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WASTE MANAGEMENT AND SUSTAINABLE DEVELOPMENT ASSESSMENT

Three cases on improving the international students' attitude on waste sorting in Kokkola

Thesis
CENTRIA UNIVERSITY OF APPLIED SCIENCES
Environmental Chemistry and Technology
June 2020

ABSTRACT

Centria University of Applied Sciences	Date June 2020	Author Ngoc-Thuy Pham
Degree programme Environmental Chemistry and Technology		
Name of thesis WASTE MANAGEMENT AND SUSTAINABLE DEVELOPMENT ASSESSMENT. Three cases on improving the international students' attitude on waste sorting in Kokkola.		
Instructor Michael Hagström		**Pages** 46 + 1
Supervisor Michael Hagström		

Waste management, especially plastic waste is a huge topic nowadays; however, Finland is among the best-applied waste-controlling-system countries in the world. As more foreigners are coming to Finland every year, it is required that enough instruction must be delivered clearly to ensure the highest number of people are doing the sorting. The more people sort, the more effective circular economy transformation is.

The thesis first gives an overview of waste management in Europe, especially in Kokkola, Central Finland. Three suggestions are given to help raise the international students' awareness on waste sorting: making the sorting instruction readable at the collecting point, proposing a waste management course as elective curricular, and promoting international media campaign on how to sort waste. These three proposals will be evaluated on their sustainability, innovation, and impact on the local community in Kokkola. The author believes the thesis provides useful information for the City of Kokkola – Environmental Services and Centria University of Applied Sciences, where most international students are studying.

Keywords
Waste management, plastic, sustainability assessment.

CONCEPT DEFINITIONS

EPR: Extended Product Responsibility

EU: European

MSW: municipal solid waste

MW: municipal waste

OWB: Central Ostrobothnia Waste Board, Pohjanmaan Jätelautakunta

PRF: A Plastics Roadmap for Finland

SD: Sustainable Development

SDG(s): Sustainable Development Goal(s)

TBL: the triple bottom line

UAS: University of Applied Sciences

UN: United Nations

YM: Ympäristöministeriö, Finnish Ministry of the Environment

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1 INTRODUCTION

Circular economy and sustainable development (SD) are universal goals until 2030 (United Nations 2015, 3). Implementing Sustainable Development Goals (SDGs) is the responsibility of every individual, organisation, and nation. However, being a change maker for society requires a considerable effort to create a change in every member's routine. Some small actions, such as bringing the reusable utensils, or sorting waste, can bring a long-step movement in transforming towards the circular-economy and more sustainable world. Finland has one of the most effective waste sorting systems that should be shared and integrated into other countries. However, not many immigrants and international students have heard about the concept and the goals; this leads to ignorance in waste sorting. Some explanations from international students in Kokkola, Central of Finland, showed that there is a lack of understandable information as well as motivation to do the sorting. Centria University of Applied Sciences (UAS) became the most international UAS in Finland 2019; therefore, the demand for English and other non-Nordic languages instruction is significantly essential, especially in everyday life (Centria 2020a).

This thesis project aims to provide information on the waste management of Finland and assess the attitude of international students to waste sorting in Kokkola to suggest the recommended methods to improve the situation. All three suggestions were evaluated following the SD assessment adopted from the book "Materials and Sustainable Development" by Michael F. Ashby, Didac F. Balas, and Jordi S. Coral.

In chapter 2, the waste sorting situation in Kokkola is highlighted as a result of a survey done in the beginning phase of the thesis project. Chapter 3 gives an overview of SD and the Finnish Agenda on SD. The theory of waste management information in Finland and the plastic waste collection strategy, particularly in Kokkola, is described in chapter 4 and chapter 5. In chapter 6, the author introduces the survey process and the sustainability assessment method as an evaluating framework. Sustainability assessment is a powerful tool for every developing project since it promotes critical thinking and evaluates every aspect of the solution. Afterwards, three suggestions are evaluated using the given assessment in chapter 7. The possibility of applying and integrating those methods is also mentioned in the same chapter.

2 PROBLEM TO BE SOLVED

Finland aims to be the fastest country in Europe towards the circular economy (Sitra 2016, 53). To reach that target, numerous actions have been taken in many sectors: industry, forestry, municipality, and education. Waste sorting is a small but crucial habit that can be done by everybody. This waste sorting overview was based on the survey among the international community Kokkola. The survey was described in chapter 6 about methodology, and other results were shown in appendix 1. In general, the survey reached about 1/5 of the international students in Kokkola, of which 70% are degree students, 17% exchange students, and 13% of graduates. Most of them are from the Environmental Chemistry and Technology degree with 34%, while others are studying in Business Management, Nursing, and Information Technology field (APPENDIX 1).

After evaluation, it can be concluded that the sorting behaviour depends on the period since students came to Finland, the types of apartment, the flatmate behaviour, and the sufficiency of the information provided. Based on the result, up to 47% of students in the first year do not do the sorting. This rate decreases dramatically to 20% in the third year group and above. The results also showed that 96% of the students do not sort waste because their flatmate also puts trash in the same bin. Comparing between the blocks of flats and the single-family houses, the number of students sorting is the same at 36%. However, students who are living in a single-family house must bring their trash to the nearest Ecopoint, which is located in the range of 200-meter radius from their home, and four of them need to transport the garbage to the recycling centre.

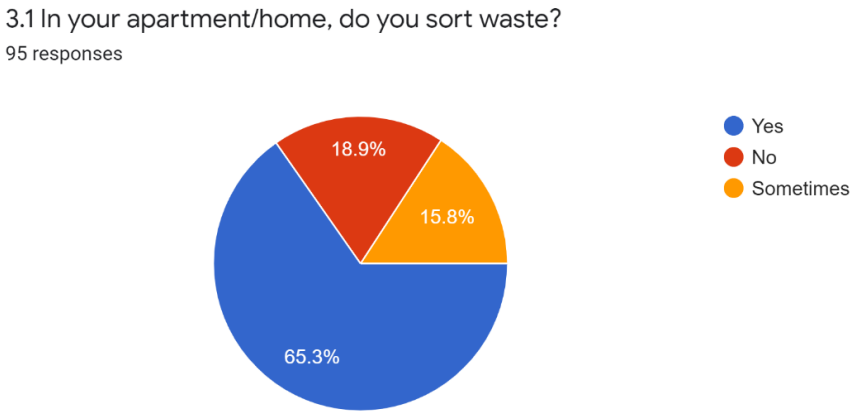

FIGURE 1. Percentage of the student on sorting behaviour (APPENDIX 1)

Besides, there is a relation between the home country and the sorting habit. For example, some students shared that there is no waste sorting in their home country so they keep that habit during the time they live in Finland. The survey recorded half of submissions from Vietnam, South Asian, and Africa, where sorting is not a habit. Therefore, many students who came from these countries to Finland under one year do not sort waste. In contrast, students from China and the European (EU) countries such as Germany, France, and Austria always do the sorting, although they just moved to Finland.

When students were asked about reasons for not sorting, 28% of people claimed that they do not know how to sort, while 18% said they were not being told about the regulation. The number of students do sort but cannot afford the boxes is about 23%. Others claimed that they are lazy and do not care about waste separation. The number of boxes students use in their house, and the collecting points are marked in Figure 2 and Figure 3. It can be seen that the sorting infrastructure in Kokkola has followed the Finnish Waste Act with enough containers for biowaste, plastic, energy waste, glass, metal, and carton/paper.

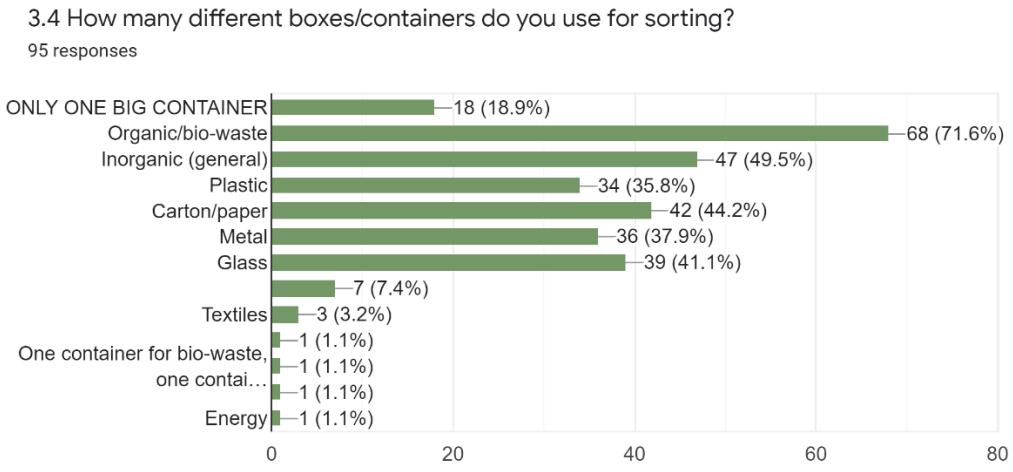

FIGURE 2. Number of sorting boxes in student houses (APPENDIX 1)

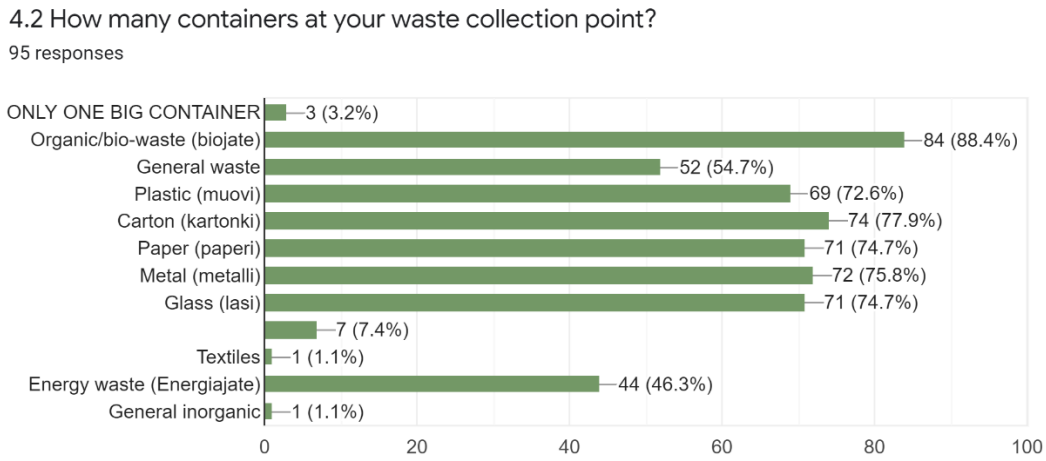

FIGURE 3. Number of sorting containers in the collecting point (APPENDIX 1)

The next target problem is the lack of useful sorting instruction. Nearly 30% of students said the sorting information could not be found easily, and this is the reason they put trash in the same place. Most of the students found the instruction on the container's body at the collecting points, while 25 people heard the information from their friends. Nevertheless, 60 over 95 responses agreed that the provided information is not specific enough, so sometimes they struggled to separate the trash. For instance, the bristle of the woody brush cannot be put in the plastic bin if there is no "energy waste" container at the collecting point. The same number of answers indicated that the instruction is only written in Finnish and Swedish; this lack of English description causes difficulty for the English-speaking community.

The resulted background was an essential resource for promoting three suggestions for improving the sorting situation in the international community at Kokkola. The suggestions should be made (1) based on the sustainable development agenda, (2) targeted the international as well as the local community, (3) as efficient as possible in the financing, timing, and reachability.

