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The Solid Waste Management Structure of the Greek Island of Samothraki. Current Challenges and Initiatives. A Case Study Approach.

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The Solid Waste Management Structure of the Greek Island of Samothraki.

Current Challenges and Initiatives. A Case Study Approach.*

von Kristina Huda

* Masterarbeit verfasst am Institut für Soziale Ökologie, Studium der Sozial- und Humanökologie. Diese Arbeit wurde von Univ.- Prof. Dr. Marina-Fischer Kowalski betreut. (Die vorliegende Fassung ist eine geringfügig überarbeitete Version der Masterarbeit.)

Abstract

This thesis is a study of the present state of the solid waste management structure (SWMS) of the island of Samothraki in Greece, its challenges and current initiatives. The work includes an extensive literature review on waste management in combination with the description of the relevant legal frameworks that the municipality of Samothraki has to respect. The first empirical part consists of a compilation of official documents from the municipality and a large amount of additional information collected through an expert interview, which made the assessment of the SWMS and policies on the island possible. The second empirical part is the evaluation of a case study of the project "Composting: Nature's Way of Recycling" in the primary schools on the island initiated by the local Association 'Sustainable Samothraki'. The outcomes of the research are that presently the SWMS is lacking personnel, has an outdated equipment fleet, and shortage in waste bins to provide for recycling and mixed waste. Moreover, illegal waste dumping and burning of waste are practices that still take place on the island. A robust picture of the SWMS has been created to be able to conclude that currently it is highly inefficient and in need of immediate improvement. The case study was evaluated based on semi-structured interviews conducted during the summer school 2019 and an additional expert interview carried out in January 2021. The outcome of the research indicates that the project was successful in introducing the concept of composting in the community as a management option for organic waste. Giving an environmental education to the children has proven to be essential in raising the awareness between different generations in the community. Through the literature on household behavior and attitudes of people the most influential factors were identified which can assist the municipality in encouraging people to increase their awareness and participation and foster a change in their habits to environmentally friendly ones. The action setting analytical framework from Pelikan and Halbmayer, was used to display the results of the study and the intervention suggestions, which could be beneficial to undertake on the person and situation level to improve the SWMS of the island and expand the composting initiative. The results of this master thesis aim to contribute to the transdisciplinary effort to transform Samothraki to a sustainable island and achieve the aspiration of being designated a UNESCO Biosphere Reserve.

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1 Introduction

Waste management has become a global issue of concern in the 21st century, due to the increasing amount and the complex composition of it. The metabolism of the global society has reached a point where it is becoming obvious that the ecological limits concerning the available resources used as inputs as well as the sinks for waste flows and emission discharges are transgressed. Currently 41 Gt of waste per year (or DPO -domestic processed outputs) are generated globally, from this amount roughly 4Gt per year of waste materials are recycled (Haas et al. 2015).The European Union (EU) has put in place several legislations and directives addressing the problematic of waste and its management, from waste generation until its disposal (European Commission 2021 online, accessed on the 18.2.21).

The EU prioritizes environmentally friendly practices determined in the hierarchy of waste from the Waste Framework Directive 2008/98/EC starting with waste prevention and minimization, reuse, recycling, recovery and at the end disposal of waste in landfills, which is the least preferred management technology due to the environmental risks it poses. The directives and legislation of the EU are legislative drivers that influence greatly all the member states of the union, therefore also Greece (Eckelman and Chertow, 2009; European Commission 2021 online). Greece has been characterized by an inefficient waste management system, which faces serious problems especially with the disposal of waste in unmanaged landfill sites. Those issues apply for the mainland as well as the islands. Nevertheless, there is a visible effort from the country in the last years in rehabilitating the unmanaged landfills and implementing new plans to promote environmentally friendly management practices (OECD 2020).

An island is a physically separated land mass confronted with unique barriers, limited resources but also distinct opportunities. Regardless of the physical separation, islands are part of the global economic market and often dependent on the imports coming from the mainland (Eckelman and Chertow, 2009). The separation of islands to the mainland creates a difficulty for them to outsource some of their problems such as the modern waste flows, thus compelling them to be confronted much sooner with the questions of sustainable development. (Deschenes and Chertow 2004; Eckelman et al. 2014). Some obstacles islands face in relation to waste management are high shipping costs, lack of appropriate locations for landfilling, restrained recycle and reuse options (Bergler et al. 2020).

Socio-ecological research on the island of Samothraki started with the aim of seeking solutions to the environmental degradation problems and suggesting an alternative to harmful waste disposal practices. The field work and exploratory transdisciplinary approach has been ongoing to seek for sustainable solutions, which can benefit the island while at the same time preserve its natural and cultural richness and preventing that it becomes a mainstream touristic destination.

Currently three quarters of the island are protected under the European NATURA 2000 (Habitat Directive 92/43/EEC) network framework (MAB, 2011). The research goal has evolved into a transdisciplinary research approach where scientists and citizens are collaborating to accomplish the alternative vision of development for the island of Samothraki to becoming a UNESCO Biosphere Reserve (Fischer-Kowalski et al., 2011; Petridis, 2016).

For achieving the ambitious aim several issues must be improved on the island among which the establishment of an efficient solid waste management system. Impermissible management practices such as illegal dumping and open air burning of waste are present on the island of Samothraki being a potential source of pollution for the environment and posing health risk for the community (Noll et al. 2017). Therefore, policy strategies with clearly

defined goals and mode of operation are needed to promote separation of waste at the source, recycling of the different waste flows and composting.
Building awareness about the waste management problematics, the benefits waste separation, and recycling has for the environment by diverting waste reaching the landfills and diminishing the cost of management for the island is a prerequisite for fashioning an efficient solid waste management system in Samothraki. The cost of waste management on the island of Samothraki is one of the highest in Greece because of the shipping cost of waste to the mainland.
The Municipality of Samothraki has written down a management plan in 2015 with the aim of addressing the struggles and deficiencies the current management system experiences. The Institute of Social Ecology (BOKU, Vienna, Austria) in cooperation with the Hellenic Centre for Marine Research (HMCR, Athens, Greece) organize each year a summer school on the Greek Island of Samothraki, in the northern Aegean Sea where several master and PhD students get the possibility to participate. The aim of the yearly event is to conduct island study research and seek solutions to complex sustainability questions. During the summer schools, participatory fieldwork and focus group interviews are carried out with different local stakeholder. The research results are made known to the community to attain maximum synergistic effect between research and local policy goals (Petridis et al., 2013).
In the course of summer school 2016, a group of researchers and students conducted expert interviews and a composition analysis of waste to obtain an understanding of the waste management system on the island and the amounts of waste flows (Noll et al. 2017).
An important discovery was that organic waste share on the recycling bin and mixed waste bins was between 35 to 59% of the municipal waste on the island (Noll et al, 2016). This finding revealed that the local management is not efficient and that there is a strong necessity for the organic waste of the island to be diverted from getting shipped to the mainland. This could benefit the municipality by saving on management costs.
Based on the results of the study on waste issues in summer school 2016, Sustainable Samothraki Association begun the initiative “Composting: Nature’s Way of Recycling”, through which they cooperated with the schools of Kamariotisa, in Lakkoma and a youth crafts centre in Chora where they installed composting facilities. Sustainable Samothraki Association consists of a group of locals that promote the vision of a sustainable island protected under the Biosphere Reserve for Samothraki and operate as a bridge between the socio-ecological research carried out and the local community. The association prepared various activities and educational games where children could learn about how composting works and its importance. During this process, not only children, which were the main target group but also their educators and parents, learned about organic material composting and how it functions (Bergler et al. 2020).
The summer school 2019 took place from the 22nd of June to the 1st of July. Among the different research aims of the summer schools was that one of the student groups would evaluate the project and the progress of the composting initiative towards its goals, with the aim of being able to provide improvement recommendations. Interviews with the children, parents and teachers involved in the composting project were carried out as well as with the project coordinator to gain a broad understanding of how the initiative was received. I was part of the group of masters and PhD students evaluating the composting project in 2019.
The participation in the summer school was my first encounter with the island of Samothraki. The comprehension gained over the challenges the island experiences on the problematic of waste management triggered my interest on the topic and led to my decision of writing my master thesis on this matter.

1.1 Aim of the Master Thesis and the Research Questions

This thesis is an attempt to understand the particular challenges that islands face in terms of solid waste management system, by taking a case study approach. More specifically, the research will focus on the Greek island of Samothraki. An extensive literature review will be used to describe the legal and policy basis of waste management in the European Union. The intention is to be able to elaborate on the technologies Greece applies in the management of waste in the country and the approach it has taken towards the recycling and management goals it must fulfil as a member state of the EU. This is necessary to clarify because the aims and goals set by the EU influence the strategies employed by the islands in Greece as well.
The thesis is structured in two main sections.
The aim of the first section of this thesis is to provide by means of official documents and expert interviews a thorough understanding of the present state of the solid waste management system on the island of Samothraki in Greece. Subsequently, an evaluation of the system efficiency can be made. At the same time, these data will lead to the identification of important problematics, current initiatives and advantages a small island can have in relation to waste management and provide improvement suggestions. A further aim is to discuss the long-term goals set by the Municipality of Samothraki in the municipality plan and bring insights from scientific literature that could be of value and could influence the local authority in reflecting towards the possible implications of those aims to the natural ecosystem of the island.
The second section of the thesis is concerning the case study "Composting: Nature's Way of Recycling" initiated in 2018 by the local Association Sustainable Samothraki. The objective is to elaborate on the importance of organic waste being diverted from landing the waste bins and the benefits this could have for the community, describe the effort of the association to raise awareness in the community about the topic of composting through environmental education and discuss what successes are visible on the community level. More specifically, this section will present an assessment of the progress made by this initiative and to point out the present ideas and necessities that could contribute to its expansion in other areas across the island. Most importantly, this case study provides an insight on what role; children can have as a target group in fostering habit change in a small community.

The information gathered through the interviews with the different stakeholders are analysed from the perspective of household behaviours theoretical foundation and are summarized in the "Action Setting Framework" of Pelikan and Halbmayer to be able to suggest strategy interventions on the person and the situation level.
Ultimately, the aim of this research is to give a scientific contribution for long-term solutions for a sustainable waste management system of the island, which could bring it a step closer to the vision of becoming an UNESCO Biosphere Reserve.

In this thesis, I try to answer the following research questions:

1. What is the present state of the municipal solid waste management system on the island of Samothraki?
2. What are the challenges and shortages of the management system that the island of Samothraki is confronted with?
3. Which are the present initiatives active in improving the opportunity structure?
4. What are the local efforts and challenges of separating organic waste? What did the local bottom-up initiative for household organic waste collection and composting at schools try and what did they achieve?
5. How effective was this initiative in paving the way towards a policy for organic waste collection in households and spreading the idea of composting?
6. Which strategies can be harnessed that can contribute to the improvement of the MSWM and the expansion of the composting initiative on other areas of the island? What are the possible benefits?

2 Introduction to the Greek Island of Samothraki

2.1 Historical and cultural characteristics

The island of Samothraki is situated in the Greek Aegean Archipelago and is characterized by rare natural richness. It is positioned close to the border of Turkey at the Northeastern point of the Aegean Sea (Petridis et al. 2013). It has been inhabited since the Neolithic times based on archeological findings dating back to 6000 BC. The early human presence on the island has created cultural landscapes still visible today, in the accessible lowland areas like traditional settlements, arable farming and the olive groves. The capital town of Chora with its characteristic stone buildings is culturally protected (Petridis 2012). The most recognized remaining of its history is the site of the "Sanctuary of the Great Gods" an important archaeological site of Hellenic or pre- Hellenic time where the "Kaveirian" Mysteries religious ceremonies were performed (Fischer- Kowalski et al. 2020). According to historical evidence, the Mysteria cult of the Great Gods practiced on the island was an important religious attraction open to slaves and free people regardless of gender and nationality, making Samothraki an important spiritual attraction from the 5th century BC until the 400 AD (Samothraki History accessed 13.12.2020). The "Sanctuary of the Great Gods" and the local archeological museum attracts many tourists due to the high cultural interest. Archeological excavations have been taking place in the last two centuries at the Sanctuary and are still ongoing. One of the major findings has been the celebrated works of the Hellenistic art; the statue of Nike, which is displayed at the Louvre since 1884 CE. The remaining of towers and fortification indicate that during the Byzantine and Ottoman times the island has been an important center of maritime trade. In 1821, the population revolted against the Turkish rule and were depopulated. Following the Balkan wars in 1912, the Greek Navy liberated the island, and it became part of the Greek modern state (Fischer- Kowalski et al. 2011, Fischer – Kowalski et al. 2020).

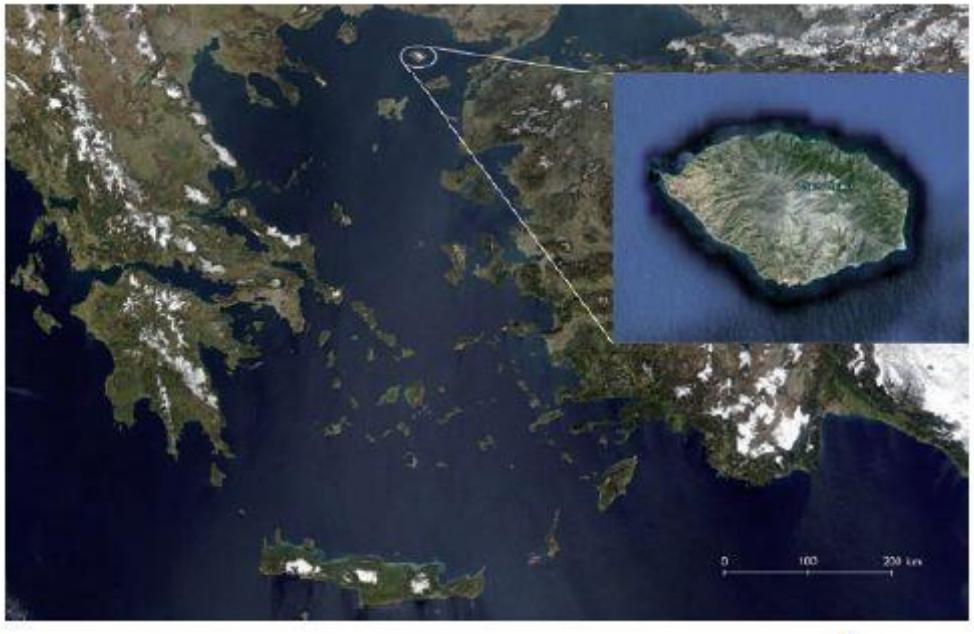

Figure 1: The location of Samothraki in the NE Aegean Sea, Greece © NASA, courtesy of nasaimages.org 2003. In: Petridis 2012.

