut/ I am not motivated
- Lajittelu ja kierrätys kuluttavat aikaa/ Sorting and recycling consumes time
- En osaa lajitella jätettä/ I do not know what item goes where
- On vain helpompaa laittaa kaikki sekajätteeseen/ It is easier to put everything in the mixed waste bin
- Se ei ole oikeasti tärkeää/ It is not really important
- Sillä ei ole merkitystä, jos yksi henkilö lajittelee tai kierrättää/ It won't make a difference if one person does or doesn't sort and recycle
- Jäteastiat ovat liian pieniä/ The bins provided are too small
- Eri jäteastioita ei ole tarpeeksi montaa/ There aren't enough bins provided
- Perheessäni ei olla totuttu lajittelemaan jätettä/ We didn't sort waste when I was growing up
- En luo paljoa jätettä/ Very little waste generated
- Ei tarpeeksi tilaa erillisille astioille/ Not enough space for separate bins
- On kätevää jättää lajittelematta/ It's convenient not to sort waste
- Other: \_\_\_\_\_

Mitä syitä, olet kuullut tuntemaltasi ihmisiltä siitä, ettei kotitalousjätteitä lajitella / kierrätä?/ What are some reasons you've heard from people you know about not sorting/recycling the household waste? \*

- En ole motivoitunut/ I am not motivated
- Lajittelu ja kierrätys kuluttavat aikaa/ Sorting and recycling consumes time
- En osaa lajitella jätettä/ I do not know what item goes where
- On vain helpompaa laittaa kaikki sekajätteeseen/ It is easier to put everything in the mixed waste bin
- Se ei ole oikeasti tärkeää/ It is not really important
- Sillä ei ole merkitystä, jos yksi henkilö lajittelee tai kierrättää/ It won't make a difference if one person does or doesn't sort and recycle
- Jäteastiat ovat liian pieniä/ The bins provided are too small
- Eri jäteastioita ei ole tarpeeksi montaa/ There aren't enough bins provided
- Perheessäni ei olla totuttu lajittelemaan jätettä/ We didn't sort waste when I was growing up
- En luo paljoa jätettä/ Very little waste generated
- Ei tarpeeksi tilaa erillisille astioille/ Not enough space for separate bins
- On kätevää jättää lajittelematta/ It's convenient not to sort waste
- Other: \_\_\_\_\_

Mikä motivoisi sinua lajittelemaan jätteesi perusteellisemmin?/ What would motivate you to sort your waste more thoroughly? \*

- Lisää astioita asunnon sisällä/ More bins inside the apartment
- Lisää/paremmat jäteastiat/ More bins outside the apartment
- Helpompi tapa säilöä jätettä/ Easier way to store
- Helpompi tapa lajitella jätettä/ Easier way to sort
- Lisätietoja lajittelusta/ More information on how to sort
- Lisätietoja kotitaloudessani syntyvästä jätteestä/ More information on waste generation in my household
- Lisätietoja kerätyistä jätteistä/ More information about the waste collected
- Parempi jätteidenkeräysmenetelmä/ Better waste collection method
- Lisätietoja siitä, miksi jätteiden lajittelu ja kierrätys ovat tärkeitä/ More information on why waste sorting and recycling are important
- Kannustimet/ Incentives

MUUT EHDOTUKSET/ OTHER SUGGESTIONS \*

Your answer

Back

Next

Page 5 of 6

## Final Thesis Survey - Waste Generation and Recycling

End of Survey

Kirjoita sähköpostiosoitteesi, jos haluat osallistua palkintoarvontaan/ Enter your email address if you want to be part of the prize draw

Your answer

Se siitä!/ That's it!

Kiitos ajastasi ja siitä että autatte minua valmistumaan!

Thank you for your time, and for helping me graduate!

Back

Submit

Page 6 of 6