3 SUSTAINABLE DEVELOPMENT

Sustainability is usually used to target natural resources while talking about development. However, sustainable development is more than the relationship between the environment and the human manufacturing activities. It includes the connection between nature, society, and the global economic system (Ashby, Balas & Coral 2016, 28). SD can be defined from a different point of view. For example, an economist considers the financial aspect while a humanist takes care of the value for future generations and social problems. For an environmentalist, the Earth resources and the biodiversity is prioritised. Hence, there is no entirely right or wrong answer for the SD, based on the fact that essence SD is a complex system. The most-defined quotation about SD from the Brundtland Commission stated that SD is the development in which the current needs is met without affecting the future generation's ability to meet their needs (Brundtland Report 1987).

Where the "development" is defined as an improvement to move the world to a more sustainable state, SD becomes a challenge for the current generation to balance and comply the development to maintain the social, economical and environmental value. According to John Elkington 2000, SD is the combination of the triple bottom line (TBL), in which any articulation affects three main aspects, to the people, the planet, and the prosperity (Elkington 2000, 69). TBL is also referred to as the 3P model, or the three capitals, described in Figure 4. The planet sector illustrates the natural capital, including nurtured land, healthy atmosphere, clean water, functional biodiversity, sustainable material and energy resources. The human and social capital relates to the education, health, accumulated knowledge, skills, and happiness of a human being and within society. The manufactured and financial capital contains a built environment, infrastructure, financial health, and industrial capacity. As a result, global wealth is presented as a total of three capitals. (Ashby et al. 2016, 32.)

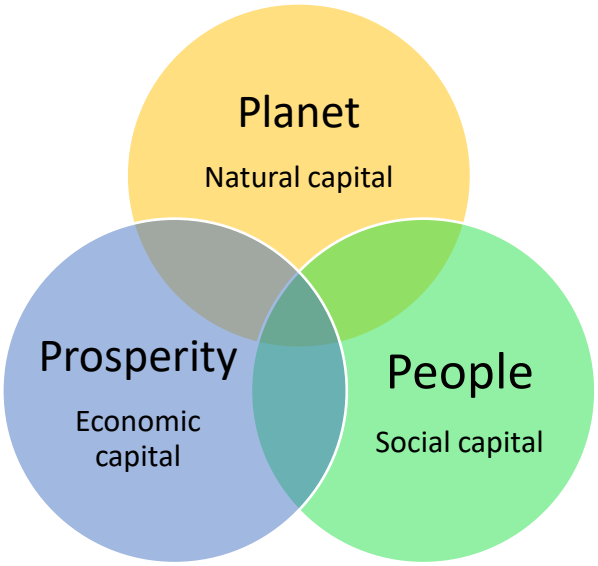

FIGURE 4. The triple bottom line of sustainable development (Adopted from Ashby et al. 2016, 30.)

Currently, due to economic pressure, the global system is mainly driven to the most profit circumstances. This demand, however, puts significant pressure on the environment and the degradation of social development. According to the Global Footprint Network, the year 2019 witnessed the Earth Overshoot Day on July 29, the earliest time in the history (Earth Overshoot Day 2019a). Earth Overshoot Day is the date indicates humanity's annual demand on the natural resources exceeds the regenerating ability of the Earth's ecosystem in that year. After this day, every resource used belongs to the next year's regeneration capacity (Earth Overshoot Day, 2019b). Since the industrial revolution in the 1970s, human has used up to 175% of the Earth's recovery rate every year (Earth Overshoot Day, 2019a). If human activity keeps working at this rate, there will be no planet B to provide enough resources. This rate anticipates an unsustainable future that requires a drive in changing all the sections include industry, agriculture, tourism, municipality, and society.

3.1 Sustainable Development Goals

SDGs is the global plan of the United Nations (UN) Members established in 2015. Belonging to the 2030 Agenda for Sustainable Development, SDGs provides a shared framework for prosperity and peace for humanity and the planet. SDGs include 17 goals, which target all the problems about people, planet, prosperity, peace, and partnership. Those goals are listed in Figure 5. (UN 2015.)

FIGURE 5. SDGs in The 2030 Agenda for Sustainable Development (adopted from the UN 2015)

3.2 Sustainable Development in Finland

Finland also understands the importance of SD to the planet and the people. According to the ex-Prime Minister Juha Sipilä, SD should be applied by various groups of society. Immigrants and children are the problematic yet essential group during the process. Following the UN 2030 Agenda, the innovative business model and governance were designed to reach the SDGs (GoF 2016). The Finnish Ministry of Environment (YM) gathered some published documents on national indicator programmes: Finnish National Commission on Sustainable Development, the Society Commitment to Sustainable Development, The Finland we want 2050 brochure, and Sustainable Development indicator (YM 2015). Finnish National Commission organised the practice of SDGs to company and school plan by volunteering commitment to four main sectors: finance, forestry, energy, and trade (FNCSD, VNK & UM 2016). In 2016, a total of 300 commitments with eight shared objectives which were given to different stakeholders was described in Figure 6.

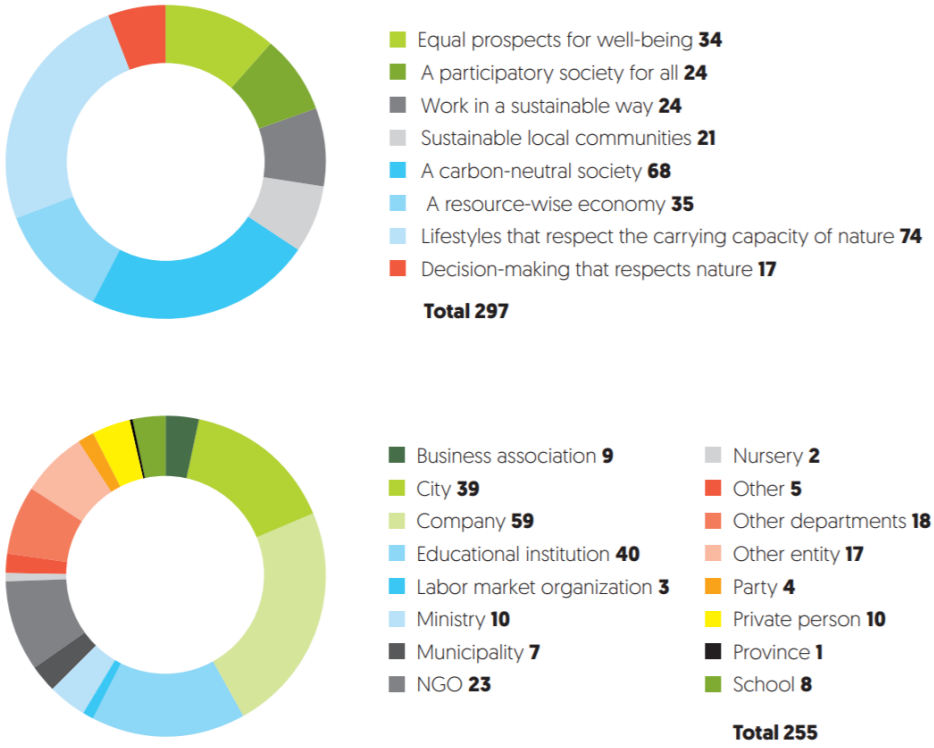

FIGURE 6. Eight main objectives of the Finnish commitment to SDGs and their stakeholders (adopted from FNCSD et al. 2016)

4 WASTE MANAGEMENT IN FINLAND

In the Directive 2008/98/EC on waste and repealing specific Directives, the legislative framework of handling waste (Waste Framework Directive) was introduced as a mutual management for all EU countries. According to the Directive, waste management is defined as the combination of collecting, shipment, recovery, disposal of waste, monitoring and end-of-life treatment. (Directive 2008/98/EC.) Waste is managed based on the basic principle that it cannot cause a danger to human and environmental health. It includes the risks of pollution to water, air, soil, noise, humans, biosphere, and specific areas such as the countryside. (EC 2019.)

Waste management in Finland must follow EU waste management. On average, every EU country utilises 16 tonnes of material annually, in which 6 tonnes are discarded as waste. It is almost 38% of the total generation. (EC 2020a.) Following the report on waste generation in 2016, 36% of waste came from construction and demolition, and 8.5% of the total waste generation is from the household (Olivares, Puyol, Melero & Dufour 2019, 4).

4.1 Laws and Regulations

According to the Finnish Ministry of the Environment, Finnish waste legislation is mainly based on EU legislation. It covers most types of waste, except for some specific categories, such as nuclear waste. The Finnish government has published acts and decrees on general waste management, monitoring, treatment and recovery of waste, specific waste types, and waste shipment. (YM 2020.) As with the EU Directive on waste, YM published the Waste Act with the same targets in 2014. It states the definition of waste, general principles and obligations, the stakeholder duties, waste management by municipalities, producer responsibility, beverage containers, littering obligation, charges, planning guidance, register approval, supervision enforcement, and some other regulations. (Waste Act 2011). There are Government Decrees on specific waste types: batteries and accumulators, extractive waste, end-of-life vehicles, electrical and electronic equipment, discarded tires, packaging, and PCB equipment. (YM 2020). The transboundary shipments of waste are also mentioned in the EU Parliament and the Council Regulation (EC 1013/2006).

4.2 European waste management hierarchy

The Directive covers the definition of waste as well as recycling and the recovery legislation. The EU countries' policies must apply the order of priority on waste management and prevention by the following hierarchy in Figure 7, including five steps: prevention, preparing for reuse, recycling, another energy recovery, and disposal. (Directive 2008/98/EC, 312/10.) The Directive states that each country is responsible for its strategy of moving up to the top layers (EC 2010, 4).

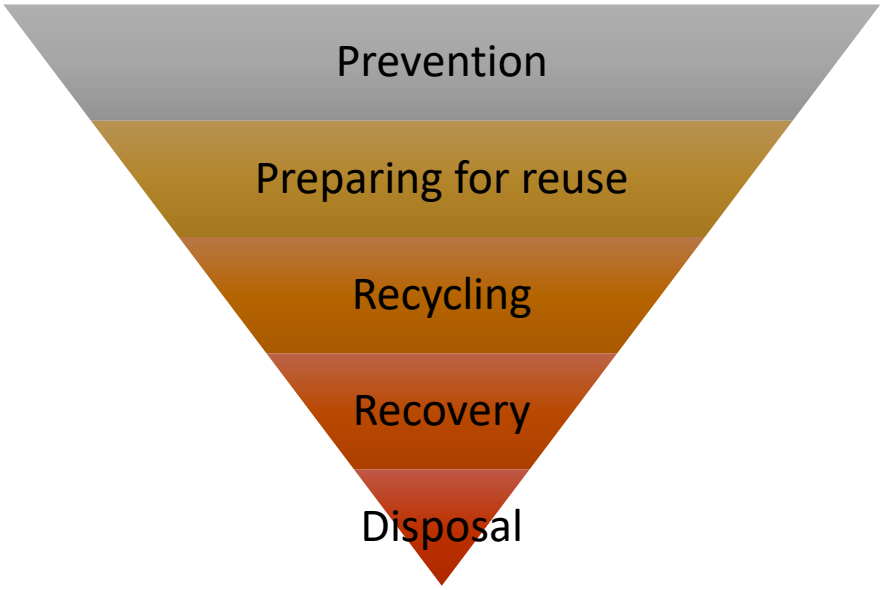

FIGURE 7. The hierarchy of waste management and prevention (adopted from EC 2010, 5)

The hierarchy is described as an upside-down triangle, where the upper layer is the prioritised method to treat waste. Only prevention step is used to treat the materials, products or substances before they become waste. The prevention includes the reduction of the quantity of waste, the adverse impacts, and the content of hazardous substances in the materials. The quantity reduction includes the time of the reuse and the extension of the product life span. During the prevention stage, the effects of the generated waste must be limited as much as possible to human health and the environment. The next step in the hierarchy is to reuse any products or components as their original purpose. Reusing method is to check, clean, or repair recovery operations. Hence, it is sure that the product components had become waste can be reused without pre-processing. Then, recycling is applied to any recovery process which waste materials come to a re-process into products, substances, or materials for the original or further purposes. Recycling does not mean to recover energy or re-process material for being used as fuels. Finally, disposal is any operation in which products cannot be treated as recovery. (Directive 2008/98/EC, 312/9-10.)