2.2 Natural Characteristics

The island of Samothraki has a surface of approximately 178 km2 and, a large part of the island is mountainous because of its volcanic origin. The highest mountain is Saos with its peak called Fengari, which in Greek means “the moon” rising to 1611 m high, making it the second highest mountain in the Aegean Sea. The mountainous relieve combined with the distance from the mainland kept large parts of the island inaccessible and undisturbed by humans giving the possibility to various habitats and species to flourish. The fauna and flora in Samothraki are rich and worthy of conservation. Flora is rich with 962 plant species including 62 tree and bush species, many of them are rare and endangered (Alkimos 1988, IUCN TPC 1982, Strid and Tan 1991, Strid and Tan 1998 in MAB 2011). Furthermore, eight plant species are native to Samothraki Island. The fauna of the island is composed of 15 mammal species and 27 reptile and amphibian species endemic to Greece and 156 bird species (Broggi 1988, Buttle 1989, Clark 1991, Cattaneo 2001 in MAB 2011).

Most of the mountainous territory is protected under Natura 2000 conservation area, and in year 2009, a marine protected area was added as well. The protection of the marine area is as important as the protection of the terrestrial habitat. Deep-sea trenches up to 1000m deep are highly important for the conservation of endangered marine mammals like whales and dolphins as well as the Mediterranean monk seal (Monachus monachus) and the Mediterranean Sea turtle (Caretta caretta) which are frequently seen in the waters around Samothraki (Fischer-Kowalski et al. 2011).

Unique characteristic for a Greek island is as well the abundance with fresh water circulating all year round through the numerous streams and rivers past hundreds of waterfalls creating a wet microclimate in the north (MAB 2011, Fischer- Kowalski et al. 2011). A typically Mediterranean climate and vegetation is found in the southern and western part of the island. Agricultural fields where goats and sheep are herding, olive groves and wheat fields, vineyards are characteristic landscapes of the island (Fischer- Kowalski et al. 2011). Due to its norther location, in comparison to other parts in Greece the summers are a little cooler and shorter, with typical temperature from 18 °C to 24°C. Samothraki is known as the “Island of the Winds” because strong winds do occur, and the winters can be harsh with heavy rainfall and snow (Schwaiger 2017). The tectonic stretches have created thermal springs that were known since the time of Antiquity for their health benefits (Petridis et al. 2013).

2.3 Socio- Economic characteristics

The island population was 4200 inhabitants in year 1951 but has experienced a decrease starting from the 1960s. The reason behind this decline is the labor migration period in the 1960s where many left to search for better life and work possibilities in other European countries particularly in Germany (Kolodny 1982 at Fischer- Kowalski et al. 2011). There is even today a vibrant community of Samothrakians in Stuttgart, which frequently visit their relatives and spend their summer holidays on the island. Some people have returned to work in the tourism sector on the island, running restaurants or accommodation businesses (Schwaiger 2017). The current resident population is measured at 2840 inhabitants (2011 census). More than 60 percent of the resident population have received only the primary education and thirteen percent have a university background (EL. STAT 2011).

Until the second half of the 20th century small-scale agriculture was the main source of income for Samothraki, until tourism started to increase and became the major source of income. In 2001, the primary sector accounting for agriculture, animal husbandry and fishing employed 45 percent of the local working force. In contrast to the average in Greece which is 12,5 percent this number is very high (Petridis et al. 2013). Most of the farmers are highly

dependent on the European Common Agricultural Policy (CAP) subsidies most of which are expended on the livestock sector. Due to these subsidies, the number of goats and sheep has increased substantially in the last years and is now posing a threat to the ecological balance on the island. The secondary sector consists of an olive press, a dairy, a beer brewery, a small winery, and several bakeries as well as construction and mining activity, which represent a small fraction of the economic activity. The tertiary sector is increasing substantially employing 60 percent of the workforce on the island. The service sector including tourism is contributing significantly to the economy on the island. Concretely based on estimates from Fischer-Kowalski 2020, tourism generates about 13 million € annually which compromises almost half of the income of Samothraki. This indicates a socioeconomic shift in the last decade from the primary sector being the dominating sector to the tertiary sector gaining considerable importance (Fischer-Kowalski et al. 2020).

2.4 Socio- ecological research interest in Samothraki

In 2007 members of the group, “Sustainable Samothraki” made contact with long time visitors who were scientists with experience in nature conservation and sustainable development. The citizens were concerned about the degradation of nature ecosystems, as a result of overfishing, growing amounts of waste, severe erosion caused by overgrazing by goats and sheep which number has increased drastically due to EU agricultural subsidies and other issues (Fischer-Kowalski et al. 2011). The aim of these concerned citizens was to preserve the natural and cultural richness of the island and fostering an alternative path of development for Samothraki and not a conventional tourist one. This is how the socio- ecological research interest for a sustainable future of Samothraki Island began. Socio- ecological research has emerged as a paradigm, which ameliorates and advances an interdisciplinary communication in sustainability science (Petridis et al. 2017). The Vienna School of Social Ecology decided to view the island on the prism of a complex socio – ecological system to be able to influence the development dynamics. Guiding local sustainable development means to understand the socio-economic structure of the island and see under which conditions it could assure a preservation of the quality and resilience of the ecosystems while supporting the quality of life and income of the population. The social-metabolism model from Haberl et al. (2004) serves as a framework to portray the interaction of society and nature which is thought as a hybrid between the natural sphere (biophysical) and a cultural sphere of causation (Fig1) (Fischer-Kowalski and Weisz, 1999).

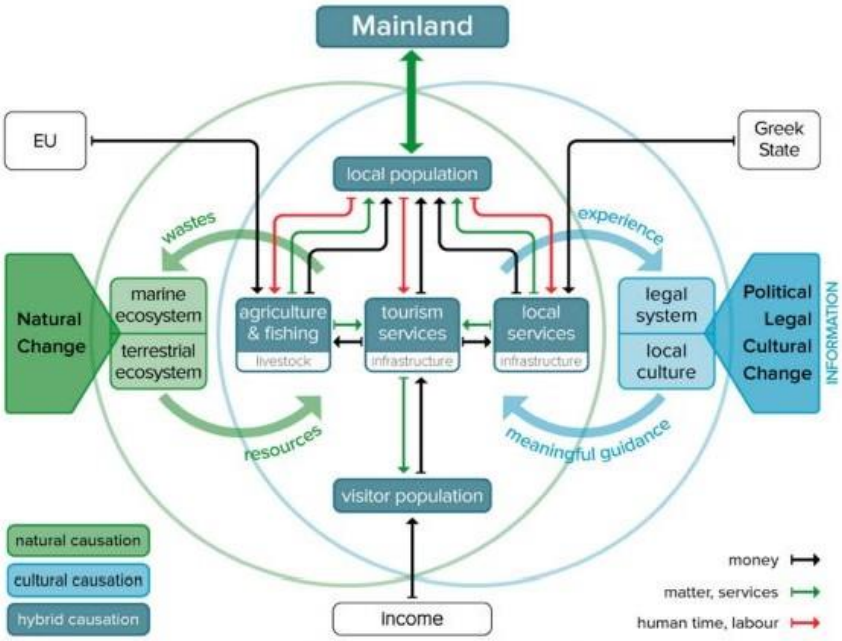

Figure 2: Socio-metabolic system model for the relevant stocks and flows within and between the local society and its natural environment. (Fischer-Kowalski 2020).

Figure 1 shows the socio-metabolic model applied for the island of Samothraki. The core area represents the human population and their involvement in the three socioeconomic sectors of: agriculture and fishing, tourism services and local public services. The sectors draw on certain natural resources and by that waste and emissions are produced. Human labor is necessary to produce and provide economic benefit. Legal and cultural factors influence these factors with the time (Fischer-Kowalski et al. 2020). Even though the island is geographically separated from the mainland politically and economically, it is strongly linked to the Greek state, European Union, and the market forces (Eckelman et al. 2014).

Socio-ecological research on Samothraki has been characterized by continuous transdisciplinary action, research in support to the local initiatives and to the local policy institutions (Petridis et al. 2017). Furthermore, the Vienna School of Social Ecology has been organizing summer schools on the island since 2012 and they are considered as being perhaps the best example of synergistic thinking (Petridis et al. 2017).

The summer schools provide education on socioecological methods and approaches while at the same time generating data, which support the current applied research and encourage the local sustainability initiatives. Most importantly they create the *space* and the *conditions* for transformative learning to take place (Winiwarter, 2016), and promote a transition to more sustainable practices on the island (Petridis et al. 2017). Through their participation, many students decide to write their master thesis or their PhD about island sustainability and furthering this way the ongoing research for a sustainable future on Samothraki Island.

2.5 Natura 2000 status and aspiration to be a UNESCO Biosphere Reserve.

Because of the natural richness of the island ecosystems on Samothraki, more than three thirds of the island surface as well as a marine area are designated Natura 2000 conservation areas. Nevertheless, the process of designation as a Natura 2000 should be officially announced by Presidential Decree, which has not happened yet, so there is a legislation disparity. However, the vision of finding a sustainable pathway of development brought the researchers to the idea of proposing Samothraki to become a Biosphere Reserve. For that, a study was conducted since 2007 to see if the preconditions for a Biosphere Reserve could be fulfilled and if the community and municipality of Samothraki had the same willingness of the preservation of the natural and cultural values of the island (Fischer-Kowalski et al. 2020).

Biosphere Reserves promote solutions, which combine the conservation of biodiversity with its sustainable use. They are learning areas for sustainable development under diverse ecological, social and economic contexts. They are areas where interdisciplinary approaches are applied to understand and manage changes and interactions between social and ecological systems. Biosphere Reserves include terrestrial, marine, and coastal ecosystems. They are nominated by national governments and remain under sovereign jurisdiction of the states where they are located but become internationally recognized by UNESCO. Biosphere reserves form a World Network under the protection of UNESCO. Under this network exchange of experience, know-how and capacity building takes place. Currently there are 714 biosphere reserves in 129 countries, including 21 transboundary sites all over the world (Biosphere Reserves UNESCO, accessed 15.12.2020).

Scientists from the institute of Social Ecology in Vienna together with local stakeholders prepared the application form. The latter was signed by the Mayor and other Greek authorities and got submitted as official application in 2013. Sadly, due to unfulfilled legal and managerial preconditions from the side of the Greek government associated with the core conservation area of Natura 2000, UNESCO suspended the application. This means more time and effort is needed and new local synergies and policy alliances to continue the path for a sustainable future in Samothraki (Fischer-Kowalski et al. 2020).

3 Theoretical Framework and Legal Background on Waste Management

3.1 Importance of municipal solid waste management

One of the biggest challenges, which is accompanying the current system of economic and social development, is the increase of waste amounts that are generated. Society is facing a double challenge in terms of waste which has not only to do with the increase of the weight and volume but also with the composition of waste which has become more complex through plastic packaging and more electronics (Ma and Hipel, 2016). It is because of the increased variety of waste being discarded that has made waste management to have an essential role for the society of the 21st century (UNEP 2015). Waste is a matter, which has a global importance, and it is directly related with the production and consumption patterns of the society. When examined in a longer period of time waste composition of a society can indicate also the cultural and technological trends (Vergara and Tchobanoglous 2012). In the field of waste management, there are different definitions of waste. The European Union definition of waste is *"an object the holder discards intends to discard or is required to discard*".

There are four major reasons why the development of waste management plans is important: public health, environmental protection, resource recovery and climate change (Vergara and Tchobanoglous 2012). Public health is directly impacted by the way waste is managed or mismanaged. When waste is not properly collected and treated but is thrown in open areas it can become a disease carrier and at the same time, it can pollute the environment by contaminating the water, soil, and the air. Hence the consequences of waste management on the public health and the environment are intrinsically connected. In terms of climate change, even though waste management does not contribute significantly to greenhouse gas (GHG) emissions, it has the potential of either being a net source or sink of the gases. Mitigation of GHG from waste can happen indirectly through prevention of waste and recycling. This would consequently reduce the need to use primary resources and energy for collection, transport, and management. It can also happen directly by diverting organic waste from reaching landfills and treating it in ways, which could prove useful for the society like composting (Vergara and Tchobanoglous 2012).

In this master thesis, the issue of municipal solid waste management will be treated with a focus on organic waste as well. For this, it is important to define what is understood with the term municipal waste. The European Parliament under the Landfill Directive defines municipal waste to be waste from households, as well as other waste, which because of its composition is similar to household waste, that could include waste from businesses or public institutions in the municipality (European Parliament 2017; Bačova and Stričík 2018).

The Global Waste Management report (UNEP 2015) estimates the global municipal solid waste (MSW) to be about 2 billion tones every year (Ma and Hipel, 2016).

Municipal solid waste comprises less than 10 per cent of total waste generated in the EU, but it is one of most polluting waste flows with significant necessity for improvements (European Parliament 2017). In the EU-28 in 2015, the quantity of municipal waste generated was 476kg per capita (Bačova and Stričík 2018).

Having this in mind, we realize the importance of a functioning and well-organized solid waste management system. However, waste studies are acknowledging that not the same waste management methods and mechanisms are applicable everywhere. The technologies and policies, which will be employed, if they are to be successful, must take into the account the

environmental, social, cultural, and economic circumstances of the country in consideration (Vergara and Tchobanoglous 2012).

3.2 EU Waste Management Legal Regulations

In the European Union, several legislations and directives have been passed which serve as policy suggestions for the member states of prioritizing the most environmentally friendly ways of treating waste.
United Nations Environmental Program (UNEP) (2015) finds the management of waste to be so important for the society as to consider it as a '*basic human right*'. For a waste management system to be well organized and efficient or be available at all it is crucial that waste regulations are existing, and their implementation and enforcement is ensured by institutional bodies which control that. When regulations are missing the creator of waste is predisposed to choose the most convenient and cheapest way of discarding or treating the waste without taking into consideration the environmental or health consequences of such actions. Examples could be open dumbing or burning of waste (UNEP 2015).

The EU provides legal, institutional, technological guidance and support to the member states so that they fulfill the goals set in the respective directives. On the other hand, if the countries fail to abide to the regulations set, the EU has the right to refer them to the European Union Court of Justice (European Commission, 2015, accessed on the 16.12.20).

The legally binding directives and regulations of the European Union have been key drivers in the improvement of waste management practices, advocating for increase in recycling, prevention of waste when possible, diverting bio-waste from landfills and creating awareness among consumers (European Commission online, accessed on the 7.01.21). The table below shows some of the most significant EU directives and regulations about waste management and the ones, which are included in the circular economy package (European Parliament 2017). For this master thesis, three of the directives are the most relevant and will be discussed: the Waste Framework Directive, the Landfill Directive and the Circular Economy package.

Table 1: Main influencing EU-directives and regulations relating to waste management and the circular economy. In: European Parliament 2017.