4.3 Extended Product Responsibility

The Extended Product Responsibility (EPR) or Producer Responsibility is an environmental strategy to shift the responsibility of waste management from local waste agencies and municipalities to the producers in the post-consumer stages. The EPR means that the manufacturer has the responsibility to treat their end-of-life product brought to the market (Waste Act 2011, 20). Numerous types of product are encouraged to apply this EPR policy such as vehicles, tyres, electronic and electrical equipment, batteries, paper products, and packaging (Pirkanmaa ELY Centre 2017, 1). The four significant advantages of EPR targets the manufacturer's administrative, physical, and financial policy approach to end-of-life products. First, EPR encourages the manufacturers to change their design and material packaging of the product to increase the recycling efficiently, hence reduces the environmental effect during the product's lifespan. Second, ERP creates a redundant fund for recycling programs for the collection and disposal process. In addition, ERP also improves the efficiency of recycling, results in less investment. Finally, ERP provides a fair system where the consumers only pay for their consumption, and the manufacturer must be responsible for their product entirely. (Rogoff 2014, c3.)

By collaborating with the retailers, the manufacturers can collect their products after customer consumption efficiently. For example, in Finland, almost every electronic store has its collection point to receive old electronic and electrical equipment. The customers bring the broken equipment to the stores such as Gigantti and Power instead of driving them to the recycling stations. Furthermore, all the supermarkets operate the recycling process of beverage packaging. The producer organisation Suomen Palautuspakkaus, Palpa in English, is responsible for the returning beverage packaging (Palpa 2019a, 2). The most popular beverage-returnable types are glass bottle, metal drinking cans, and plastic bottles. Picture 1 is a corner at Minimani where locals come to return the bottles and cans.

PICTURE 1. Bottle return corner at Minimani Kokkola

4.4 Municipal solid waste

Municipal Solid Waste (MSW) belongs to the household waste group, which is discarded from the ordinary dwelling and residential houses, disguised from the industrial waste (Waste Act 646/2011, 3). There are different categories among countries in defining municipal waste (MW); some also include other waste from offices and commercial activities. Overall MW represents only 10% of the total waste generated in Europe, but the reduction of this waste plays a vital role in environmental protection (EEA 2019, 1). According to the European Policies and Targets, the EU Commission in 2015 proposed recycling and preparing to reuse goal of MW to 65% in 2030 (EEA 2019, 2). Finland has also banned dumping organic waste to landfill since 2016 (Fischer 2013, 14). MSW includes food waste, carton boxes, unused stuff, and packagings like metal cans, plastic bags, plastic wrappers, and bottles.

Although Finland has a significant amount of 2.5 million tonnes of MSW annually, the disposal of MW by landfill has decreased dramatically since 2008 (Eurostat 2020a). According to the Waste Statistic 2019, Figure 8 shows that only one per cent of MSW was buried in landfills in 2017. Finland has seen a massive replacement of energy recovery, from 300 thousand to 1700 thousand tonnes (Statistics Finland 2019). The waste-to-energy method has been used in Finland for decades to treat the forestry waste and its side stream (Business Finland 2020). The energy recovered can be used for the district heating for built-up areas.

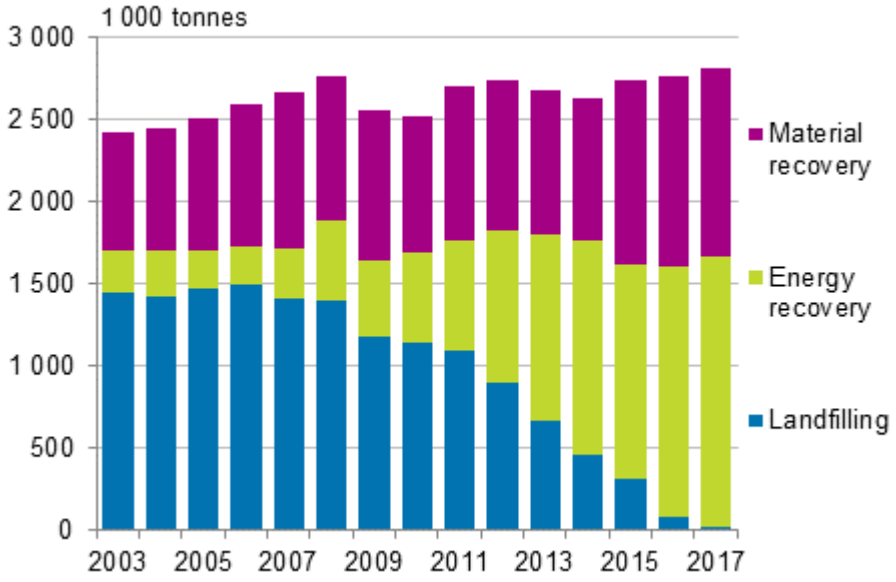

FIGURE 8. MW treatment in Finland in 2003 to 2017 (Adapted from Statistics Finland 2019)

4.5 Plastic management in Finland

Even plastic is polluting the oceans and damaging the marine ecosystem; it cannot be denied that plastic is one of the most efficient materials. The Plastics Roadmap for Finland (PRF) indicates critical steps towards a sustainable plastic economy. It includes five primary Rs: Refuse – Reduce – Recycle – Replace. PRF aims to reduce the harm of plastic waste, encourage consumers in waste management, increase the recovery and redesign efficiency, support investment for innovation towards the circular economy, and promote bio-based materials and solutions. The PRF implementation is the responsibility of the ministers, cities and municipalities, Finnish Research Institutes, NGOs, Plastic Federations, Academies, Business Co-operators, innovative start-ups, and waste management companies. Numerous actions and commitments have been taken to achieve the target in the PRF. (YM 2018.) For instance, the campaign "I love Plastics" or "Rakastan Muovia", founded by YLE, creates challenges for citizens to encourage plastic reduction and recycling. The campaign has been published both online and broadcasted via radio and television with many public events. (YLE.)

FIGURE 9. Ten key actions of A Plastics Roadmap for Finland (adopted from YM, The Plastic Roadmap in brief 2018)

5 WASTE MANAGEMENT IN KOKKOLA

Kokkola Karleby is the capital of the Central Ostrobothnia, Keski-Pohjamaa in Finnish. With the land area of 14,440 square kilometres and the population of 47,660 inhabitants, Kokkola is responsible as the administrative, economic, and cultural centre for the Ostrobothnia region. There are more than 3,500 students currently living in the city, which belong to the three leading schools: The Kokkola University Consortium Chydenius, Centria UAS, The Federation of Education in Central Ostrobothnia. (City of Kokkola 2020, 3&10.)

5.1 Centria student community

Centria is the most international university of applied sciences, with one of five students are international (City of Kokkola 2020, 29). Centria has three campuses: Talonpojankatu campus in Kokkola, Allergo campus in Pietarsaari, and Vierimaantie campus in Ylivieska (Centria 2020b). In this thesis work, the primary target audience was the Kokkola international student community from Centria UAS. In 2019, the total number of international students at Talonpojankatu Campus was 471 students. The number of students in different degrees, which enrolled as present, is described in Table 1 (Vipunen 2020). Kokkola students are currently living in student housing called Tankkari. Tankkari housing company operates six apartment areas, 1-6. At the moment, Tankkari 2 has been renovated (Tankkari 2020). Besides Tankkari housing, students can rent an apartment from the residents or local housing companies.

TABLE 1. The number of international students in Centria Talonpojankatu Campus in 2019 (adopted from Vipunen 2020)

Degree	Number of international students
Environmental Chemistry and Technology	90
Informational Technology	114
Nursing	42
Business and Administrator	225
Total	**471**

5.2 Waste management in Kokkola

The city of Kokkola is a member of two waste management corporations: Ekorosk and Ostrobothnia Waste Board (OBS – Pohjanmaan Jätelautakunta). In the Central Ostrobothnia region, Ab Ekorosk Oy is the waste management company based in Pietarsaari, which is operating in Kokkola, Pietarsaari, Nykarleby, and nine other areas. Started in 1989, Ekorosk handles the waste of 124,000 inhabitants. Ekorosk is responsible for collecting the sorted waste, transporting to the recycling company, and disposal. Ekorosk also publishes instructions on sorting waste and makes contracts with households in their handling areas. In total, Ekorosk operates 23 recovery stations and 170 Ecopoints in Pietarsaari, Kokkola, Pirilö, and Storkohmo. (Ekorosk 2018.)

FIGURE 10. Ten regions managed by Ekorosk (adopted from Ekorosk 2018, 2)

The Central Ostrobothnia Waste Board (OWB), Pohjanmaan Jätelautakunta in Finnish, is a joint member with Ekorosk company. It is the MW management authority of the same ten members. OWB is a part of the Pietarsaari municipality administration. OWB's primary responsibility is to prescribe the Waste Act and the Board's regulations, as well as supervise the litter matters and waste management. (PJ 2020a.) The Board draws up and decides the waste management regulations, issues general instructions, and approves the MW charge. The applied waste management fees and taxes are decided by OWB, including transportation and treatment charges. The yearly fee about different types of household waste such as energy waste or biowaste is also regulated and recorded to the administration data. Moreover, OWB provides opinions and reports to various authorities relating to waste management such as Ekorosk and the municipal environmental protection authority. (PJ 2020b.)

5.2.1 Waste collecting

In the Kokkola region, there are 39 Ecopoints by Ekorosk and 26 Rinki points by Rinki (Ekorosk 2020a). Ecopoint is a collecting place located near small household areas, supermarkets, and shopping centres. Ecopoints collect household waste such as glass, metal, papers, and batteries (Ekorosk 2020b). Besides, there are Rinki points, called recycling points, operated by Rinki company, in which some collect paper, cardboard and plastic in the whole of Finland (Ekorosk 2020a). With more substantial objects, recycling points are used to collect and manage waste sorting (Ekorosk 2020c). Students living in student housing like Tankkari have their waste collecting point inside the building area. However, students living in other residential areas must come to the Ecopoints to discard their waste. For a single-family house, waste should be delivered to the nearest Ecopoint or the recycling station. There is an Ekorosk recycling station at Terminaalikatu 11, Kokkola, which collects energy waste, wood waste, landfill waste, large metal, dangerous waste, electrical and electronic equipment, garden waste, paper, cardboard, glass, and aggregates. Picture 2-4 showed the current containers at three collection points in Kokkola: the Ekopoint, the sorting station, and the waste collection that belongs to Tankkari housing.

PICTURE 2. Rinki-ecopoint at Herman Renlundinkatu 26, Kokkola

PICTURE 3. Container for betong (concrete) waste at the Kokkola recycling station

PICTURE 4. Waste collecting point at Tankkari 5, Kokkola

5.2.2 Waste sorting

MSW sorting is first implemented within the house with several bins for many types of waste. Depending on the collecting points, then MSW can be sorted into many containers before it is transported to the recycling company or being disposed. There are six main types of MSW, including biowaste, energy waste, glass, metal, paper, and plastic waste. Other types are garden waste, construction waste, hazardous waste, clothing and other textiles, electric and electronic waste, and mixed waste. The sorting instruction is clearly provided on the container's body and the regional waste management information website. Picture 5(a-g) illustrates the waste sorting container at a student housing, Tankkari 5, with seven types of MSW. For further instructions, there are many Finnish websites offering instruction in different languages such as English, Vietnamese, Spanish, Chinese, Arabian, and Russian. Typical websites like infoFinland.fi and Ekorosk.fi also illustrate the visual instructions about waste sorting and give details about where to put specific trash.

PICTURE 5. Type of waste containers at Tankkari 5 (a) biowaste (b) energy waste (c) glass (d) metal (e) paper (f) carton and (g) plastics

There is also a different sorting system for metal cans, glass and plastic bottles in every supermarket. Following the Palpa fee, a plastic bottle is marked with a small deposit ranging from 0.1 to 0.5 euros (Palpa 2019b). When the beverages are bought, the customer must pay this amount along with the original price of the drink. After using, the customer brings those bottles back to the collecting point at a supermarket and returns it at the automatic sorting system, and then they receive the deposit money back. Customer can donate the money to the children's charity organisation if they want. Picture 6 was taken at the bottle collection machine at Lidl Kokkola.

PICTURE 6. The bottle-collecting machine at Lidl Centre Kokkola

5.2.3 Waste transportation

Ekorosk cooperates with three primary transporters to collect and carry MW for recycling (Ekorosk 2020d). Ekokuljetus JNH Oy is responsible for the collection of waste, emptying septic tanks, and drainage of grease and sand, especially for detached houses. Kaustinen Monitoimi Oy offers transportation for solid and liquid municipal waste, also collecting of metal, paper, and cardboard (Kaustisen Monitoimi 2020). Lassila & Tikanoja Oyj Rantavallinkaari is mainly focusing on circular economy strategy

with services on promoting the sorting, data-driven management, and improvement of the material streams (L&T 2020). For single-family houses, the residents can order the shipment from the waste carrier, under the contract with OWB. Waste collecting must be done within two weeks as the biowaste is not allowed to be stored longer, and up to four weeks if the biowaste is composted. All changes in waste shipment must be notified to the OWB to support the data management. (Ekorosk 2020e.)

5.2.4 Waste treatment

Based on the Finnish statistics on waste treatment, MSW is mainly recycled and delivered to the waste-to-energy combustion. The biodegradable waste is converted in the biogas and biorefinery plant. Other mixed and energy waste are burnt in the large-scale heat and power production to produce electricity back to the cities. (Business Finland 2020.) Household biowaste and energy waste from Kokkola go to the Pirilö Waste Centre in Pietarsaari. There, the energy waste is crushed at the Ewapower plant and used for recycled fuel while biowaste is transported to the biogas plant.

6 METHODOLOGY

In this chapter, the author describes the survey process and the basics of the SD assessment. The survey started from March 4 to the beginning of April, including four main steps to gain the Centria students' attitude and behaviour to waste sorting. The SD assessment is based on the framework of Michael Ashby about assessing an articulation in SD.

6.1 Survey Process

In the first stage of the project, at week 1-2, the survey link was sent of all Centria students by email. The survey aimed to collect data about waste sorting in the international student community. The process included four primary processes: creating the survey, prototyping, sending, and analysing collected data.

The creating process was brainstormed under the help of Mr Hagström in the first week. The first draft of the survey was completed based on three main sections. Necessary pieces of information such as years living in Finland, nationalities, majors, and types of studies were asked in the first section. The second section focused on how students treat waste at their home and the waste-collecting point in their apartment. Some additional data was gathered, such as interest in the circular economy, and the student shares about their cultural background at their home country. As a part of the goal, some useful resources used in this project will be shared to students who are interested in the topic, as well as created a knowledge base for them to motivate other students to do the sorting.

In the next step, the questionnaire was sent to the first five international students in three majors: Information Technology, Nursing, and Business Management. Valuable feedback was given on concise the questions, the length of the survey, and the range of the answers. After the prototyping, the survey was fixed to be more concise and targeting the right audience.

The final survey edition was then sent to all international Centria email addresses twice, and a follow-up email after two weeks indicating the closing date. With the help of Mr Hagström, more survey pieces were sent to the Centria alumni. The survey was also posted on the Vietnamese student community group, as well as the Centria international student group on Facebook. These online posts targeted all the foreigners or non-Finnish speakers who are living in Kokkola.

The survey was closed after three weeks with 95 submissions, reached 1/5 of the international students at Centria. However, most international students were not living in Kokkola at that time due to the exchange semester, internships, and the COVID-19 crisis. All the results were illustrated by Google Form' figures and analysed to give the exact overview of the situation on waste sorting in Kokkola. Some charts were highlighted in chapter 2; the other figures covered the other parts of the survey are shown in APPENDIX 1.

6.2 Sustainability assessment

It is required a well-prepared arrangement while assessing an innovative moment, called an articulation. A detailed plan was made to consider all the factors that can affect the project. Due to its complexity and interactivity, a new project can be called a system. Such a system requires a comprehensive method to understand; therefore, SD assessment is used to analyse several layers of thinking. This layer-based thinking separates the aspects and objectives of a project. All the changes require a goal, the stakeholders, a factual background, a synthesis on three bottom-line capitals, and a reflection if it completely aligns with the situation at the moment. The sustainability assessment method here is used as a framework, including five steps, starting from the left side. Each of the following steps is based on the deepening structure of the previous one. Figure 11 illustrates the interconnection between this system assessment. (Ashby et al. 2016, 40-41.)

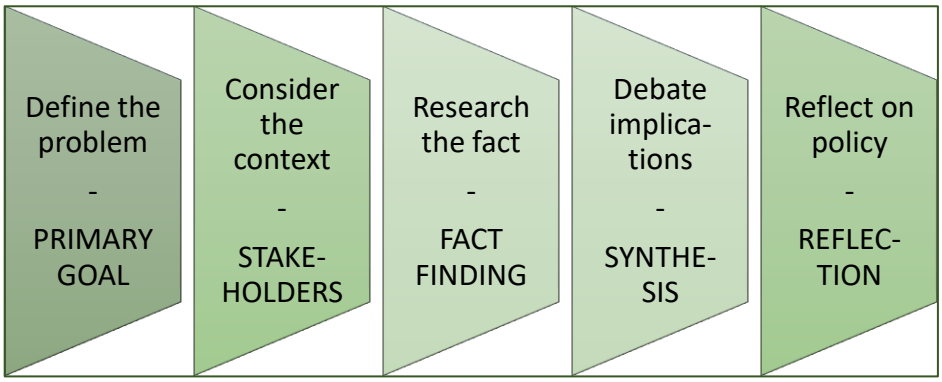

FIGURE 11. Layering about defining the way of thinking about a complex system (adopted from Ashby et al. 2016, 41)

The first layer defines the problem of the project needed to be solved. It includes the very first statement about the problem, how the problem arises, and the decided goal. Then all the related interdependencies are taken into account. For example, the prejudgement or believe-dependence value would affect the

problems. At this stage, every stakeholder is concerned about their impact and interest in the project. Critical thinking is considered as a crucial factor when moving to the next step. Acknowledged facts are gathered from different points of view, and this is to give the complete diverse perspective about the project. Then, all the facts should be put in a discussion or a debate in step 4 to synthesise the most suitable result. Finally, the result is concluded as good if it delivers the lowest dissatisfaction for all the stakeholders. (Ashby et al. 2016)

Applying this approach forms progressive and interactive thinking between different layers and within each layer. This method also creates a direction from left to right by the build-up the following layer based on the previous one's clarification. The detail of each step is introduced in the next sections.

6.2.1 Problem definition

Every articulation must be motivated by a prime goal to make a significant difference. When targeting the problem, the alternative should have a scale in time and size. It becomes the basis when analysing the problem. Every SD is impossible if there is no clarification of the objective, how soon it happens, or how long it should be. The clearer the goal, the easier the analysis. Usually, the SMART and 5W1H method are used as a tool to describe motivation clearly. SMART stands for Specific, Measurable, Achievable, Realistic, and Time-bound. In addition, the 5W1H defines the answers for six questions: What, Where, When, Who, Why, and How. These methods cover most aspects of the prime objective, including the time and size scale. (CFI 2020.)

The scale of time is significantly essential. The time can be considered based on the government strategy, or the economic targets. If the time is too short, there might be an insufficient resource such as equipment and personnel. In contrast, the lengthy change leads to the increasing cost due to the longevity of equipment and the lost in stakeholder commitment. Similarly, while considering the size scale of the project, it directly links to the investment and operating cost. The larger-scale project brings more social, economic, and political implications—the more significant the scope, the higher demand on material, labour, and economic resources. (Ashby et al. 2016, 56.) The goal of sustainability is to balance the connection between the environment, economy, and society. Therefore, any suggestion must comply with acceptable demand while delivering the most effective impact.

6.2.2 Stakeholder identification

Anyone who impacts or is affected by the change moment is called a stakeholder. For example, a person who puts money and human resource wishes to see the benefits and the success of the project. Being a stakeholder combines both interest and influence. A stakeholder can be an individual, a company, an organisation, or a group of tribes. It is essential to manage the relationship to all the stakeholders and address their concerns; otherwise, the project might not be acceptable. Stakeholder identification means to define all the interested parties, their concerns, their impact and the ways they interact with the project. The stakeholder can be identified easily by face-to-face interview or through a questionnaire.

Usually, possible stakeholders can be divided into three main groups: Local or national government, supplier, customers, and other existing and potential stakeholders. The first group includes the owners, the employees, local authorities such as health and planning department, and alliance partners. The supplier group can be a business partner, trade unions, the press and other means of social media, and the local public community. The investors, shareholders, managers, colleagues, and other interested groups like scientific or environmental community are involved in the final group. They are the most basic category to identify targeted stakeholders. (Ashby et al. 2016, 58.) Stakeholder identification step gives an overview of the management strategy. It answers the most critical questions: Who are the stakeholders? What do they expect? What is our action to meet their requirement? Therefore, some fact-finding is generated in the next steps based on the defined stakeholders.

The impact and interest of a stakeholder can be evaluated by a matrix. The higher a stakeholder has in both factors, the higher concentration the project needs to engage with. If a stakeholder is ignored, they will react, most of all, negatively to the project success. Figure 12 shows a standard stakeholder matrix, where each stakeholder is positioned and the relationship between them. The horizontal axe describes how high their interest and expectation to the project, while the power of the stakeholder is shown in the vertical axe. There are four types of stakeholders described by four quadrants on the interest and influence matrix: Bystanders, Context setters, Concerned citizens, and Key players. All of them require different management methods to engage and monitor. (Fili 2019, 131.)