	Waste prevention	Municipal waste	Packaging waste	Food waste	Bio-waste and residues	Critical raw materials
Waste Framework Directive 2008/98/EC	X	X	X	X	X	X
Landfill Directive 99/31/EC		X	X	X	X	X
Packaging and Packaging Waste Directive 94/62/EC	X		X			
The Waste Electrical and Electronic Equipment (WEEE) 2012/19/EU						X
Batteries and accumulators and waste batteries and accumulators Directive 2006/66/EC						X

3.2.1 Waste Directive

The current Waste Framework Directive (Directive 2008/98/EC) of the European Parliament is the result of repealing previous Waste Directive (2006/12/EC), Hazardous Waste Directive (91/689/EEC) and the Waste Oils Directive (75/439/EEC). The main purpose was to be updated to the current waste situation and available technology and to include concrete actions to be taken to manage all kinds of waste. This directive acts as a general framework of waste management requirements, sets the legal basis for waste treatment and the waste management definitions in the EU. The Directive has introduced two key principles for waste management the "polluter pays principle" and the "waste hierarchy" (European Commission, accessed on the 7.01.21). The European Union objective is for waste to be treated without posing risk to water, air, soil, plants, or animals, without causing irritation through noise or smells and by not affecting places of special environmental value and interest. It is important to ensure that human health and the environment is not endangered from a lack of waste management or bad waste management practices.
Therefore, the European Union member states shall adjust their waste management strategy according to the waste hierarchy. Preventing waste production and reusing are the most desired measures, followed by recycling, which includes also composting, energy recovery - meaning producing energy through incinerations and lastly waste disposal in landfills. Landfilling is considered as the least preferred option because of the environmental risks that it poses (production of greenhouse gases, soil, water, and air pollution) and because of the significant material getting lost which otherwise could have been recycled or managed. (European Commission online, accessed on the 10.01.21). The Waste Framework Directive of the European Union is crucial because it has put forward a new way of dealing with waste where the emphasis is on waste prevention and considering the whole life cycle of the products and not only the waste phase (Bačova and Stričík 2018).

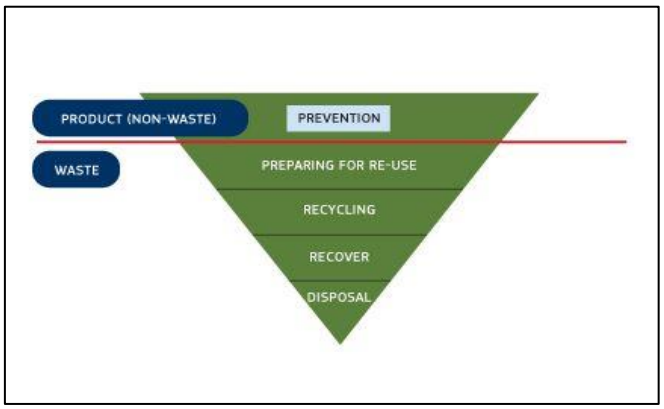

Figure 3:Waste management hierarchy. In: European Commission online.

3.2.2 Landfill Directive

Municipal waste because of its diverse composition has been difficult to treat and therefore it has mainly been landfilled. For instance, approximately one third of the municipal waste was sent to landfill in the EU in 2012 (European Parliament 2017). Landfilling is the most common way of treating waste in the world (Vergara and Tchobanoglous 2012). Contrarily to that, as stated in the waste hierarchy, landfilling is the least preferred way of treating waste because of its impacts on the environment. For this reason, the Landfill Directive is an important legislation in the EU in relation to municipal waste because it requires from the member states to divert the biodegradable municipal waste and waste which can get recycled

from being landfilled. By diverting biodegradable waste from landfills, it avoids or reduces methane gas production or leakage, which is harming for the environment.

Landfills must comply with the uncompromising requirements of the Directive 1999/31/EC on the landfill of waste. The aim of this directive is to prevent or reduce as far as possible negative effects on the environment or on human health. *The Landfill Directive defines the different categories of waste (municipal waste, hazardous waste, non-hazardous waste and inert waste) and applies to all landfills, defined as waste disposal sites for the deposit of waste onto or into land* (European Commission, accessed on the 10.01.21).

The European Union has amended Article V of the Directive on the landfilling of waste for including three ambitious targets, which apply for all the Member States.

1. *By 2035 the amount of municipal waste landfilled should be reduced to 10% or less of the total amount of municipal waste generated (by weight).*
2. *By 2030, waste that is suitable for recycling or other material or energy recovery should not be landfilled.*
3. *Separately collected waste should not be accepted in landfills.*

*(*European Environment Agency, Accessed on the 20.01.21)

3.2.3 Circular Economy Package

To deal with the issue of waste as stated also in the UNEP report it is necessary to reduce the amounts of waste but at the same time shift the perspective and consider waste as a potential resource. For this, it is needed to treat this matter not from a linear perspective, but from a circular economy perspective (UNEP 2015). At the moment, the world economy is a linear one, where resources get extracted, products get produced, distribution, consumption and in the end disposal of waste takes place (Ellen Macarthur Foundation online, accessed on the 22.01.21). Nevertheless, this economic model can only function in the long term if there are limitless resources available in order to sustain the system constantly. The reality is that the global demand is rising while the availability of non-renewable resources is finite. Hence, a shift to a circular economy is necessary for going in the direction of a sustainable future (European Parliament 2017).

European Union legislations and directives, some of which were mentioned above, aim to encourage a shift to a more sustainable future where waste is seen as a resource. In the framework of the Circular Economy Package, the products should be produced already with the purpose of having a long life and ensuring the possibility of being reused or repaired so that waste disposal can be kept to a necessary minimum. Although all these policies and guidelines are to be followed by the member states still effective waste management strategies depend on several local conditions including the culture, the climate, the socioeconomic situation, and institutional capacity in a country (Vergara and Tchobanoglous 2012).
The fundamental principle of a circular economy is to keep the resources and their value in the economy for as long as possible. Two are the central challenges for the future: reducing the amounts of waste generated and to couple the waste management objectives with those of the circular economy (European Parliament 2017).

The waste directive, landfill directive, the waste hierarchy concept and all other relevant directives about waste are incorporated in the circular economy package and aspiring targets for the EU member states have been formulated as follows:

1. Reducing landfilling of municipal waste to 10% by 2035. (as mentioned above in the landfill directive).
2. To be able to re-use and recycle up to 65% of the municipal waste by 2030.
3. To be able to re-use and recycle 75% of packaging waste by 2030. (European Environment Agency, accessed on the 20.01.21).

These targets show clearly that the European Union is designing and initiating another way of dealing with waste using them as resources and has set ambitious binding goals for its member states.

3.3 National Waste Management Plans in Greece

Greece is a peninsular and mountainous country located in Southern Europe with a population of 10.7 million (Eurostat 2019 online, accessed on the 14.12.20). The geographical surface of Greece is divided in 13 regions, nine of them are situated in the mainland and four in the islands (Katsanos et al. 2010). Waste management in Greece has been lacking organization and is acknowledged to be the most serious environmental issue where much action is needed (OECD 2020). Until the end of the previous century waste management meant that waste was disposed mainly in semi-controlled landfills. While landfills continue to be one of the main technologies applied much has also improved in terms of policy, legislation, organization, and environmental goals set (Bakas and Milios 2013).

3.3.1 Legislation and managing authorities.

The legal framework for waste management in Greece is correlated to the waste management strategies, policies, and directives of the European Union. The most important EU directives such as the Waste Framework Directive, Landfill Directive, and Packaging Directive has all been transposed to Greek Laws in the last decade. The Waste Framework Directive (2008/98/EC) is transposed into the Law 4042/2012 in Greece (EIB 2010). One of the main aims of the EU Landfill Directive is the diversion of biodegradable municipal waste from landfills, an aim that is very relevant and urgent for Greece to achieve since it is landfilling most of its waste. The landfill tax has also been instituted in Greece in the Law 4042/2012 and applies to any organization or business, which disposes specific categories of waste untreated into landfill with the aim to advance the efforts of diverting waste from landfills (Farley and Williams 2015). Landfilling is related to high levels of direct emissions and emits methane for years after the waste is deposited. The European Laws have shown to have a positive effect in triggering initiatives in Greece in an effort to uncouple dependency on landfills. For example, the Packaging Waste Directive is transposed in the Law 2939/2001 in Greece and one of the direct results of it was the establishment of the Hellenic Recovery Recycling Corporation (HERRCO) in the end of 2001. HERRCO started operating in 2003, and has amplified the performance of recycling and material recovery rate in Greece (Bakas and Milios 2013).

The main decision-making institutions in terms of the waste management in Greece are the Ministries of Environment, Ministry of Finance and Ministry of Interior as well as the Waste Management Authorities (WMA). The Ministry of Environment is accountable for policy making, national planning, technical matters as well as licensing and regulating the financing of large waste treatment and disposal facilities. The Ministry of Interior is responsible for organizing and monitoring of the WMA, while the ministry of Finance for funding the necessary infrastructure (Katsanos et al. 2010).
Following the National Solid Waste Management Plan (NSWMP), the municipalities are in charge of waste collection, the operation of transfer stations, the processing and disposal of

waste is administered by the WMA. Waste streams, which are not part of the MSW, the responsibility of management is not of the municipalities but of the producers as stated in the 'polluter pays principle' introduced in 2003. There is no separated bio-waste collection scheme in place in Greece.

3.3.2 Waste management profile of the country

In fact, in line with the National Waste Management Planning (NWMP) (2003) it is reported that 4,6 million tonnes of waste are produced annually, from which 39% is produced in the region of Attica (Athens) (Katsanos et al. 2010). There has been observed an increase in the amount of waste generated from 416 kg per capita in 2001 to 512 kg per capita in 2017, above the Europe average. It is worthy to contend that tourism could be also a factor contributing to this increase (OECD 2020). In 2017, 80% of the municipal waste generated was landfilled, this is nearly twice the European average, making Greece one of the countries with the highest level of landfilling rates in Europe. Concerning the waste profile of the country, MSW consists mainly of organic (44%), paper (28%), plastic (13%), glass and metals around (3%) each and the last (9%) is made up of different materials like wood, rubber, and leather (Katsanos et al. 2010).

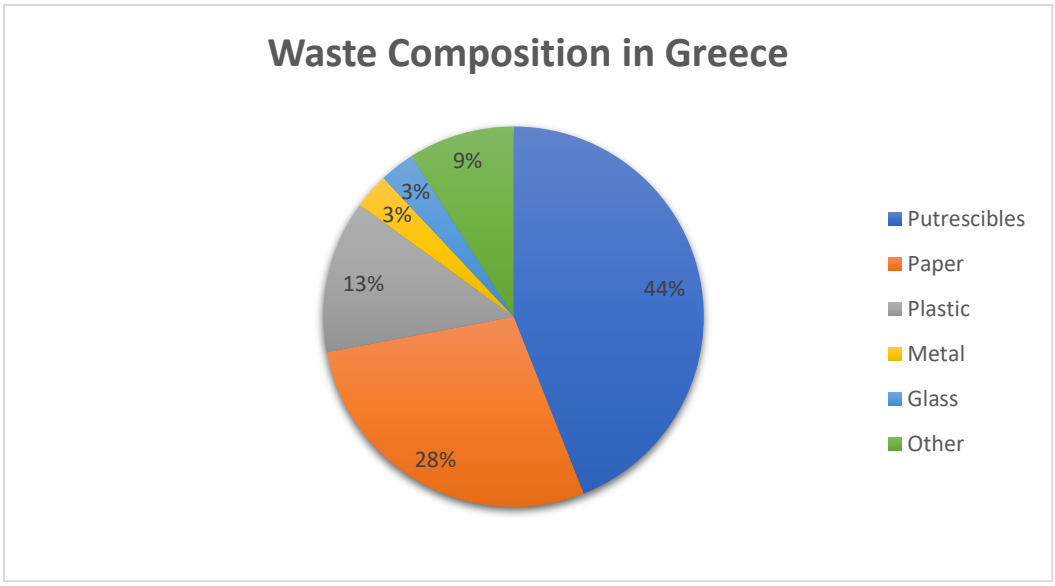

Figure 4: Waste Composition in Greece (2010). In: Katsanos et al. 2010.

The construction of the first two mechanical biological treatment (MBT) facilities between 2004 and 2006 had an effect in the recycling rates in the country (Bakas and Milios 2013). The MBT facility in Athens is the biggest MBT plant in Europe with an annual capacity of 450 000 tonnes. It treats mixed municipal waste, produces Refuse Derived Fuel (RDF) and compost from bio waste. The second MBT facility is in Chania, in the island of Crete and has an annual treatment capacity of 70 000 tonnes. There are two other MBT plants which started functioning in 2010, one in Heraklio (island of Crete) and in Kefalonia (one of the Ionian islands), six additional MBT plants were planned to start functioning in 2014 and two incineration plants are on planning phase designated for the island of Rhodes and Thiva (EIB 2010). The recycling rate in 2007 was about 14 %. Besides the recycling rate for batteries, the recycling rates for all other waste streams are below the EU average (Katsanos et al. 2010).
For the collection of waste, the bins being used have the capacity from 80 to 1700 litters and the transport is implemented by the municipalities using mainly press and mill type vehicles. Recycling bins for packaging waste are the blue ones and are provided throughout all of

Greece by HERRCO. After being collected by the municipalities, the waste is transported to material recovery facilities (MRF). It is estimated that the total amount of packaging materials produced is 1 Mio tonnes/year, while 20% of the total waste amount encompasses packaging waste (Katsanos et al. 2010). Other than HERRCO, other recycling systems have been established as well. Furthermore, since 2009 municipalities have the possibility of receiving additional financial support for the collection of recyclables depending on the amount collected per inhabitant (Katsanos et al. 2010).

3.3.3 Main challenges of waste management

Municipal solid waste management is still one of the most problematic fields in Greece for several reasons. Among those reasons, the most challenging is the large number of unlawful landfills which continue to be present in the Greek countryside in breach of the EU Waste Framework Directive, for which Greece was brought to the European Court of Justice in 2005. The court ruled that by 2008 all illegal dumping sites should be closed and rehabilitated (Bakas and Milios 2013). In 2011, still 109 illegal dumbing sites were operating in Greece. In 2014 Greece was fined by the European Commission with the sum of 10 million EUR and an additional fine every six months if the remaining 70 illegal landfills are not closed and restored properly (Farley and Williams 2015). Between 2014 and 2019 Greece paid 85 million EUR of fines for non-compliance with the EU legislation on waste (OECD 2020).

"While in many member states the main goal is to reduce waste generation and to increase recycling and recovery rates, in Greece the main problem that needs to be solved remains the uncontrolled disposal in illegal landfills in order to avoid penalties imposed by the EU" (Katsanos et al. 2010).