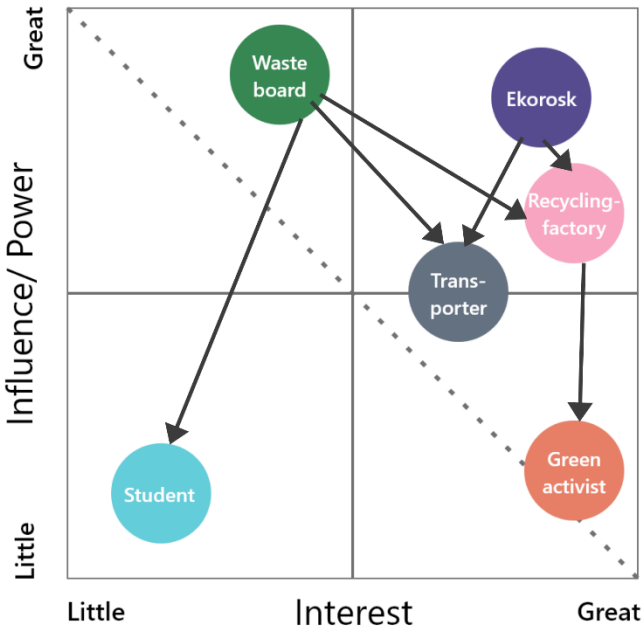

FIGURE 12. Sample of stakeholder matrix on improving recycling

Bystanders are the first group who has little interest and also no influence. They are unlikely to withdraw their attention, so the team can monitor them by providing enough information. Stakeholders with high impact but low interest, for example, a local authority is the Context setter. They require attention, but due to the low interest, keeping them satisfied is enough to deal with them. In contrast, a stakeholder with lack of influence but high interest, called Concerned citizen, tends to ally with more influential groups. This group needs to be updated regularly and consult them with suitable information. Key players are the critical stakeholder group an articulation requires monitoring the most. With the significance in interest and impact, they are the decision-makers that should be engaged fully with negotiation and compromise. They are also the closest to have as allies. (Fili 2019, 131.)

6.2.3 Fact-finding

Fact-finding is a crucial step in sustainability assessment. It is to assemble all the factual information about the project and the expressed concerns. The fact must be withdrawn from evaluated resources such as articles, books, and journals. It is essential to keep the facts objective and non-judgemental. A six-sector heading in Figure 13 can be used as a prompt for the key questions. (Ashby et al. 2016, 61.)

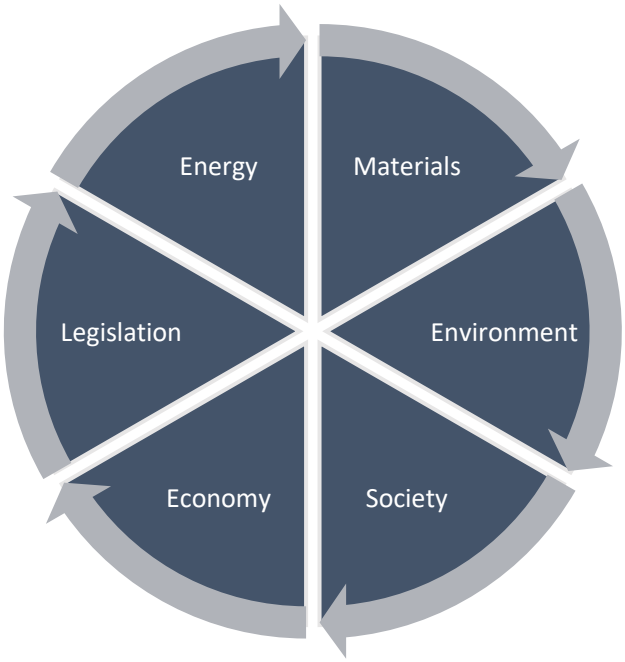

FIGURE 13. Six-sector for headings in fact-finding (adopted from Ashby et al. 2016, 61)

The larger the project, the more material and manufacture are required. In the material section, the amount of the material and its critical level affect the articulation's supply chain. The material used should be compared with the world annual production, geological origin, and ethical sourcing. Some template questions are used to define the cover of the material section such as the bill of the material, the security of the supply chain, the critical material, the material source and human-right record, and the efficiency of the used material. (Ashby et al. 2016, 60.)

Environmental damage and resource consumption are the determinate factors to be considered for the environmental sector. It can be assessed by using life cycle assessment or an eco-audit, to give the authoritative guide to decision-making. (Ashby et al. 2016, 63.) While tackling the environment, some factors should be asked, such as the carbon/water/soil footprint, LCA, eco-audit, possible recycling, and the environmental threat while using or disposing of the articulation.

Social equity is ensured in the next section. Along with the rise in corporate social responsibility in business and organisation, the duty of the articulation is expected to benefit the local communities. It is to offer the local investment in welfare, health, education, labour, and respect to customs, traditions and beliefs. (Ashby et al. 2016, 63.) The ideas of job opportunities for local, equitable wealth share, self-esteem contribution, self-sufficiency of the personal and national level can be targeted.

Economic is a vital factor as it relates to the money benefit. It is the most difficult as well as the most controversial due to the crash in success definition. To reach the SD, the balance of cost-benefit should be precisely established. (Ashby et al. 2016, 64.) Assessing the cost-benefit value or other credit can be used to fulfil sustainability is an essential way for the economic section.

The project must follow the legislation and regulations. For example, the reporting of toxic substances, material and energy use for collection at the end of the product life is required under-designed guideline. Otherwise, the articulation is not considered sustainable. (Ashby et al. 2016, 63.) Some considered aspects are about the regulatory measurement, the restriction imposed, or anticipated legislation.

Energy usually relates to the carbon footprint of the project. The energy consumption, includes side products, should be calculated based on the intensity use and over the life cycle. The footprint of the energy carrier affects the environment directly or indirectly. (Ashby et al. 2016, 62.) It is usually analysed renewable energy, how it is stored and the energy efficiency during the life-expectation.

6.2.4 Synthesis

Synthesis is to gather all the facts collected in the previous step to create a balanced judgement based on the three capitals of the SD. An articulation will affect and change the base value of the current situation. However, each concerned group has a different perspective and priority. Environmentalists consider more on the natural aspect while the economists prioritise the growth and the capital investment. Therefore, this step is to summarise the judgement to give the shared point of view regarding the underlying beliefs, values, religious, political and cultures. (Ashby et al. 2016, 66.) It is highly recommended to hold a debate and holistic thinking to give an objective and achievable outcome. A checklist on the description of three capitals, how it can be measured, why it is essential, and what can damage it is used to debate and synthesise such a complex structure.

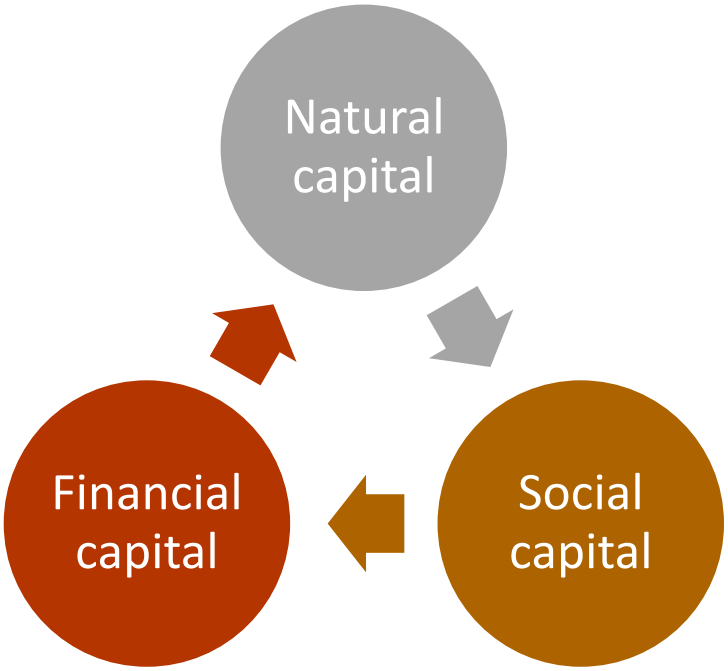

FIGURE 14. Three main capitals of SD (adopted from Ashby et al. 2016, 48)

Based on the result from the fact-finding step, the information can be placed in a structural matrix of the three capitals and six sectors as in Figure 14. Each fact can be counted as a plus (+) or a minus (-), which is a positive or negative impact to that capital, respectively. Usually, a fact can contribute to one capital, yet it is seen as harmful to another (Ashby et al. 2016, 69). Finally, the net gain or loss is withdrawn and can be seen as an overview conclusion. Table 2 is an example of a situation where recycling is increasing once the sorting behaviour improved.

TABLE 2. Synthesis of improving waste sorting behaviour

Facts	**Natural Capital**	**Social Capital**	**Financial Capital**
Materials	+ Less material is exploited		+ Reduce waste stream
Energy	+ Less energy used for sorting at the factory		+ Energy recovered increased by waste-to-energy technology
Environment	+ Reduce environment contamination	+ Awareness of environmental protection spread in society	
Society		+ Increase friendliness _ Required more human resources + Satisfaction when seeing a clean environment	

Legislation	+ Contribute to the circular economy	+ Create a habit + Recycling legislation approved	
Economics			_ Costs for the operating company
Synthesis	+ Less material required + Contribute to the circular economy	+ Awareness increased in environment protection _ Required human resource	+ Reduce waste stream _ Increase operating cost

6.2.5 Reflection

Finally, the alternatives are reflected on the prime objective and its difference, the benefit outweighing, and the broadening ability of the final assessment. Some articulation should be considered more about the timing. For example, the project may gain more negatives in the near-term; however, it will bring more benefits to the long-term picture. Some alternatives affect social thought and behaviour; therefore, they require further method and adjustment in the objective. Any problem and unintended obstacles are considered to develop a possibly productive way of the method to reach the target. (Ashby et al. 2016, 71.)

6.2.6 Summary and conclusion

After assembling all the layers and understand the system thinking, there comes the conclusion. It is essential to understand that there is no right answer in SD. Every articulation has its beneficial values and dimension so that it can be applied in a particular period. The sustainability assessment covers the overall theme to support the need for compromise, judgement, and critical thinking.

7 SOLUTION CASES

To reach the primary goal of increasing the sorting awareness, some suggestions were made not only targeted at international students but also reach the other Finnish students and the foreigner community. These methods included creating a more natural way for the students to know about the regulations and sorting instructions with a more simple visualisation so that they could understand the meaning of small actions towards a more sustainable future. All the articulations can be made as a short-time project or a long-time program. SD assessment was used to evaluate the possibility and reachability to give a critical overview of each project.

7.1 Case 1: Readable instruction at the collecting point

Based on the student feedback about the misreading of the sorting instruction on the container body at the collection point, there are three main problems: the instruction cannot be seen due to the degradation, the instruction is not specific enough, so students were confused when sorting, and the instruction is only in Finnish and Swedish (APPENDIX 1). Making the instruction is the easiest and most effective way because most students claimed that they got the idea of sorting when they come to the collecting point. Picture 7-8 showed the instructions in the energy container at Tankkari 5 with the dirty label and Finnish only label, respectively.

PICTURE 7. Label of the Energy waste container at Tankkari 5 with many languages yet dirty

PICTURE 8. Label of the Paper waste container at Tankkari 5 with only Finnish instruction

7.1.1 Primary goal

Therefore, if the instruction can be upgraded with clear information label in more international languages and visual effect will raise the interest in waste sorting. In addition, the English version encourages the international feel of being cared and decreases the xenophobia within Finland. The upgrade requires at least two weeks to prepare the objects, and the labels can be renewed every several years to ensure the readability.

7.1.2 Stakeholders

The stakeholders, in this case, include the local authority, the waste management company, the students, the student housing or resident, the label-making project team, and the label supplier. The Kokkola authority in the environment is responsible for the awareness-raising in the circular economy and waste sorting. Waste management company operates and monitors the project. Students are the one using the services and the main target of project monitoring. The landlords can benefit from the project by reducing the price they have to pay on garbage service. The label maker and label supplier can sell their work and goods by making the upgraded label. Figure 15 shows the relationship between the impact and the interest of each stakeholder in the first case.

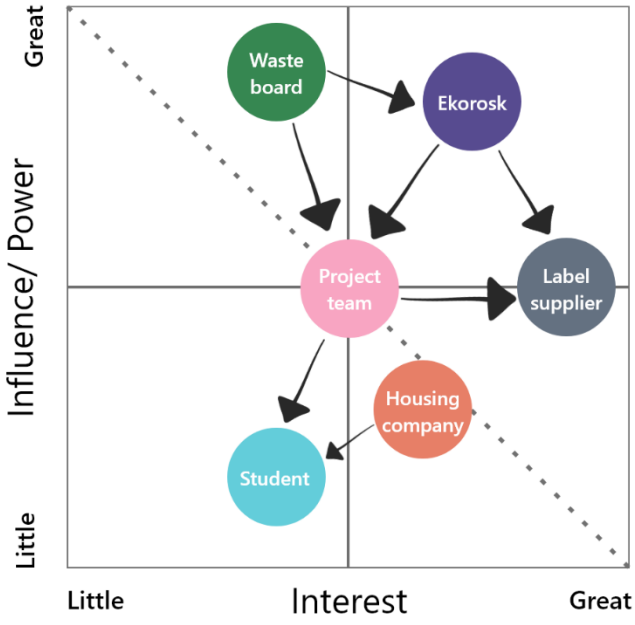

FIGURE 15. Stakeholder matrix for case 1

7.1.3 Fact-findings

A label is made without any critical materials, and the supply chain is available in the Kokkola area. On average, there are ten containers at every collecting point; therefore, it requires 10-20 labels. In total, there are at least 650 paper-like, glued sheets used in each upgradation. The environmental effect can be seen clearly with better sorting behaviour. The energy and material recovery have rocketed since the push of the circular economy. However, there is another problem with the label itself. The glue behind the label can pose a threat to the soil and water flow nearby. If plastic cover is used, the amount of plastic will be increased; however, a plastic cover is a good alternative since it can protect the sheet longer and save paper for an extended period. The project can create jobs for international students as well as environmental students in Centria as they could contribute to delivering the content and language on the label. In this case, the project helps to raise the awareness about sorting habit of international students, which is the norm of the local community. It also creates a better impression of the local about foreigners. The project costs the waste management company, but not too much. The use of the label material should follow the environmental laws and regulations.

7.1.4 Synthesis

TABLE 3. Synthesis of operating an international labelling project

Fact	**Natural Capital**	**Social Capital**	**Financial Capital**
Materials	+ Push the available logistics	+ Create jobs for international students	+ Money saved for operating company by reducing sorting activity _ Require more material for the up-gradation
Energy	+ Less energy used for sorting at the factory _ More energy to produce the upgraded label		+ More money from energy recovery
Environment	_ More plastic production _ The glue brings negative effect		
Society		+ Increase friendliness + Satisfaction when seeing a clean environment	

Legislation	+ Contribute to the circular economy		
Economics			_ Costs for the operating company on producing
Synthesis	+ Contribute to the circular economy _ Small negative effect on the environment	+ Satisfaction when seeing a clean environment + Create jobs for international students	_ Costs for the operating company + More money from energy and material recovery

For the natural capital, a small effect on the environment can be replaced with the other contributors to the circular economy. This ensures environmental health and reaches the prime objective. In addition, all stakeholder's requirements are satisfied. This project brings an excellent benefit for the locals and foreigners by creating a contract job for international students while reducing the xenophobia of local Finns. Although the operating cost is higher than the current label, the profit from reducing the waste stream is undoubtedly recommended.

7.1.5 Reflection

This articulation not only serves instantly; it also advantages for a long-time period. If the labels are renewed regularly, new students can find them for the first time they come to Finland. It is a passive but effective method to create the sorting habit to people who have not done before. It is also an excellent chance for international students to learn and get used to the Finnish culture.

7.2 Case 2: Waste management as an elective course

There were 1517 courses on the Campus Online platform in 2019 (eAMK 2019, 7). In spring 2020, there are 25 students took the course "Cleaning Techniques" which was operated by Centria UAS in the Campus Online platform (Optima 2020). Centria UAS can host a course belonging to the engineering group about waste management, the threat of landfill, and circular economy. The survey indicated that 70 students are interested in the circular economy, and 35 people are willing to take an elective course in Waste Management (APPENDIX 1).

7.2.1 Primary goal

The elective course can be taught every year for the open UAS students who are interested in waste sorting. Half of the students agreed that excursion would be an excellent choice to raise awareness on sorting waste (APPENDIX 1). An excursion to the recycling centre or the plastic management company can be held for students not only in the Environmental Chemistry and Technology degree but also in other degrees. The trip may belong to an on-going environmental course, which takes one day per semester.

7.2.2 Stakeholders

The stakeholders, in this case, include Centria UAS, the students, the teachers, and CampusOnline operator. Centria UAS is responsible for the coordinating and the OnlineCampus and Optima platform to connect students with teachers as well as material storage. The teacher is a crucial factor that must help students understand the importance of sorting and circular economy. Students are the key role to learn and apply the instruction to their living and spread their understanding to other students. Therefore, the behaviour would be improved in both scale and size.

For the excursion trip, the stakeholders include the Centria Chemistry Department, the teachers, the recycling centre, the transport operator, and the students. While the Chemistry Department coordinates a suitable course and delivers it to the teacher in charge, they must also keep in contact with the partners: recycling companies and waste management authorities. Bus operator could be an excellent partner to transport students between places.

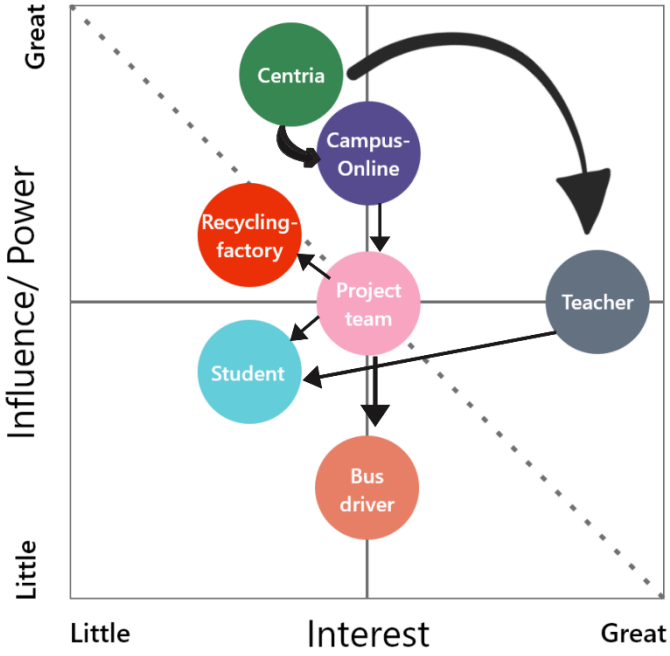

FIGURE 16. Stakeholder matrix for case 2

7.2.3 Fact-findings

If the course is online, no paper-like material can be counted. However, there is an amount of energy used to connect within the classroom. This energy is for electricity, the internet connection, and material storage via the cloud. If the course is operated at Centria UAS, Centria has to prepare the classroom and material required. In some cases, students go to school by cars and public transport which create some energy footprint. Usually, when operating a learning trip, a bus is used as mobile transport, and some buses still use non-renewable fuel. Convectional energy use causes air pollution. Coordinating a course may cost a long time both for student and teacher, with a limit in the number of students per semester. Instead, every student profoundly understands the importance of sorting waste and circular economy. Students also gain many resources on waste regulation, so that they can talk with their flatmates. This communicating will spread the information to other people in the community. When students come to the recycling factory, they create a professional network with the company, which is a potential to get a job in the future. The operating costs are countable, yet the effect of waste sorting efficiency is outweighing it.

7.2.4 Synthesis

TABLE 4. Synthesis on developing an elective waste management course

Fact	Natural Capital	Social Capital	Financial Capital
Materials	_ Some paper material is used to operate in contact teaching		_ Cost for offline paper used
Energy	_ Electricity required to operate the course. _ Convection fuel required to operate the course + Less energy used for sorting at the factory		_ Money paid for electricity and internet used. _ Money paid for transportation fuel. + More money from energy recovery
Environment	_ Use of convectional energy causes harm.		
Social		+ Interaction between students and teacher _ Time-consuming + Potential of a job for students	
Legislation	+ Contribute to the circular economy	+ Easy connecting students with regulation + Increase the factory reputation	
Economics			_ Transportation cost
Synthesis	_ Use of convectional energy causes harm. + Contribute to the circular economy	+ Potential of a job for students + Easy connecting students with regulation _ Time-consuming	_ Money paid for electricity and internet used. _ Transportation cost

Overall, this method is not so good as a suggestion. The advantage is not bold enough to ensure the result of sorting improvement. The environment effect is negative, as well as the financial budget. This articulation posts a potential but requires more commitment from the students to ensure a brighter result.

7.2.5 Reflection

This articulation can be improved more by transporting to the destination via bus using bio-fuel. Bio-fuel is one of the top-trend research topics at Centria and the whole of Finland (Centria 2020c). Some of the bus operators have switched to bio-fuel recently.

7.3 Case 3: The English-speaking environmental media campaign

In a tech-driven, fast-paced life nowadays, the internet takes a vital role in spreading media via numerous online platforms. Media requires well-known expertise to control and regulate the information unless the fake news affects the campaign result.

7.3.1 Primary goal

An English campaign on waste sorting can be a one-month challenge or an informative flyer combined with other environmental topics. The campaign should be held in both online and offline via popular social media platforms such as Facebook, Instagram, Yammer, and press. The challenge project can be hosted once a semester and continue in the coming years. Besides, due to the diverse nationalities and languages, the campaign can cooperate with other international students to create a multilingual project to spread the information to the different non-Finnish communities in Kokkola.

7.3.2 Stakeholders

The stakeholders include the Centria Research and Development department (R&D), the student union COPSA, the project team, the students, social media platform, the green activists, and the multi-cultural community. Centria R&D manages the activities within the development service field, while the student union has remarkable coverage to support the student community. The project core team needs to be active during the campaign with different roles to ensure project efficiency. Social media operators are less interested; however, they provide the platforms and can benefit from it. The more popular the campaign, the more the social media earning. Because it is an environmental campaign, it attracts free green-activists and could gain support from this community.

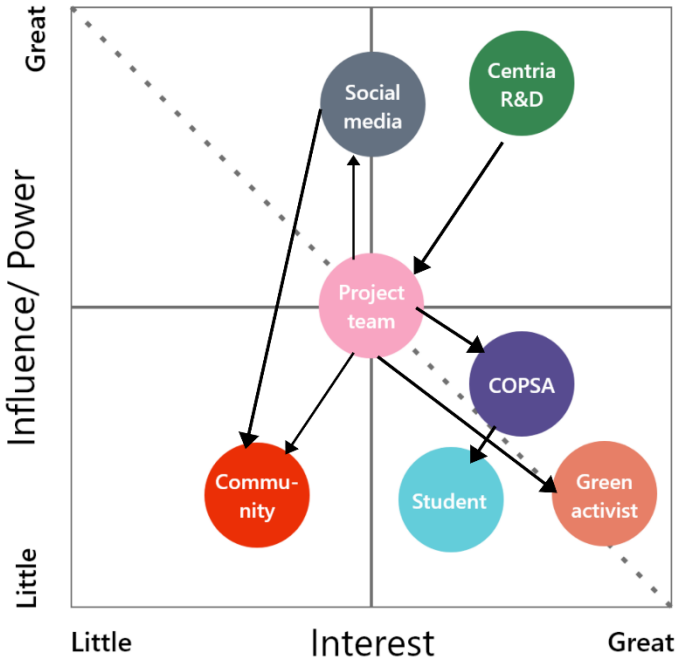

FIGURE 17. Stakeholder matrix for case 3

7.3.3 Fact-findings

A university-scale project requires around 50 leaflets per campaign. The design of the flyer could be used for the next campaign to save paper. When the campaign is raised online, the amount of energy is used as an internet connection and online storage. Leaflet with cheap ink posts a threat to the environment if it is thrown away. The ink pollutes the soil and underground water. However, this type of media campaign prints has the most effective reachability outside the student community. Due to its online characteristic, the campaign can connect with the green community and operate the challenge that targets other environmental aspects such as SD, pollution, and circular economy. The real-life working project, in general, will benefit the core team that come from several fields. It creates a cross-discipline environment for students to share and partner, as well as improves their personal and interpersonal competencies. While running the campaign, social media can collect money from advertising. In fact, the Ekorosk website already displays the instructions in many other languages than Finnish and Swedish, yet a small number of students do not know about this information.