The main problem with landfills is the methane emissions, which is released in the atmosphere but also in the soil and sometimes ends up causing the pollution of the underground water. When the landfills are uncontrolled the environmental risk is even higher and public health is in jeopardy. Thus, the benefits of a better MSW management by closing and rehabilitating the illegal landfills would contribute to lowering GHG emissions.
Secondly, another major challenge of the MSW management in Greece is biological waste. As mentioned, Greece is one of the countries with the highest landfilling rates which means high amounts of biological waste gets landfilled as well. Even though Greece has fulfilled its commitment to the European Union to establish a National Planning for Biodegradables and the separate collection of organics is promoted by the regional waste management planning this is not at all reflected in terms of actions implemented, not even at a pilot scale (Katsanos et al. 2010). Instead, actions which encourage at home composting and at source separation are not valued as especially important by the WMA even in rural or semi urban regions.
Thirdly, the sanitation fee in Greece is set according to the m2 of the building therefore, it does not offer any economic incentive to the citizens for waste prevention and separation (Katsanos et al. 2010).

3.3.4 European Union targets and the future plans of Greece

As stated by the OECD Greece risks missing both the Landfill Directive target and NWMP target of reducing 40% of the municipal biodegradable waste disposal and the target of the Waste Framework directive of reuse and recycling of 50% of the municipal waste by 2020. Poor performance owns to lack of infrastructure for source separation of recyclable, biowaste mismanagement, low public awareness, and lack of economic stimulus (OECD, 2020).

However, it is important to mention that besides the huge challenges which Greece still needs to face for a better waste management strategy, significant steps have been made in terms of policies, organization of MWA, initiatives like the one on the recycling scheme and management of waste. In 2018, Greece has also approved a National Circular Economy Strategy with an action plan extended till 2023. One of the main goals stated there is the efforts to further implement the waste hierarchy showing that the willingness and ambitions for catching up with the targets set by the European Union (OECD 2020).

3.4 Island related waste challenges

Explaining the significance of solid waste management and the legislative basis in the EU as well as Greece was essential in creating an idea about the existing requirements of the EU and the present conditions in Greece. This helps in better understanding the distinct challenges that islands face with waste management. This master thesis will explain the waste management challenges on the island of Samothraki in Greece, as such, existing scientific literature on island studies clearly point out to the most prominent challenges and help us understand why they occur.

Research from Eckelman et al. (2014) on "Island Waste Management Systems" provides an insightful literature review on the common barriers that islands face due to their physical characteristics. Obstacles such as the high cost of treatment or shipping to mainland could also be a trigger for island governments or municipalities to seek dealing with their waste in ways that are more sustainable and innovative than the usual treatment methods. As a definition, islands share with each other the characteristic of being separated from other landmasses but at the same time, they differ because of their socioeconomic and physical qualities. There are islands, which are very small and are inhabited by only a few thousand people and other islands, which are of a considerable geographical size, home to millions of people serve as important economic centers.

*"Frequently, islands are viewed as microcosmic in that they display the dynamics of competition for scarce resources and, increasingly, the pressures and impacts of humans on the environment. Yet, islands are distinct in their role as small systems affected by global-scale forces . . . when comparatively closed, fragile island environments are coupled with open, global economic systems." (*Eckelman et al. 2014*).*

Therefore, many of the challenges islands face in relation to waste management emerge from the fact that they can import all goods from the global market but have to deal locally with the generated waste in a limited land surface. Another factor of significance for islands with tourism is that in the high season waste produced can be many times more than the other months of the year. The composition of waste changes as well according to the consumption preference of the tourists. This can cause an overload for the waste management system and challenge its capacity (Gidarakos et al. 2006).

The main barriers that islands have to face, identified by the research of Eckelman et al. are: (1) limited space, (2) high operational costs, (3) vulnerability to extreme weather events, (4) lack of capital and financing options, (5) insignificant market sizes, and (6) changing in methods relating to product reuse, and recycling. These barriers will be put in the context of Samothraki Island, to guide the situation analysis of this research.

3.5 Municipality Waste Management Plan 2015

The Municipality of Samothraki is motivated to tackle the issue of waste management, because they recognize that in the long term, they must abide to the aims set by the European Union. In addition to that, a better management would save the municipality money, which they could potentially invest elsewhere. Hence, the Municipality of Samothraki has written down a Management Plan in 2015 where they set the major priorities for a better management of municipal waste.

The major challenges the Municipality recognizes as priority are:

1. to reduce the amount of organic waste in the waste containers
2. to increase the materials which can be recycled
3. to control illegal dumping sites.

In the municipality plans, there are several concrete proposals stated. One proposal is the construction of a small-scale solid waste treatment unit. This involves the process of mechanical separation and composting of organic material. A good organic waste management, which is of high percentage on the island of Samothraki, would significantly decrease the amount of waste, which needs to be shipped, and consequently the costs as well. Furthermore, it is an opportunity of raising the awareness for sustainable waste management practices.

According to Eckelman et al., the high costs of waste treatment for islands are very often connected to the need of waste to be shipped to the mainland. In the long-term the high costs are a key driver for looking for alternative practices and specially to seek for local waste reuse and recycling solutions. From the literature review, there are several cases where treatment of organic waste on the island is recommended to being very beneficial for many reasons. From Foolmaun et al. (2011) we know that in the case of Mauritius a proposal was made on creating several large-scale composting plants with the primary motivation of producing organic fertilizer themselves and consequently interrupt the dependency on imported chemical fertilizer. This would have a double benefit. Firstly, fostering a composting and recycling attitude (which is in accordance with a circular economy and the philosophy of closing the loop) and on the other hand it would even save money on importing fertilizer. In the case of Oahu, Hawaii there is already a composting system in place, which treats a high quantity of the organic waste. This kind of treatment of organic waste has been a common practice in the islands and long before the chemical fertilizers were available (Morrison and Monro 1999; Eckelman et al. 2014). The results from the research in the island of Corfu from Skordilis (2004) acknowledge that the best solution for small communities is the combination of material recovery at the source and the utilization of organic waste. Even though the population in Corfu is much bigger and it is receiving more tourists every year, this conclusion may be relevant for the case of Samothraki as well.
Additional plans foreseen for Samothraki are the construction of a landfill and the construction of three green spots one in Chora, in Therma and one in Lakkoma. Waste separation is a priority issue that is brought up in local as well as National Plans (Tsompanoglou 2017).

3.6 Household waste behavior and attitude and its role on the success of waste management practices

As mentioned above MSW is an important matter which needs to be dealt with in the most environmentally friendly ways and for that appropriate policies, technologies and social rules must be in place (De Feo and De Gisi 2010). The European Union has recognized the importance and consequently has set goals in terms of recycling and selective collection system for the biowaste. Several countries have incorporated this new approach in their MSW management system but for it to be successful, people must change their habits on how they deal with waste in their households (Bernad-Beltrán et al. 2014). The policy and technical development part of MSW management has already gained much attention but the social dimension has been underestimated. Therefore, it is crucial to recognize that the citizen's attitude and behavior plays a key role in recycling, reusing, and reduction of the resources used. Research on the social, economic, and psychological constituents is paramount as a means to understand, the main factors that can influence people to develop more environmentally friendly attitudes, with the way they deal with waste (Ma and Hipel 2016).

Babaei et al. 2015 defines knowledge, attitude and behaviour and explains the interconnectedness between them as stated below; *"Knowledge is a familiarity, awareness or understanding of a community, such as facts, information, descriptions, or skills towards the topic of interest, which is acquired through experience or education by perceiving, discovering, or learning. Attitude is a settled way of thinking or feeling about something and refers to the community thoughts which may have tended to it. Practice, on the other hand, is an action based on the community knowledge and attitudes. Knowledge and attitude are two factors determining behavior of society and the people in it*" (Babaei et al. 2015).

A study from Barr and Gilg seeks to provide solutions to the environmental problem of waste by using theoretical conceptualizations of behavior which get observed on the basis of integrating social, situational and cognitive processes. An important conclusion of the study is that local knowledge of the waste services is more important than awareness initiatives. Concretely formulated that means that what is important for people is to clearly know what to recycle, where and when (Barr and Gilg 2005). De Feo and De Gisi (2010), also regards public knowledge to have a vital role. Otherwise, the lack of it becomes an information barrier, which hinders the change in practices and the incorporation of new management options (Read, 1999a, Ma and Hipel 2016). Additionally, the managing institutions should provide the opportunities for the citizens to be able to sort their waste as well as inform on the practicalities of time and the place (Refsgaard and Magnussen 2009). It has also been observed that regardless of the education one has on environmental implication of waste, if the infrastructure is provided and the convenience is given, so if a recycling bin is easily reachable, even people who usually would not recycle would much probably do it (Babaei et al. 2015). This clearly indicates that a better opportunity structure of waste management could also motivate people who are not practicing recycling and composting to start doing so.
Knowledge of the importance of these factors is of interest for the objective of improvement of the MSW management on Samothraki Island.

4 Methodology of my local case study

4.1 Data collection

For the purpose of this master thesis a qualitative case study research design was developed. The research topic is separated in two main sections: the evaluation of the SWMS of the island of Samothraki and examining the impact of the composting initiative in spreading awareness about management of organic waste and triggering a shift of habits in the community. The data was collected through an extensive literature review and by carrying out semi-structured and expert interviews.

The literature review serves as the introduction in the field of municipal solid waste management and explaining the reasons why this issue has gained substantial significance. The literature review includes a wide range of publications among which policy documents, journal articles, books, university publications, and information from internet websites. For attaining most of these publications the electronic search engine of the library of the University of Vienna was used *(u:search)*.

The definition of Denzin and Lincoln (2005) describes the attributes of qualitative research effectively: *"Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretative, material practices that make the world visible. These practices transform the world […] At this level, qualitative research involves an interpretative, naturalistic approach to the world. This means that qualitative researchers study things in their natural setting, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them."*

Besides its interpretive character, qualitative research is also of an iterative nature (Bergler et al. 2020) This means that "[…] *the researcher may need to reconsider or modify any design decision during the study in response to new developments or to changes in some other aspect of the design*" (Maxwell 2018). This is the reason why qualitative research was appropriate because it allows the flexibility which the work with the people on the island required and the need to make adjustments on the way.

The case- study approach was selected for the advantages it has in evaluating the composting project in primary schools initiated by the Association Sustainable Samothraki. According to Yin 2003, case studies make it possible for researchers to understand complex social phenomena by attaining holistic and meaningful insight in a real-life context (Kohlbacher 2006). The definition of a case study by Berg is: "[…] *method involving systematically gathering enough information about a particular person, setting, event or group to permit the researcher to effectively understand how the subject operates or functions*" (Berg 2007). In this case, information was gathered from all the possible stakeholders involved to understand what for an impact the project had on the people, children, and community at large.

4.1.1 Expert Interviews

Apart from secondary data collected from the literature review, the primary source of data has been the semi-structured interviews realized in the frame of the summer school on the island and the two expert interviews.

The expert interviews were essential in answering the research questions especially because of an additional perspective and the updated information provided on the current waste management situation in the island. "*According to Meuser and Nagel (1991), the expert status is to a certain degree awarded by the researcher and is limited to the specific research question"* (Tekalec 2020). In this case, both interviewees have specific information, in one case

because of the education and profession and the second one because of the important role in the project.
The two expert interviews conducted by me for the thesis were made in English. The interview with an expert working for the municipality of Samothraki was accomplished in December 2020. The content of the interview with the expert will lead to replying to the central question about the infrastructure and the effectiveness of the waste management system on the island. It will unveil the existing problems, which need to get tackled, the objectives set by the municipality and the state of the existing initiatives.
The interviews that have been made in the summer school about the case study will then shift the focus on the organic waste topic, which is a central issue for Greece and islands in particular. It will elaborate on the initiative, its aims, the stakeholders, challenges, and successes. The second expert interview that was realized in January 2021 with the coordinator of the composting project, presents the current state of the initiative and the progress made since summer school 2019.
The requests for the expert interviews were sent by e-mail and were in both cases done by Skype. The permission for the interview to be recorded was taken already in the beginning of the conversation and the confirmation was given. In the beginning the background of the interviewer was made known and the aim of the interview and research purpose was made clear.The interviews are conducted in the form of a guideline-based interview, where a questionnaire is already prepared in advance, but the order of the questions can be freely adapted during the interview. Moreover, ad-hoc questions can be posed during the interview when unanticipated information emerges which is also relevant and brings new insights for the research questions (Hussy et al 2013). The interviews were recorded and then transcribed.

4.2 Data Analysis

4.2.1 Interview data analysis

The semi-structured interviews of the case study and semi-structured expert interviews will be evaluated based on Mayring's qualitative content analysis approach. This method of qualitative content analysis was developed in the 1980s and as maintained by it practically any kind of recorded document can be the content for analyses (Mayring 2014).
A careful description of the data and the development of categories has proven to be essential in the process of data analysis. In this case, the object of analysis is in the form of interviews which have been recorded and transcribed. The text cannot be interpreted as a whole, but as part of the analyzing method, it has to be split into segments. Furthermore, the interpretation of the segment and deciding which segments are important depends on the interpretation method chosen. In this master thesis the interviews are interpreted by the summarizing interpretation form. Through this form, the interview material is analyzed and reduced to the extent that the essential content remains and provides an overarching overview which answers the research questions (Mayring 2014).
The approach of content analytical summary fits best for this study and can be used for the development of inductive categories from the material (Kohlbacher 2006). Inductive category formation is when the summarizing categories are attained directly from the information gathered by the interviews and not from theoretical considerations (Mayring 2014). The replies of the interviews will be coded (Mayring 2014) in different categories with the aim to reply to the research questions addressed in this master thesis.

4.2.2 Action setting analysis approach from Pelikan and Halbmayer

The system theoretical approach developed by Pelican and Halbmayer (1999), was developed with the aim of using the action model to identify strategic changes and interventions which can be health promoting in organizations. "*People always reproduce themselves as people by behaving within specific natural and social environments and acting in relation to them. Action of a person must be understood from the interaction of personal and situational characteristics"* (Pelikan and Halbmayer 1999).

The core idea of this action method is based on Lewin's Field Theory famous definition that "*behavior is the result of the individual and the environment"*. By that is recognized the difference between the individual characteristics (person) and the situational context (surrounding or situation). Second reference point is the theory of James Coleman of collective action from where the authors draw the difference between possibility structures that enable /allow certain handling options from preference structures that determine the selection of certain options from all possible (Pelikan and Halbmayer 1999).

Table 2: Explanation scheme for behavior and actions of people in a situation (Pelikan and Halbmayer 1999).

Behaviour/Actions of a person depend on	**Possibility Structure**	**Relevance/Selection Culture**
Person	Personal knowledge and abilities (Could do)	Personal aims and preferences (Want to do)
Situation	Situational Infrastructure and possibilities (What is possible)	Situational values and norms *(Should do)

*with corresponding positive incentives or negative sanctions.