7.3.4 Synthesis

TABLE 5. Synthesis of an environmental media campaign

Fact	Natural Capital	Social Capital	Financial Capital
Materials	_ Require paper to make flyers		_ Paper used for flyer
Energy	_ Energy from non-renewable sources required to operate the campaign.		_ Money paid for electricity and internet used. + More money from energy recovery
Environment	_ Excessed number of flyers becomes trash _ Print ink harms the environment		
Social	+ Raise awareness beyond sorting	+ Interaction between students + Collaboration to improve soft skills + Benefit for university reputation	
Legislation	+ Contribute to the circular economy	+ Easy reach students with regulation	
Economics			+ Benefit for the media platform
Synthesis	_ Require paper to make flyers + Raise awareness beyond sorting	+ Collaboration to improve soft skills + Benefit for university reputation	+ Benefit for the media platform _ Paper used for flyer

Even the campaign requires a considerable amount of leaflet; it can reach students in many environmental topics, not only waste sorting. Working in a real-life project brings benefits to the students, improves their soft skills, and the adaptability to work in an international environment. Centria also gains an excellent reputation for acting towards a more sustainable future. All the stakeholder's concerns are managed.

7.3.5 Reflection

Although the campaign requires the paper-making process, the leaflet can be used for a further campaign in the future to save paper. Creating a challenging campaign can further develop to a non-profit

organisation, which attracts the green-activist outside the student community. The project core team possibly becomes a community engager in the future.

8 DISCUSSIONS AND CONCLUSIONS

Finland is one of the most leading countries in the circular economy. This research aims to revise the waste sorting in Kokkola, which is a critical step towards the circular economy. The author first took an overview of waste management in Europe and how it was adopted to Kokkola, Central Finland. With the target of SDGs by UN, the understanding of SD was mentioned as a foundation for assessment. Based on the survey within the international student community at Centria UAS, the author evaluated the attitude of students towards the waste sorting and suggested three projects to improve the sorting efficiency.

The three most difficult problems the international students are facing when sorting waste are the instruction is not specific enough, the information is all in Finnish, and the label is not visible. Three suggestions were made and evaluated by the SD assessment. This method is to understand the system as a keychain in a broader picture and develop critical thinking when proposing a solution. All methods were evaluated by six relative factors: material, energy, environment, economics, legislation, and society. After evaluation, the label renewal and the media campaign are more effective than the waste sorting course. However, it depends on the timing and the coordination from Centria, and the elective course has some benefits for students who are genuinely interested in circular economy research.

There were some limitations during the thesis process. First, there were not enough gathered submissions. It reached only 1/5 of the international students enrolled this year. Some students were not living in Kokkola at the time of the survey, so it was merely seen as a reference for estimation. Second, the plastic recycling trip could not take place due to the COVID-19 crisis, so there is no description of the plastic sorting review.

In conclusion, SD assessment requires a broader view of any articulation. It is a combination method of tackling every aspect of an issue to debate and solve the problem. SD assessment can be used in further circumstances to plan a project for the change maker towards sustainable development.

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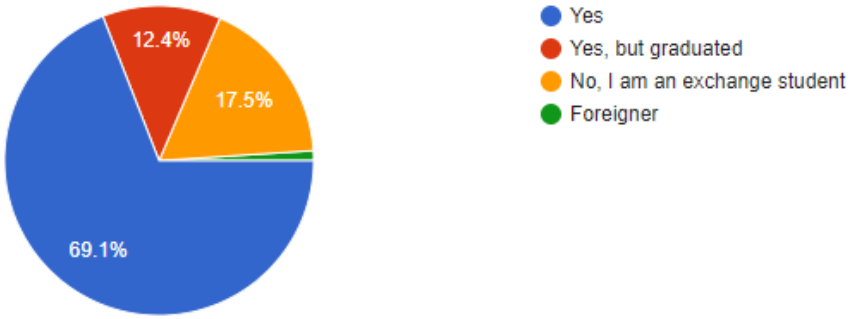
APPENDIX 1/1

Survey Result

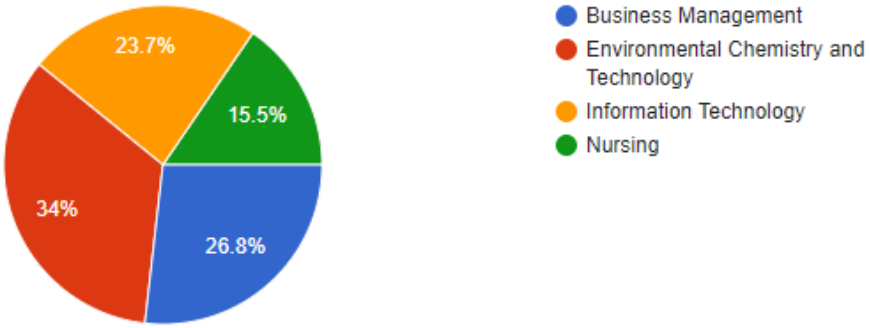
1.1 Are you a degree student at Centria UAS?

97 responses



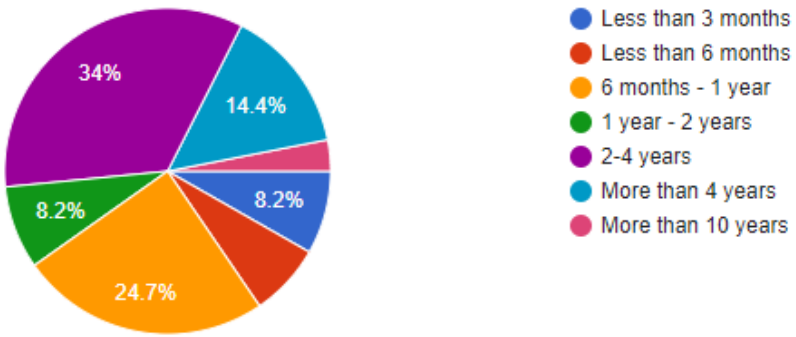
1.3 What is your major?

97 responses



1.4 How long do you live in Finland?

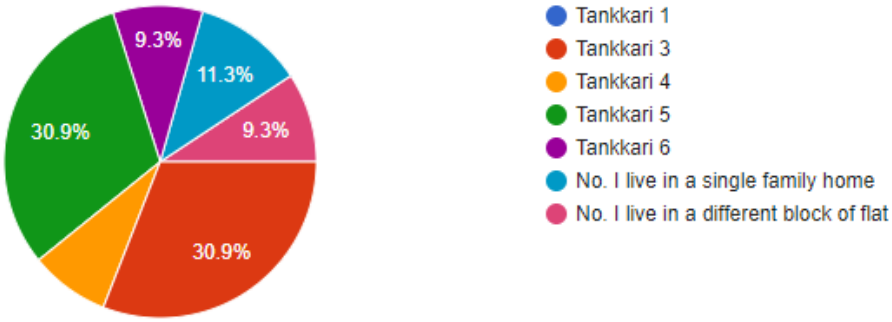
97 responses



APPENDIX 1/2

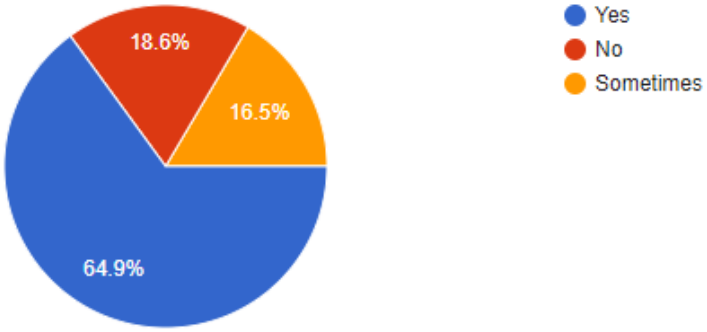
2.1 Are you living in a student apartment (Tankkari)?

97 responses



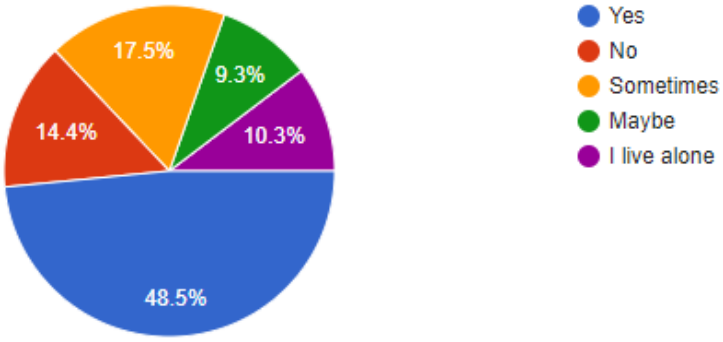
3.1 In your apartment/home, do you sort waste?

97 responses



3.2 In your apartment, do your friends, partner, family members sort waste?

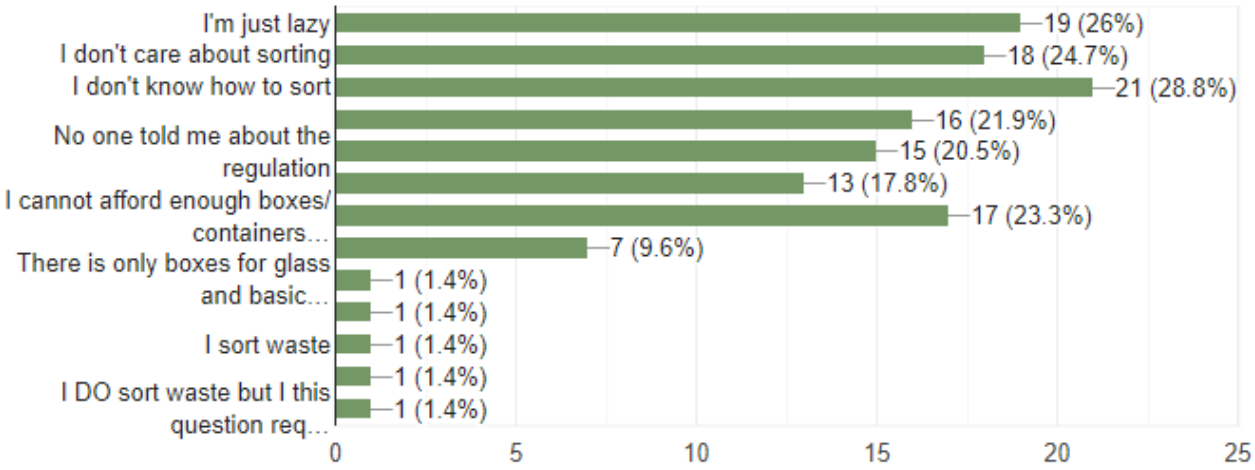
97 responses



APPENDIX 1/3

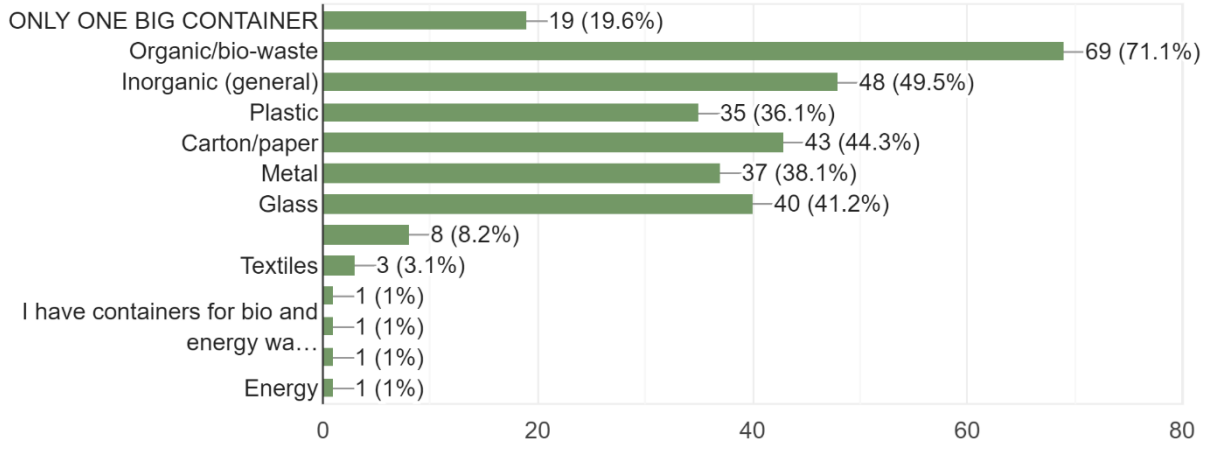
3.3 If you do NOT sort waste, what would be the reasons?

73 responses



3.4 How many different boxes/containers do you use for sorting?

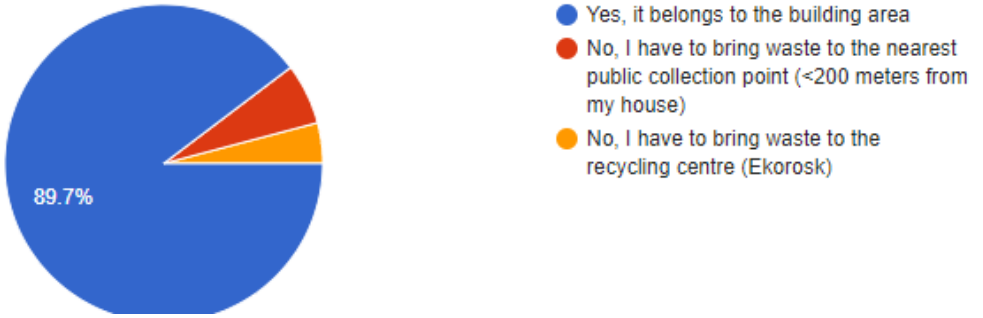
97 responses



APPENDIX 1/4

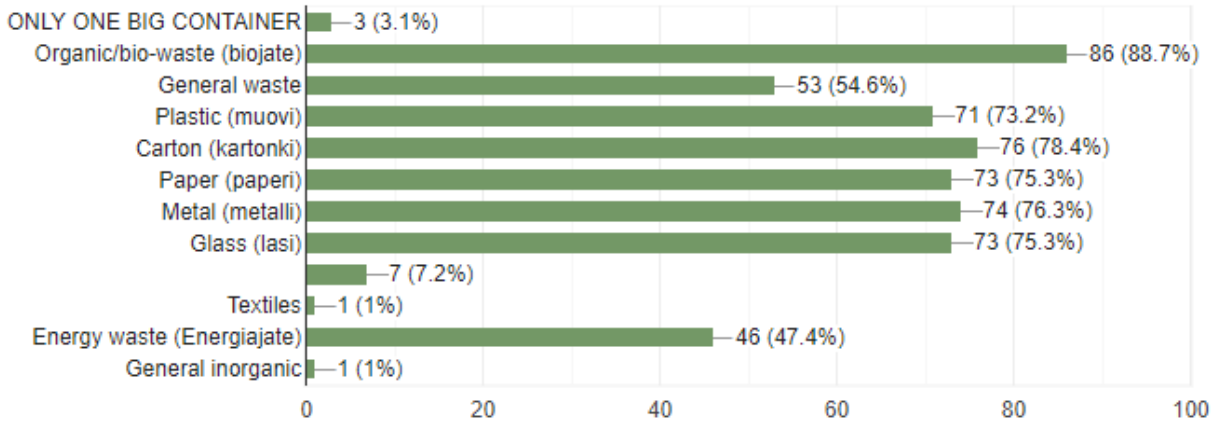
4.1 Does your building have a waste collection point?

97 responses



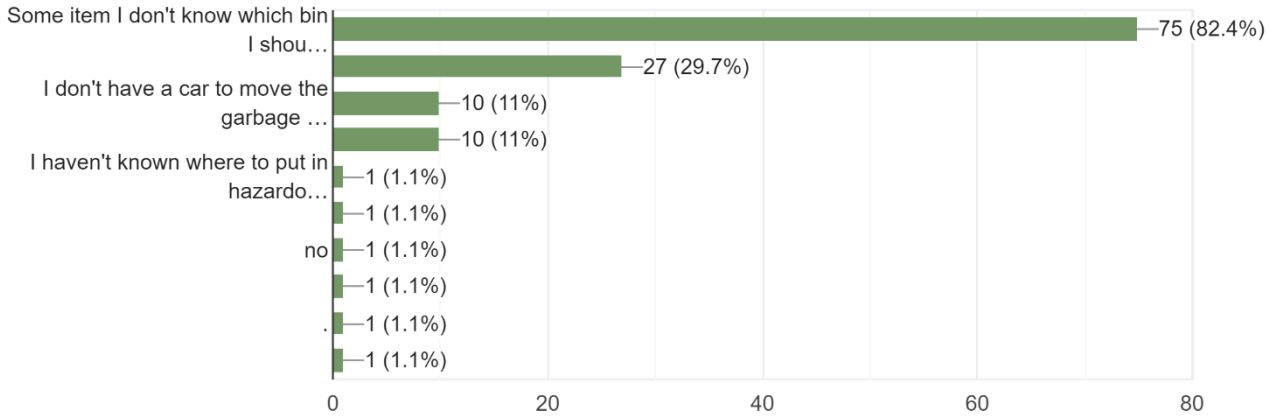
4.2 How many containers at your waste collection point?

97 responses



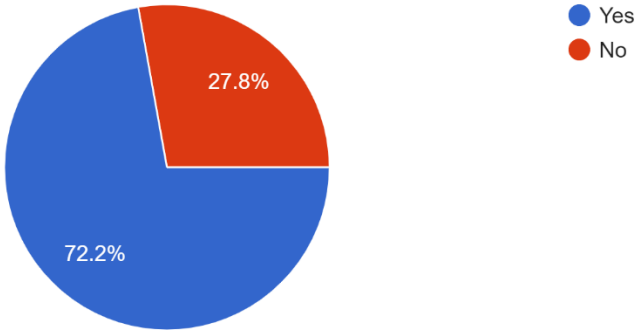
4.3 Is there any problem with your waste sorting?

91 responses



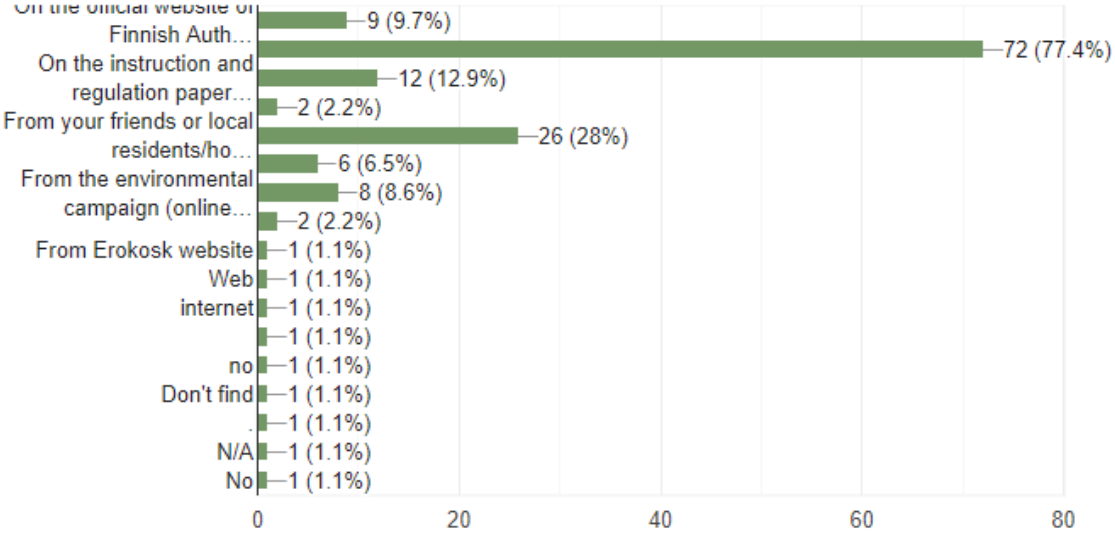
5.1 Do you find the information to sort waste easily?

97 responses



5.2 If yes, where do you find the information?

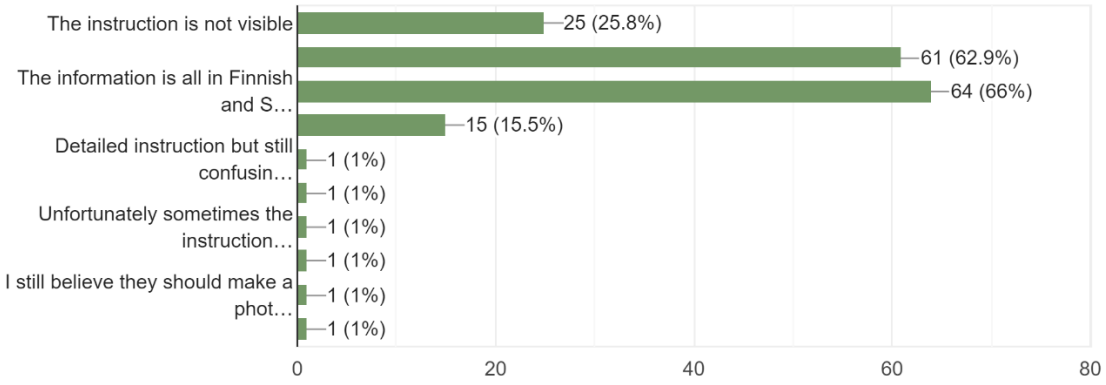
93 responses



APPENDIX 1/6

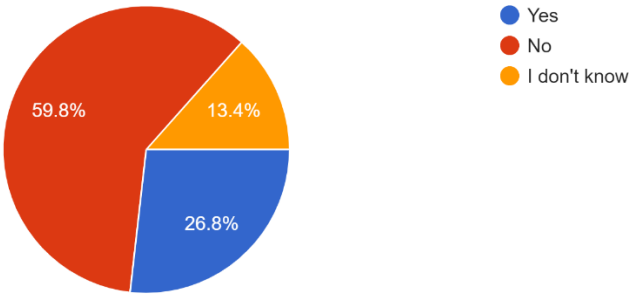
5.3 If you can not find the sorting instruction, what, in your opinion, would be the reason?

97 responses



6.1 Is waste sorting a regular basis in your home country?

97 responses



6.4 I have some suggestions to improve sorting efficiency. Choose what you think would motivate you to do the sorting.

97 responses