The analytical framework of "Action Setting" is designed in a way, which makes it possible to gain an overview of complex structures with the goal of being able to recognize the best intervention strategy that is possible and relevant in the context examined and could help in improving the given situation. This action model will be exploited in this master thesis, to identify strategic sustainable interventions to improve the opportunity structure of the waste management system on the island of Samothraki, and provide an overview of the changes which the people can make, and the ones they would be willing to make on a person level, the changes which should take place on the situation and context level for the improvements to take place (see Chapter 7).

The aim is to be able to contribute to the local community by reflecting the possible improvements for the case study that is focused on organic waste. Furthermore, the purpose is to also reflect on a system level, what changes the local government could employ, by indicating sustainable interventions for the municipal waste management. The development of this table is intends to portray the possible interventions which are in line with the objectives set by the Municipality of Samothraki.

5 Waste management on Samothraki, municipal infrastructure and its challenges. Findings from documents and an expert interview.

5.1 Data sources and methods

For the purpose of gathering the necessary data of the SWMS on the island I performed one interview with an expert working in the municipality. I was able to get the contact of the expert thanks to Panos Petridis which is a Greek researcher part of the Institute of Social Ecology in Vienna and who is actively involved on Samothraki Island. I sent an e-mail and the expert responded positively to the request of a skype interview.
The experts' responsibilities are mostly being in charge of administering municipal policies. She has an education background in Environmental studies and has a contract from the Region of Eastern Macedonia and Thrace with the Municipality where she is in charge of two projects. One of the projects has been the planning of the sewage treatment of the livestock slaughter place and establishing a contract with a company to manage the waste (more information about this project in section 5.6.). The interview was conducted in English and besides the worthy information about the state of the art of the waste management system she provided also relevant official documents from the Municipality of Samothraki relating to the waste issue. The fact that I speak and understand Greek was very useful in being able to screen the most relevant parts on the documents for this thesis and translate them to English.

5.2 The infrastructure of waste management on Samothraki Island

The rising amounts and complexity of the waste composition have led to the administration methods and plans being regional. Moreover, the technologies and policies have advanced to manage waste in such a manner that the environmental and social impacts are minimized. Still, through the studies on waste it has become clear that there is no universal policy or technological strategy model, which can apply to any place. The effectivity of a management system depends on several local factors such as, socioeconomic, cultural, environmental, and institutional capacity (Vergara and Tchobanoglous 2012). Ideally, the above factors mentioned are taken into consideration when deciding on the best methods to apply on managing the waste of a place.
The six functional elements constituting waste management that describe the path waste takes from creation to disposal are waste generation, waste handling at the source, collection, transport, processing and transformation, and disposal (Vergara and Tchobanoglous 2012). The functionality of these elements influences the quality and quantity of the recovered resources and is what defines an effective collection system.

5.2.1 Current waste itinerary of Samothraki Island

The Municipality of Samothraki comprises all the villages of the island and is part of the region of Eastern Macedonia and Thrace (Greece Terrabook online, accessed on the 5.03.21). In Samothraki currently the situation of waste management is as described below. The municipal solid waste does not get treated on Samothraki Island. The waste after being collected is transferred to the Waste Transfer Station of Samothraki (ΣΜΑ Σαμοθράκησ). After that it gets transferred by ferry to Alexandrupoli. The collected recycling waste from the blue bins (for aluminum, metals, paper, glass and plastics) ends up at the Recycling Sorting Plant in Alexandroupoli (ΚΔΑΥ Αλεξανδρούπολησ) while the residual waste in a landfill in Komotini (Tsompanoglou 2017).

5.2.2 Frequency of waste collection

In the municipality plan from 2015, the frequency of waste collection per week in each of the villages is specified. Of interest in the table is the increase in the frequency of waste collection in the summer season because it indicates the burden the waste management structure experiences in those months. In some villages noted in the table, the waste collection takes place only in the summer season because it is connected with the tourist activity.

Table 2: Frequency of waste collection. In: Waste Management Plan of the Municipality of Samothraki 2015.

A/α	From	To	Frequency	
			Winter Season 1/10-30/4	Summer Season 1/5-30/9
1	WMA*	Kamariotissa	3 times/week	6 times/week
2	WMA	Chora	3 times/week	5 times/week
3	WMA	Alonia- Military	2 times/week	3 times/week
4	WMA	Xiropotamos Makrylies	2 times/week	3 times/week
5	WMA	Lakkoma Dafnes	2 times/week	3 times/week
6	WMA	Profiti Ilia	2 times/week	3 times/week
7	WMA	Ano Meria (Fonias-Kipos)*	1 times/week	2 times/week
8	WMA	Paliapoli - Karyotes - Therma	2 times/week	6 times/week

**WMA- Waste Management Authority*
**Collection only in the summer season*

5.2.3 Stakeholders, workers, and transportation

Two main stakeholders are in charge of the municipal solid waste management on Samothraki Island: the municipality and a private company. The collection of recycling and the collection of mixed waste is done separately. The municipality must provide the bins for both recycling and for the mixed waste. The transportation of all waste from the island to the mainland is completely overseen by the municipality. Regarding recycling waste, the municipality does the collection and transportation, and for the mixed waste only the transportation from the island to Alexandroupoli and Komotini.

There are trucks that collect the waste from the villages and others separately for transportation to the mainland. The municipality of Samothraki as per requirement of the Ministry of Environment and Energy has performed an evaluation of the current waste management structure and identified what is lacking. One of the elements considered were the number of additional trucks needed for waste collection. The conclusion is that two more trucks would be needed for the mixed waste, two additional for recycling waste and one for

the biological waste. Important to note here is that presently there is no system of separation for biological waste, therefore also no truck at all available for its collection.
Collection of recycling waste is the duty of the municipality. For the collection of recycling waste, the municipality has two trucks, one of which is for the collection and the second for the transportation to the mainland because it has a container. The private company oversees the collection of mixed waste on the island and for that it has own employees and own vehicles. For the mixed waste, the private company has three trucks with which the collection is made. For the transportation of mixed waste by ferry, there are two trucks available.
The municipality employs two drivers and four workers for the waste collection and transport of recycling waste. The private company has three employees, which conduct the waste collection of mixed waste. As declared by the municipality there would need to be employed four more people for the waste collection and two more workers as drivers. This means that in total there is a shortage of six people in the work force dealing with the waste collection and transportation.
The Municipality of Samothraki has considerable staff shortages because it does not have enough permanent employees and tries to manage with seasonally available staff. This coordination is not successful mainly because there are gaps between the employments of the seasonal workers and often their number is not enough, and because it is required, a transitional period where the seasonal staff needs to be properly trained and informed about the work duties and how it is performed (Municipality of Samothraki 2015).

Table 3: Estimation of the needed employees for the solid waste management collection. In: Municipality of Samothraki 2020.

Staff specialization	**Needed**	**Present situation**	**New staff requirements**
Collection workers	**8**	**4**	**4**
Drivers	**4**	**2**	**2**

The transportation of waste from the island is made by ferry and the frequency depends on the season. In the winter months and the months without tourism, the waste gets transported once a week by ferry. During summer because of the increase in waste flow, the transport of waste by ferry is organized twice a week. The added transportation fares translate to additional management costs.

5.2.4 Waste Bins

There are two kind of waste bins on the island, the green bins that are for the mixed waste, and the blue ones for the recycling waste.
For the recycling waste there are currently about 86 waste bins available spread out throughout the island and as the expert communicated, they are estimated to be insufficient. Regarding the green bins for the mixed waste there are 60 bins available. The blue recycling waste bins are free of charge in Greece. The system functions like this: for the blue bins, if during the year some of them break, the national system is informed, and new ones are ordered. Delays can happen but in general, it is not an issue of concern for the municipality since this is part of an established state program.
In relation to the location and accessibility of the bins, this is not regarded as a big concern. If there are problems, they are minor. One of the most essential issues of the waste management structure on the island is the lack of green bins for the mixed waste. This is a

major drawback for the opportunity structure. Because of that, there are villages, which use the blue bins for the mixed waste, thus damaging the recycling procedure. That is the reason, why the municipality does not have a high percentage of waste for recycling, but mostly mixed waste for the disposal of which the municipality has to pay - therefore the cost of waste management remains high.

The expert comments that: *"The problem with the green bins is that the municipality must buy these bins and they don't. Because they use the money elsewhere. It is not that they do not have enough money to order the bins, but they do not give the money for this purpose."* This fact communicates that this municipal solid waste management is not seen as a priority by the municipality.

The expert provided an official document from the municipality, which states that providing a good opportunity structure there would need to be 90 more green waste bins, and 64 blue bins more for it to be fully equipped. For organic waste, there currently is no separate management infrastructure at all. The result of an estimation made by the Municipality on request of the Ministry of Environment and Energy was that if the bio waste would be also collected 810 brown waste bins would need to be placed throughout the island.

This neglect of management of the organic wastes may have to do with the fact that Samothraki has been, until recently (see chapter 2) an exclusively agricultural community. Organic household wastes were fed to hens and pigs, and the rest was dumped somewhere to rot. Careful composting of organic waste was not common on the island. The only organic waste that received special treatment was the wool from sheep-shearing, and animal corpses: they were buried in the ground. Nowadays, people hardly keep hens and pigs anymore, and the newly founded farmers association tries to store the wool from sheep for possibly further use (Fischer-Kowalski, verbal introduction at the summer school 2019).

Furthermore, besides the above-mentioned lacking in human resources and waste bins, the municipality recognizes a deficiency in the existing collection and transport equipment. It has a very outdated fleet of vehicles that needs to travel daily long distances and difficult routes in between the settlements of the Municipality.

Table 4: Equipment requirements for the solid waste management structure on Samothraki Island. In: Municipality of Samothraki 2020.

Equipment type	*Necessary equipment*	*Existing*	*Requirements for new equipment*
Mixed waste bins (green)	**150**	**60**	**90**
Recycling bins (blue) *Note (i)*	**150**	**86**	**64**
Bio-waste bins (brown) *Note (ii)*	**810**	**0**	**810**
Garbage trucks for green bin collection *Note (iii)*	**3**	**1**	**2**
Garbage trucks for blue bin collection	**3**	**1**	**2**
Garbage trucks for brown bin collection *Note (ii)*	**1**	**0**	**1**

(i): Of the 86 blue bins, 42 are damaged, there is a relevant request of the Municipality to EEAA for replacement on 30.10.2019.
(ii): A program contract is in planning between the Municipality and DIAAMATH
(iii): Existing contract of the Municipality with a contractor for the collection of recycling waste.

Upon which assumptions these estimates are based is not very clear: Does this only apply to household wastes? In Europe, typically household wastes contain about 50% organic wastes (Compost Network online, accessed on the 03.06.2021). Thus 810 bins for organic wastes compared to 300 bins for the rest seems a little out of proportion. If it applies to all wastes, including sheep wool and organic wastes from livestock, it would not suffice – apart from the fact that one better does not place these wastes into municipal bins.

Beyond, there is the issue of bulky wastes: worn-out washing machines and furniture, wrecked cars, car tyres etc. All of this is probably not included in the above management plan (see section 5.2.6).
When asked in terms of the quality of the bins, the expert explains that the quality used is the same for all Greece. Regarding the blue bins, which are for recycling the Greek government is buying a high amount for the whole country. The blue bins are given for free and so they are bought massively from one or two big companies, for this reason they have a common quality for all Greece. The municipality can buy the green bins, so they choose on the quality and decide according to the price that they are willing to pay. The topic of the bad quality particularly of the green bins is a matter that has been discussed but it is considered a detail in comparison to the real infrastructural and equipment needs for a proper waste management infrastructure. As Samothraki is an island where storms and strong winds are frequent, a necessary step would be to build protection structures where the waste bins can be put inside.

Relating to the labels on the waste bins, to make people understand which one is for recycling (and what to put into it) and which for the mixed waste, the expert conveys that the bins are properly labelled, and that the fact that the people do not use them accordingly has to do with the mentality and their inherited habits. Although the role of habits and mentality of the community are important factors that the research experience and interviews during the summer schools confirm, an adequate labelling of the bins is strongly lacking. Figure 5, shows how the blue recycling bins ideally would look like throughout the island, but in reality, there are hardly any bins labeled. And tourists, for example, who are as many as the whole population of the island in the summer season, have no idea of what the colours mean, and mostly, there are no written labels on them at all, let alone in another language but Greek!

Figure 5: Graphic of the waste bin for recycling waste. The illustration shows what goes in the blue bins: paper packaging, glass packaging, tin and aluminum packaging, plastic packaging (source: HERRCO.gr).

The expert argues: "*I think that the main problem with recycling is the lack of the green bins and that it is not a priority for the people who are on the municipality board, but it should be. That is very bad, because in most of the municipalities of the region of East Macedonia and Thrace they have started to be more serious about waste management matters because they know that if they reduce the mixed garbage and increase the recycling, they will reduce the cost. That must be a priority for the municipality board. First these people have to understand that and after that they can tell it to the people here.*"

5.2.5 Recycling

Reducing the cost of waste management depends on the amount of waste, which gets recycled. In average for the region of East Macedonia and Thrace, the best municipality with recycling is Alexandroupoli.

The expert clarifies: *"You have to understand there is a system for recycling 'the law 2939'. There is a system where big companies like Coca Cola are part of, who are producing waste that can be recycled at the municipalities of Greece. If we buy a Coca Cola or a yogurt for*

instance, we pay an amount in the price that goes for recycling. All the big producers of waste must be in this system. They pay money which is taken from the consumer."

The Law 2939/2001 on packaging waste mentioned by the expert has been also mentioned in the theoretical framework (chapter 3). It is an important law because; it is the transposed Packaging Waste Directive of the European Union, and has established in Greece the Hellenic Recovery Recycling Corporation (HERRCO). This corporation is responsible for recycling all packaging waste in Greece since 2003 and is in the same time the scheme where all the big companies are part of and pay money to (Bakas and Milios 2013). With that money, HERRCO makes it possible to provide recycling equipment to the municipalities such as the blue bins.
Thus, the consumer pays indirectly through the tax of the product about recycling. The taxes are given for the recycling in Greece and through that the municipalities gets provided for free the blue recycling bins and some of the equipment, but still there are struggles also in this regard. For example, the island of Samothraki has blue bins where all recyclable waste should be disposed. Although, to ensure a separate disposal for each recyclable category (like glass, paper, metal), additional bins with other colors should also get provided.

The expert was asked, if by Greek law all recycling material should be disposed in different bins and not all of it together, she explains that: "*Yes, but the system that I was talking about they have to do that for free. We should have equipment for recycling everything differently. For example, I have asked for recycling glass, and we cannot do that because of the transportation cost. That's illegal but they do that, they say that we can't do the recycling of glass separately because it is the cost of transportation. That is generally the main problem of the waste management on an island: the cost of transportation."*

The recycling depends on the price of the market as well, there needs to be certain amount for it to be worthy to make the transportation from Samothraki feasible. For example, in Thassos, glass recycling is done because it is a bigger island, it has a larger population and there is a lot of tourism there. Samothraki is the second smaller municipality at the periphery, has a small population, and in comparison to Thassos Island fewer tourists.
High shipping costs and small material quantities are two well-known factors in island waste studies to be an economic barrier for recycling businesses to operate on islands. The transportation cost makes the recycling material from islands relatively expensive to the international market, as the expert also communicated in the interview (Eckelman et al. 2014). Bai and Sutanto (2002) report the example from Singapore where several recycling schemes have failed or experienced considerable economic difficulties due to the volatile waste markets (Eckelman et al. 2014).
The expert reveals that the absence of adequate infrastructure, organization and good management practices for waste is the reason why there has been fires in some places in Greece. For instance, in Aspropyrgos it has been claimed that the fires happened accidentally, but it is believed that the lack of possibility to manage the wastes is the reason behind the fires.

5.2.6 Illegal dumping

In less industrialized countries the practice of open dumping is a common practice and landfilling is to this time the most pervasive waste technology in the world (Vergara and Tchobanoglous 2012). On the island of Samothraki, there has been research since 2016 by Noll et al. seeking to identify illegal waste disposal sites and the scale of the problem. Lack of law enforcement for illegal dumping and a low awareness among the locals aggravate the situation. Gidarakos et al. (2006) reports that illegal dumping is a problem, which concerns the

island of Creta we well. This suggests that reasons why illegal dumping occurs cannot be seen as case specific but is a broader systemic issue (Noll et al. 2019). Only then, it is possible to understand the drivers and tackle the matter and to suggest lasting solutions.

Figure 6: Illegal dumping of waste. Construction waste and electronic waste visible. From field research of Noll et al. 2015.

The expert interview conducted for this master thesis in 2020 confirms that illegal dumping of waste is a common phenomenon on the island of Samothraki. She believes that the municipality would have to show more motivation and provide some solutions to stop this practice from taking place. This information indicates that there has been no improvement on this concern since 2017 when Noll et al. wrote about the problematic of illegal dumping on the island. Some of the waste flows, which end up illegally dumped throughout the island, could be organized, to be recycled from private sector companies (Expert Interview).

A major part of the management problem is the waste derived from construction. The Greek law states that everyone who is doing construction work has to pay for the waste management. That means if a citizen builds a house or rebuilds a house, he will have to pay for the management of the waste - not the municipality. In all of Greece, the same rule is valid, but the citizens on the island (and probably also elsewhere) nevertheless dispose of these wastes illegally, because they would have to pay for the collection of the wastes and the transportation by ferry. The construction waste of Samothraki as a rule needs to get transported to Alexandropuli because of the lack in treatment methods on the island.
The expert elaborates on the illegal dumping of waste: "*Of course, the cost of the transportation is high - but the inhabitants which are making a construction could talk to each other to share a container for the waste and this way divide the cost. They do not care therefore they dispose it everywhere. If the municipality finds illegally dumped waste flows, laying in a place, which belongs to it, it is responsible to manage it. If they find for example waste from construction or you may find oil which is dangerous, they must find the company to dispose it.*"

Research from Noll et al. (2019), discloses that tourism, EU-funding, labor migration and the construction of the new port in the year 1960 are factors which have directly influenced in the expansion of the built environment on the island. The construction and demolition waste (CDW) amounts experienced a 15-fold annual increase from 175 t/cap to 350 t/cap in the time frame from 1971 to 2016. With a 14% recycling rate of CDW, Samothraki and Greece as a country are far away from the goal set in the European Waste Framework Directive and the Circular Economy Package of 2018 that member states must reach a recycling rate of 70% in

CDW until 2020 (Noll et al. 2019). To reach the goals set by the EU directives, Samothraki must focus on using the locally available resources such as wool for insulation and lower the import of environmentally problematic materials (Fischer-Kowalski et al. 2020).
As mentioned above, electronic waste and construction waste comprise a considerable amount of the waste being illegally disposed. In addition to these flows, big beds and furniture are also frequently illegally disposed of. Livestock waste like for instance sheep wool can be found dumped in rivers throughout the island.
Two main hotspots where the inhabitants dispose waste illegally is in Makrilies somewhere near the beach and in Rodofilies, but also in small rivers.

5.2.7 Conflict of interest

There are some companies that are registered at the Ministry of Environment and deal with recycling and management of electronic waste. When the municipality would have a contract with them, the company would be responsible for the transportation costs and, depending on the amount of waste getting collected; the municipality could even get money from that. Given the fact that refrigerators are being randomly dumped on rivers, when the municipality would provide a container in some selected place on the island and inform the citizens that this is designated for these bulky wastes, this would be a practical solution with not much effort which would help tackle illegal dumping.

The expert argues that: "*A part of the problem is that in the municipality they are indifferent, or they have other motives to separate some flows. I have given to the board a contract with a company, which could collect refrigerators, and computers and we could give them for free. If there would be a big quantity, we would receive money, but they didn't do it. Because there are two guys here on the island and one is in the board who does it illegally - so they don't want to do that, that's why.*"

5.3 Cost of waste removal and management

The waste management tax on Samothraki Island is a bit more than the average tax in Greece because of the cost of the transportation by ferry. The cost of management of waste is included in the municipality taxes.
In the municipality plan from 2015, a cost estimate for waste management is presented (see Table 6).

Table 5: Cost categorization and estimation of the waste management infrastructure for a year. In: Municipality of Samothraki Plan 2015

Expense category	Cost analysis	Cost in euros per year
Workforce	Permanent: (1700*12*5) = 102.000 Seasonal: (1500*18months) = 27.000	129.000 Euro
Equipment maintenance	For garbage trucks (without changing tires)	18.000 Euro
Collection and transport	Oils and lubricants Annual contributions to DIAAMATH Transfer to landfill (ship tickets) Other expenses (driver travel costs) Total:	*44.000 Euro* *31.000 Euro* *26.874 Euro* *1.542 Euro* 103.416 Euro
Landfill usage tax		14.400 Euro
Landfill waste disposal tax	Tax of landfill disposal in Landfill of Komotini	30.000 Euro
Total cost:		**294.816 Euro**

As portrayed in the table, the annual cost of waste management for the municipality of Samothraki reaches the value of 294.816 Euros.

5.4 Waste Flows

There are statistics available for the total waste amounts and the recycling waste for the years 2015 until 2019, from the municipality of Samothraki. The quantity varies between 1.060 tonnes to 1.231 tonnes.

Table 6: Solid waste amounts from 2015- 2019 for the municipality of Samothraki.

Year	Total waste amount (tn)	Recycling (tn)
2015	1.088,360	136,700
2016	1051,710	117,130
2017	1203,150	77,840
2018	1230,370	80,450
2019	1060,550	110,980

Source: Municipality of Samothraki (Electronic Waste Register).

Through the graphic representation, it is possible to see that in the years 2017 and 2018 there has been an increase in the total waste flows but a decrease on the amount of waste recycled. This increase in waste generation, as the expert also communicated, usually indicates an increase in visitor numbers. In 2019, there is a decrease on the total waste amount close to the amount of 2017. From the table it is unclear whether the recycling amounts are included in the total annual waste amounts. Based on the more specific data available for year 2018

(see table 8), my assumption is that the recycling wastes are also included in the yearly total calculations

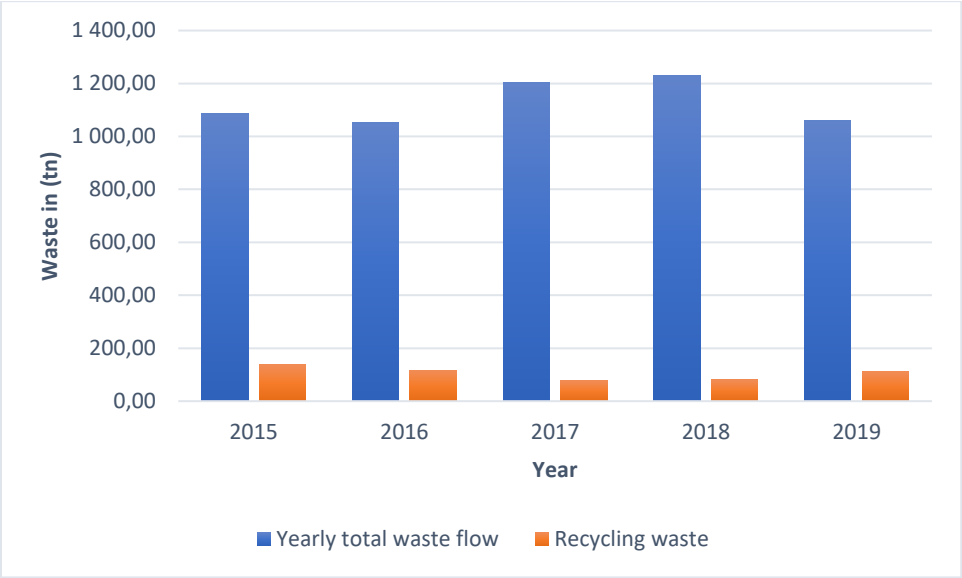

Figure 7: Representation of yearly waste flows and recycling waste from 2015-2019. Own representation.

My more detailed analysis focuses on the year 2018, because there are also monthly data available. This provides the possibility to register the seasonal changes in the flows of waste and their composition. Waste generation about doubles in the summer months in comparison to the winter months. Eight months are attached to the winter season and four months to the summer season. In table 8 is visible that the highest amount of waste corresponds to the high touristic season from mid-July to end of August (Fischer-Kowalski et al. 2020).

Table 7: Estimation of waste production in tons and their seasonal variability for the year 2018. Source: Municipality of Samothraki. Own translation from Greek to English.

Estimate of annual total municipal waste production	**1230,37**
Estimate of annual bio-waste production	**430,63**
Estimate of annual production of recyclables	**80,45**
Number of winter months	**8**
Number of summer months	**4**
Total waste production per winter month	**84,92**
Total waste production per summer month	**157,85**

Identifying the composition of waste requires time monitoring and sampling of waste. Besides the composition analysis study accomplished by Noll et al. in 2016, there is no existing study for the Municipality of Samothraki. In the Municipality plan, they take as a reference the numbers, which correspond to the average of the region of Eastern Macedonia and Thrace.

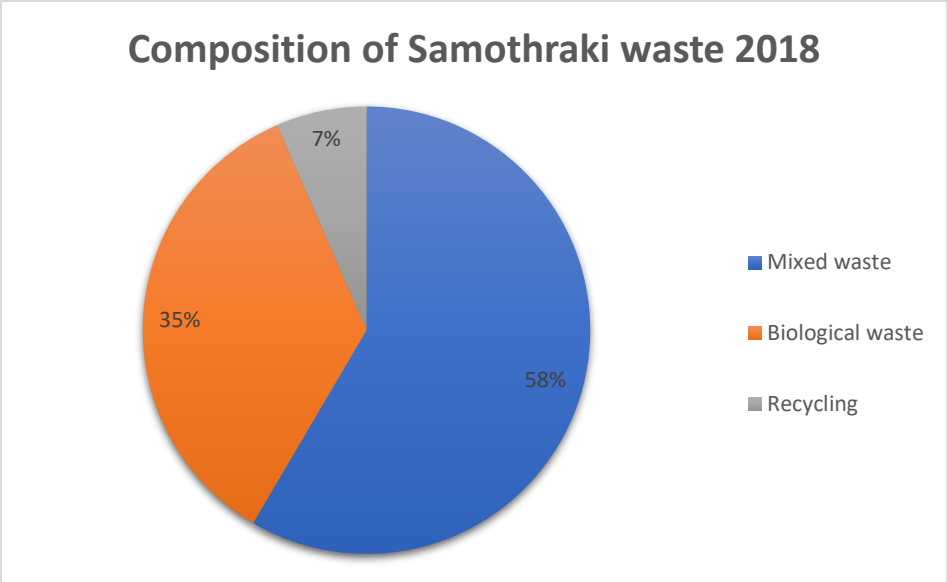

Figure 8: Data from year 2018 from official documents of the municipality of Samothraki. Data from Table 8 visualized.

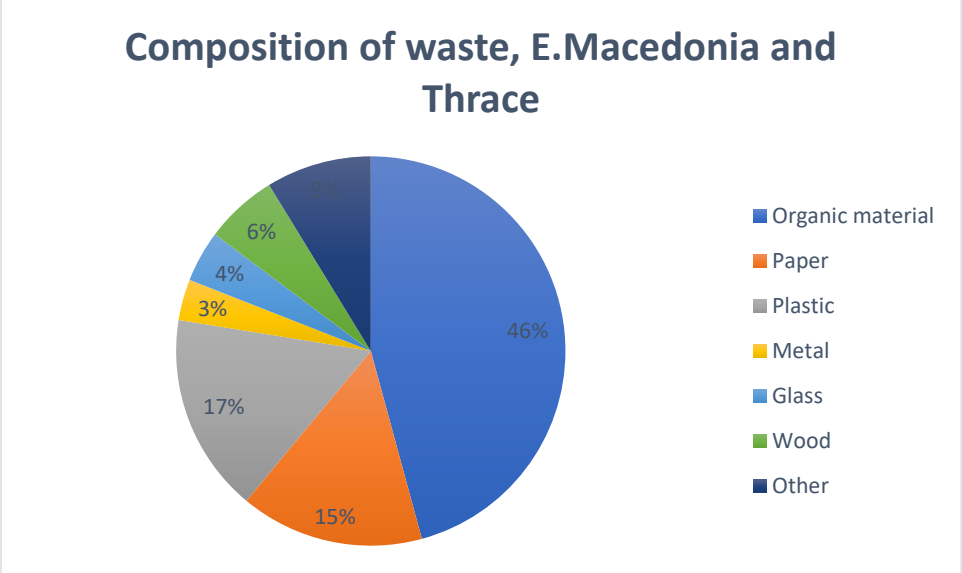

Figure 9: Average composition of waste for the region of Eastern Macedonia and Thrace. (Municipality Plan 2015)

As it is apparent from this comparison, Samothraki has a much larger share of “mixed waste” and “biological waste” (whatever this exactly means, see arguments above), and a much smaller lump amount of recycling wastes which cannot be disaggregated into components for lack of waste composition studies. The results of the only waste composition study realized for the island of Samothraki from Noll et al. (2016) is graphically portrayed in Figure 12 (see chapter 6).

Waste composition studies are important for several reasons; starting from the need to estimate material recovery potential, identify the sources of waste generation, and to estimate the physical, thermal, and chemical properties of waste. Waste composition studies facilitate for an effective waste management and help in keeping track of the waste data in order to comply with national or European law requirements (Gidarakos et al. 2006). They can be a crucial parameter in the development of adequate waste management strategies (Mohee

et al. 2015). It would be of use for the waste management structure of the municipality of Samothraki conducting a study to gather precise data on the composition of waste.

5.4.1 Organic waste and seasonal variations

Greece has a higher organic waste fraction than other countries in Europe because it has a higher share of agriculture and tourism. A considerably impactful factor for the municipal solid waste management structure are the seasonal variations of waste. During the summer months besides the permanent residents of the island 2800, an additional 3000 secondary homeowners visit the island. Furthermore, approximately 1,800 people visit their families on the island and 2000 seasonal workers. Moreover, the island receives about 22,000 tourists per season. This means that in the summer season with a peak of visitors from mid-July to mid-August the island has to sustain almost 7000 people daily (the number includes the 2800 permanent residents) (Fischer- Kowalski et al. 2020). These figures cast light on the increase in the waste flows and the overburden the management system experiences in the summer season.

Major difficulty with the organic waste flow specifically is the complications emerging in the transportation. The "more concerning issue" is that these wastes emit very strong bad odours from the containers on the ferry, troubling other passengers. Repeatedly, the ferry owners refused to take these containers on board in the tourist season (Fischer-Kowalski, 2021 oral recollection).

The expert interviewed explains that in the following way: "[..] *for example the waste which derives from the taverns and the restaurants. The taverns either throw the organic waste to the waste bin or they give it to the animals. When they don't throw it to the animals and throw it to the waste bins, they do not separate the waste. When they clean the table, they take the table paper and they put everything on it, the cans of the drinks, the glass (if it is not beer which is retainable), the bottles, the remaining food, everything and they put it in the garbage".*

Figure 10: Statistics on the monthly waste generation in year 2018 portray the seasonal fluctuation due to tourism. Own representation. Source of data: *Municipality of Samothraki.*

Another source of organic waste is the fishing business. The seasonal ups and downs are not known precisely, but in the summer months there is more fishing and consequently more waste landing in the waste bins. Often businesses have a three-month license for fishing and the waste produced is included in the waste management plan of the municipality. Nevertheless, this additional flow of organic waste that ends up in the mixed waste exacerbates the situation. The higher cost of management for the municipality is caused by the mixed waste, thus every reduction and recycling effort is beneficial.

5.5 Municipality's Plans

Island waste management authorities and experts are confronted with limited land resources, large seasonal fluctuations in waste volumes, and complex social and political dynamics that originate from their closely-knit societies. These factors can hinder the employment of regular waste management practices, but they can also trigger island governments and businesses to explore alternative technologies and strategies that are more suitable for their specific context and that might be environmentally preferable (Eckelman et al. 2014).
The Municipality of Samothraki has identified key improvements, which would like to accomplish on the island. Among them is developing actions that are in accordance with the waste hierarchy of the European Union and promote public participation. Furthermore, it states the objective of applying separate collection of the four waste streams paper, glass, metal, and plastic and introduce a system with brown bins for the collection of organic matter at the source. The major plans and the strategies appointed are discussed below.

5.5.1 Waste management authorities and the solid waste management strategies for Samothraki

The regional authorities make the major regional waste management plans. These plans also define the plans for the municipalities in that region. The regional board decides the regional plan and concretely the company responsible for its execution in the region of East Macedonia Thrace is DIAAMATH (Regional Association of Solid Waste Management Agencies of Eastern Macedonia and Thrace). The plan for Samothraki includes:

1. Construction of one small scale Solid Waste Treatment Unit

The mixed solid waste from the villages after being collected is to be transferred to this unit where mechanical separation will take place and composting of organic waste. The plan anticipates that in the case, the treatment is not successful, they will proceed only with composting of biowaste. The composting is planned to be realized with the in-vessel method (Tsompanoglou 2017).

2. Landfill for the disposal of non-recyclable material

The municipal plan mentions the construction of a landfill on the island, which will serve for the disposal of non-recyclable waste. In case its construction is delayed, the waste will be transported to the new landfill of Alexandroupoli.

3. Green Spots

A green spot is a designated place where citizens can bring recyclable materials, such as bulky stuff (e.g furniture, electrical waste, and electronic equipment), special waste (like batteries, paints, medicine, etc.), green waste and any other waste, which the municipality sees as possible to recycle or reuse. Green spots are a practice which is applied internationally also in many European countries and aspires to recycle special streams of materials. The success of green spots depends on a good organization from the municipality but also on the citizen participation.

Through the operation of the green spots, waste is diverted from the landfills having an environmental benefit as well as an economic one by saving transportation and disposal costs for the municipality of Samothraki. The green spots must be placed in carefully chosen areas, which are easily accessible to all citizens. Moreover, there is a minimum density standard to be fulfilled, they must be safe as a storage facility and be properly equipped. However, the municipality of Samothraki emphasizes that for the management and operation of the green spots to be accomplished new employees must be recruited. The Municipality of Samothraki, owing to the long distance between the villages, plans the creation of three green spots: one in the area of Chora, one in Therma and one in the area of Lakkoma. The anticipated location of the green spots is presented in the map below.

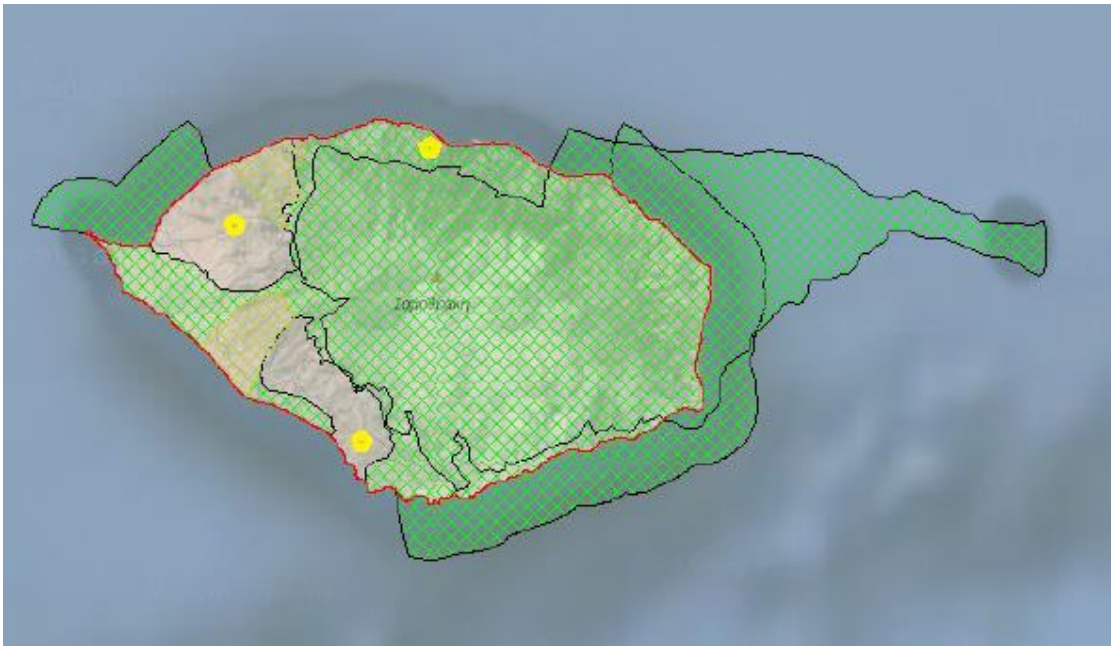

Figure 11: Green points of the Municipality of Samothrace: designated to be placed one green spot in the west of Chora, a green spot in the north of the island and a green spot in the south of the island, as displayed in the map above. In the Municipality Plan of Samothraki 2015.

Each green spot must also include office space where the staff can work. Ideally, in each of the green spots an employee must be who is responsible to monitor the process, record the incoming and outgoing waste quantities, a machinery operator, and a guard.

4. Small scale Recycling Sorting Plant

The option of a small recycling sorting plant has been proposed to be constructed close to the area of the Solid Waste Treatment Unit (Tsompanoglou 2017).

The Mayor of Samothraki has the idea of constructing the Landfill, one Green spot and the composting site at an area between Chora and Kamariotisa, near the helicopter airport (Tsompanoglou 2017). In the expert interview, regarding the Municipality plans for the waste management it was explicitly discussed only in relation to the “green spots” and the “landfill” proposals. The expert declares to be in favor of the green spots but not of the landfill.

Green spots and the Landfill

For the green spots, there are funds from the European Union for it to get accomplished. Some guides and leaflets were made with information about the green spots already few years ago. A green spot is a place of storage. The general idea of choosing the green spots is to have something small and flexible, which does not require much money and effort for the construction (Expert Interview). The ambition is for the municipality to understand how to operate them, how many workers they need, and the next step would be to expand. The required effort is logistic for ensuring a best functioning outcome of the green spots. The flows, which aim to be recycled, must be concentrated and for that, contracts with the businesses which can deal with the disposal must be established.

"I agree to have a small green spot on the island and nothing else actually. I disagree with the landfill because the operational cost is big, and the constructional cost is big. The question is: how can the municipality operate the landfill afterwards? They will not have money; they will not have workers. So, they will have money for constructing the landfill, but they will not have money later. If you have a good plan and people who can work there, if you have a population that can recycle, if everything is perfect than its ok to have a landfill. But in the case of Samothraki the best thing is to recycle and to use the cost of management and give all waste to transport. You can find cases in Greece where islands have landfills, and they cannot operate them so it's like an illegal disposal place after that because they don't operate well."

Concerning the organic waste management: "*I think the organic waste management is easier to manage on Samothraki because there are not so many people and, in this way, easier than in a big town. DIAAMATH is making plans for the biowaste management. They will have big factories. Now the first part is to take the equipment the bins and the trucks. In Samothraki we will have the bins for the bio waste and the trucks for the transportation."*

According to the expert, a preliminary study required by DIAAMATH has been made about the cost estimation of the organic waste management in Samothraki. This has included the equipment needed, trucks and the insurance, waste bins, salaries of the workers and the fuel. Moreover, in the municipality plan the places of interest for positioning the brown bins and the places, which serve as awareness points have been identified.

5.5.2 Landfill discussions

From the nature conservation perspective, the establishment of a landfill is disputable for Samothraki. Research from Noll et al. 2017 consider the establishment of a landfill on Samothraki Island unsuitable.

"Due to Samothraki's mountainous morphology (most of it included in the EU Natura 2000 network), the numerous water streams and the plethora of archaeological sites, it is not possible to establish a landfill site on the island that would comply with national environmental and cultural regulations and would also have sufficient distance from settlements" (Noll et al. 2017).

Currently, the regional plans have already decided that a landfill is to be constructed in Samothraki and apparently, there has been found a place for it. That said, the latest developments of the Greek Law in relation to the Natura 2000 areas in Greece seem not to be very positive. A new bill passed by the Ministry of Environment aims to merge the current 36 management agencies into 24 that will be overseen by a new central structure of the ministry called the Organization for the Environment and Climate Change (OFFEKKA). This newly founded organisation will develop policy, coordinate its implementation, and manage funds

for the protected areas, which will derive from state budget, EU funds, and mild commercial activity (Ekathimerini, accessed on the 20.02.21). Under the new law, the Natura 2000 areas are to be divided in four zones with descending level of protection, from the core to the periphery. In accordance with the new law, mining activity will not be allowed in the core areas of the Natura 2000. Greek environmental organisations have criticized the ministry of green- lighting mining activities in all other zones of Natura 2000 areas besides their core zone and thus diminishing the protection level of Natura 2000 areas. This law is considered to be adverse for nature protection.

The landfill, if operated correctly, must not necessarily pose threat to the natural and aquatic ecosystems on Samothraki Island. Nevertheless, if the Natura 2000 status of protected areas in Greece would enjoy proper legal protection from the government it would secure that the local managing authorities would put the necessary effort of protecting it.

In addition to this, based on several waste management studies on islands, it has been observed that on islands landfills tend to lack engineering structures for leachate or methane collection, liner systems or simple daily capping. Moreover, landfills on islands are usually located in flat coastal areas where exposure to severe weather events such as strong winds and storms is high, which can sequel the waste to get dispersed along the coast and even land on the coastal water causing immeasurable pollution (Eckelman et al. 2014). A concrete example, which reinforces the doubts regarding the quality of landfill management in Greece, comes from the island of Corfu where most of the landfills where the MSW gets disposed are not in accordance with the legal sanitary landfill regulations (Skordilis 2004).

The above-mentioned factors legitimate the need for an open discussion with multiple stakeholders of whether a landfill on Samothraki Island, is an optimal solution to MSW management. Therefore, the responsible authorities should make a thorough evaluation of the advantages and disadvantages of such a management plan before putting it in place.

5.6 Initiatives and the current status

Some waste flows can be separated, and managed by establishing contracts with private sector companies. This way the municipality has a solution for these flows and does not need to finance its management and the private sector companies profit by the reuse of this resources. In Samothraki, there are some ongoing initiatives. If each single initiative is considered as an island of sustainability (IOS) (Wallner 1997) in a landscape of unsustainability, when many initiatives emerge and eventually are connected there is a certain chance for the whole landscape to become sustainable (Deschenes and Chertow 2004).

a. Mattresses waste management

An initiative that has been managed to get organized, is dealing with old used mattresses. The municipality has contracted a company in Komotini, which can manage the mattresses. A place is designated, where the mattresses are gathered. The municipality does not have to pay for the transportation by ferry, they give the mattresses for free to this company and they recycle them.

b. Livestock waste management

An important problem for the municipality of Samothraki is waste from slaughtering. To tackle it, they have set up a contract with a company for managing the slaughtering waste. The expert herself has made the plan for the sewage treatment of the slaughtering waste. The inhabitants must pay a fee for bringing the livestock for slaughter to the place designated by the municipality. The municipality pays a company to take the waste. A transportation

company and a managing company is contracted for accomplishing this process. The waste company is registered to the Ministry of the Environment, and they have licenses for such a specialized treatment. An employee who is receiving the waste is responsible only for the transportation and for bringing the needed equipment such as boxes where the waste is placed to be stored. Until the managing company takes the waste, it is contained in refrigerators on the designated site.
The issue is that most of the farmers slaughter the animals on site at home, and some of them have many animals, which means a lot of waste gets produced. It is required that they have to bring the live animals, slaughter them at this place, and pay for that. The expert had the information that in the last year there has been a reduction of approximately 50% in the number of animals on the island. This information correlates to the findings from Fetzel et al. (2018), also Fischer-Kowalski et al. (2020) according to whom there is an apparent decline in livestock numbers on the island. It is assumed that due to chronic overgrazing, there has been a lack of food on the pastures causing many animals to die prematurely somewhere in the mountains (Fischer Kowalski et al. 2020).
This decline can be observed as a positive fact from an ecological equilibrium perspective, since the island is facing since years problems with overgrazing which has led to massive erosion and heavy degradation of the land (Fischer-Kowalski et al. 2020). On the other hand, a decline by 50% of the 45,000 animals on the island implies an enormous slaughter waste load.
If the island's livestock will in the future be reduced to numbers considered as sustainable and comply to EU standards (Fetzel et al. 2018; Noll et al 2020), this would imply a large – but transitory – high workload for the slaughtering facility.

c. 'Fotokyklosi'

Another initiative concerns the possibility of recycling lamps, batteries, and small electrical appliances such as hairdryers and mixers. The company that does that is located in Athens, and it is called "Fotokyklosi". The municipality has a contract with them, and they are willing to take these kinds of waste for recycling. A bin for the lamps and small electrical appliances is located at the waste transfer station of Samothraki (SMA Samothrakis), the place where the municipal solid waste is collected before being transported by ferry. When the bin is full then contact must be established with "Fotokyklosi" so that they collect it. The municipality must not pay anything; the transport cost is taken over by the company.
The expert has been urging for some time for the municipality to create public awareness for this recycling opportunity, but this has not happened yet. The lamps from the houses cannot get recycled because there is no place designated or a bin where the people could bring the lamps.
"If you want to recycle lamps, you have to find a place to concentrate them. One for the municipality and one for the people who are staying here. The municipality has solved this problem because there is a worker who changes the big lamps in the streets and brings them to the SMA. Someone has to call the transportation company who is in Samothraki to take these lamps and to transport them to Athens".

The expert explains that she started to work with this company since last year and they revealed her that they had a problem with Samothraki because they could not communicate with someone who is responsible for this matter. This lack of establishing the communication is the main reason why the municipality could not recycle the lamps in the last two years. The lack of motivation on the part of the municipality to inform about the initiative is an additional reason that inhibits the diversion of house lamps from landing in the waste bins.

The company "Fotokyklosi" agreed that if the municipality of Samothraki manages to deal with the situation, establish a regular communication, and thus show that they are reliable partners, they would provide special bins. The bins would be placed at the post office and allow the people to bring their home lamps. For the initiative to be successful awareness needs to be spread on the island for the existence of such a possibility and someone must be appointed from the municipality to be responsible for this matter.

d. Composting Initiative by "Sustainable Samothraki" Association

The initiative "Composting: Nature's way of recycling" had been initiated in 2018 by the local Sustainable Samothraki Association to organize composting of organic waste by primary school children. This project was seeking to tackle the issue of waste management and promote waste separation. This was to be achieved by focusing on educating the children to act as a connection between generations to spread awareness on the notion and practices of composting on the island of Samothraki. This had been the first attempt of this kind taking place on the island. The assessment of this project about what was tried and what has been achieved was the main subject of my case study work, and it is described more extensively in chapter 6.

6 Case study: Local Initiative struggling towards a solution for organic household wastes.

One of the aspirations of assessing the composting project "Composting: Nature's Way of Recycling' in primary schools was to attain a greater understanding of the waste problems small islands face in general and specifically how the project was realized and embraced by the participants (Bergler et al. 2020).
Case studies can provide a kind of deep understanding of phenomenon, events, people, or organizations, similar to Geertz's (1973) notion of "thick description." (Lune and Berg. 2017). In this case researching on this project will provide more insight than just the waste issues the island deals with. It will give a breadth of view on the mindset the people in the community of Samothraki Island have on the importance of waste management or organic waste treatment through composting, and the belief they put on the success of the project.

6.1 The research tasks and methods of evaluating the achievements of this case study

A part of the data collection for the case study initiative was accomplished through semi-structured interviews on the island in 2019. The institute of Social Ecology of Vienna organized a summer school on the island where students participated and learned more about socio-ecological research methods. The learning process was combined with various field research tasks for each of the student groups. I chose to become member of the group, which was responsible for the evaluation of the case study, led by Professor Simron Jit Singh.
The coordinator of the composting initiative was the contact person, which beforehand gave us information about the initiative, the aims set by it and the actors involved. Based on this description the most important stakeholder groups were identified, and it was decided on conducting semi-structured interviews. The main stakeholders were primary school children who were encouraged to bring the compost to the school and thus participate in the project. The parents and the teachers were important supportive actors in the execution of this initiative. The project coordinator established the contact to all the three stakeholder groups. The project was successfully implemented in the two primary schools on the island located in

Kamariotisa and in Lakkoma, and in one handicraft centre in Chora. Eventually, children stopped bringing organic material to the creative centre for reasons that will be explained in section 6.3.

The interviews were conducted in different settings where the interviewer was comfortable or in a natural environment in their everyday life. The children were interviewed in the cultural centre located in Chora where they had weekly leisure activities during the summer. The interviews with the parents took place in cafes in Chora and Kamariotisa. While with the teachers which were responsible for the project in each respective school, one interview was conducted in a cafe in Chora and the other through skype. For each of the stakeholder groups a separate draft of key questions was prepared as an orientation. However, in the beginning of each interview, the purpose of the research was explained and the interviewees were invited to ask freely any question they had and express their opinions and viewpoint. The interviews were open-ended as the interviewee could respond freely. An attribute of semi-structured interviews is the flexibility in making changes on the structure of the interview, reordering the questions on the process (Lune and Berg 2017).

In total 14 interviews were organized with teachers, parents, and children, the former mayor, a hotel owner, and an anthropologist. The interviews during the summer school have been conducted in Greek language by me and a Greek colleague but translated ad-hoc to the other members of the group and the notes were kept in the English language. The fact that I speak fluently Greek has been an advantage for me during the summer school while making the interviews. I was able to engage easily in communication with the people while on the island and perceiving the surrounding.
In January 2021, I conducted an interview with the coordinator of the project through skype. This was the second interview with her; the first one was during the summer school 2019. This expert interview was key for this thesis in elaborating on the current state of the initiative and the progress made since the summer school 2019. The way the intervention started and evolved is discussed, what was the motivation of the participants, and which was the impact the project had on the community of Samothraki. As well as on answering on the impact the initiative has had in paving a policy pathway towards organic waste collection in households and spreading the idea of composting.

6.2 The Sustainable Samothraki Association

The summer schools organized by the Institute of Social Ecology on the island of Samothraki is the event of the year where interested citizens on the topic of sustainability of the island are coming together. This recurrent event has been a trigger for the creation of the group. As the coordinator of the project revealed, discussions had been taking place over four to five years to decide whether it must be an association or non-governmental organization (NGO), and what legal form it should take. Sustainable Samothraki (SUSAKI) is an association that got founded because of the need to have a formal organization for local people to address the current socio-economic and environmental problems on the island. At the same time, this association serves as a link between the research community and the local community on the Island of Samothraki. This way, the results of the research conducted on the island could be better utilized (Sustainable-Samothraki online, accessed on the 28.10.2020). Among the aims of the association is the support for the process of Samothraki becoming part of the Network of the Biosphere Reserves, to strengthen the protection of the existing Natura 2000 areas and support sustainable innovations. The association seeks to encourage sustainable practices in all spheres on the island including issues such as overgrazing and waste management.

The local NGO of SUSAKI together with the scientists of the Institute of Social Ecology collaborated in a "citizen- science project" to tackle the topic of organic waste on the island and to bring awareness for more sustainable practices. The project aimed at introducing the practice of composting to the primary school pupils on the island. This was supported by collaboration of the association with several stakeholders, each of whom had an important role in this process. An evaluation of the composting project was conducted in the summer school of 2019 by participating Master- and PhD-Students from different European countries and Universities (Bergler et al. 2020).

6.3 Challenges of household waste on Samothraki

During the summer school of 2016, apart from data gathered through interviews and use of secondary data from the municipality, a waste decomposition analysis was conducted. A decisive finding from the study was that, on average, organic waste comprised between 35 to 59% of the municipal waste (Noll et al. 2017). It must be pointed out that the study was conducted in the touristic season, which could have had an influence on the high proportion of organic waste. Nevertheless, it is clear that the separation of organic wastes in not functioning on the island: since it was not only found in the green bins for mixed waste but also the blue bins for recycling. *(Bergler et al. 2020).* Figure 12 is the graphic representation of the composition analysis.

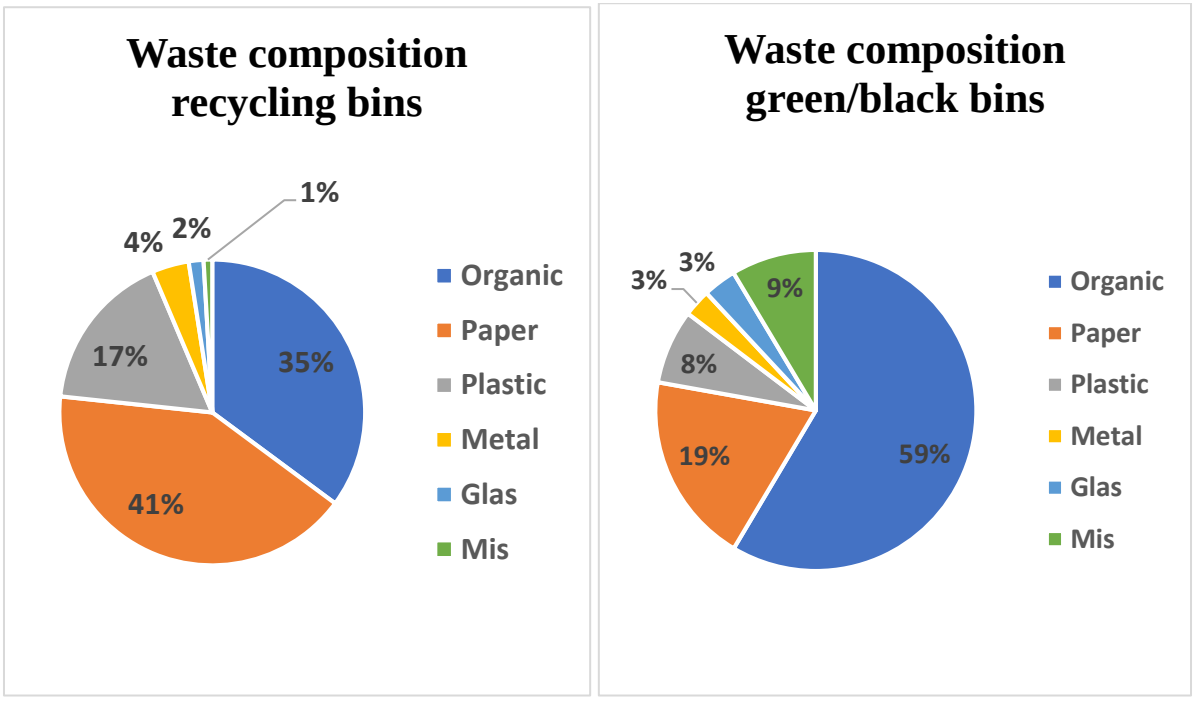

Figure 12: Composition analysis of the blue recycling bins and the mixed waste bins on the island (source: field research Noll et al. 2016).

The findings of this decomposition analysis were one of the key motivations for Sustainable Samothraki Association to start the initiative "Composting: Nature's Way of Recycling". The fact that the results of the decomposition study carried out in one of the summer schools was the prime motivation of the association to start this initiative, confirms the claims that the summer schools and field research encourage the creation of local sustainable initiatives and have an impact on the community.

According to the coordinator of the project, there are two major challenges for household waste on Samothraki. Firstly, it is the challenge on the household level, of persuading people to separate waste and that they start in some way to be responsible for their own waste. This denial and lack of motivation for separating waste may be directly linked to the distrust people have in the system. On the island, supposedly waste gets recycled, but the people have seen the recycling truck picking up the mixed waste several times. There could be a reasonable explanation to why this has happened, but so far, the municipality has given no explanation. When the people on the island see this then they do not believe that the waste in the blue bins is really being recycled. The major consequence of this is that it demotivates people to change their habits and start to recycle.
Organic waste management on the island of Samothraki is an interesting topic because many of the inhabitants on the villages across the island have chickens and pigs that they can feed a lot of their organic waste to them and they do. Nevertheless, this fact also stops the citizens from accepting that there is also a high quantity of other organic waste not edible by the animals which needs to be dealt with on the island and should not need to be transported somewhere else. An example mentioned in the interview is that even the leaves from the streets which get swept away by an employee of the municipality are thrown in a plastic bag and end at the mixed waste. The coordinator mentioned that the main problem with organic waste is the fact that people do not see the need of it being dealt with separately.

6.4 Motivation to start the initiative: aim and goals

Another key factor motivating the association to initiate the project was that they considered it possible to accomplish. A grassroots project easy to get in grips with, back to nature, back to basics kind of approach to getting people involved in a project that can make a big difference for the island. The inspiration emerged from the experience of an organization called “RE:THINK” which has initiated neighborhood composting initiatives in Kalamata. They were invited to make a presentation about their initiative in summer 2017. Sustainable Samothraki approached “RE:THINK” to discuss the option of having a future collaboration on a local project on Samothraki island. They were willing and the collaboration and constant assistance has been essential and made it easier in realizing the initiative.
The aim of the project was to educate people and children about the soil and its structure, especially important since soil erosion is an enormous problem on the island caused by overgrazing (Fischer-Kowalski et al. 2020). The intention of the project was to be educational, and for the idea of composting to enter people’s homes through the children and to trigger a habit change.
More specifically, the waste problematic is related to the lifestyle and practices of the island inhabitants. Making children aware of this problematic at such an early age creates an understanding for them on the system level. A project like the composting initiative is especially positive, as it is solution orientated. It should create the necessary awareness and provide empowerment to change peoples’ habits in a sustainable and responsible way. In the interviews conducted in summer 2019 with children, some of them said that they were not aware where does the waste produced on the island end up. They know only that the waste truck takes them away. However, when asked “*what would they like to do in the future?”.* Many of them expressed that they would like to do something to protect the environment and keep it clean. This reply reveals that a consciousness about the importance of nature has been created.

6.5 Appropriateness of the target group

The early stages of project development was dedicated to brainstorming meetings between the local coordinator of the project, the president of the association and the other members of the association involved. Initially the association thought of basing the project on the model of neighborhood composting that "RE:THINK" were using, where the people from the association Sustainable Samothraki would be responsible for the composters in the neighborhoods. However, as soon as the idea of the schools being involved and children as target group emerged, it was obvious for them that this was the best way to proceed.
The primary target group of the composting project "Composting: Nature's Way of Recycling" were the children. This was the way to generate meaningful impact in the community. The project had mainly educative intentions of teaching children more about the environment where they live in and the importance of protecting the environment through separating waste and composting. The parents and teachers confirmed that the children were the ideal target group to leverage more immediate action with respect to separating organic waste and trigger a process of changing long-time habits on Samothraki. Children can act as possible successful agents in promoting environmentally responsible behavior in individuals (Leeming and Porter 1997). Bryant and Hungerford (1977) asserts that the development of attitudes toward the environment starts already at an early age, and it is difficult to change once they become a habit (Bergler et al. 2020). The parents validated that assumption by broadly considering the school setting to be a good mean for education and to spread information.

Furthermore, the children were a bridge to their parents through composting and transmitting their new knowledge at home. The fundamental assumption was that children through their participation in the project at school would serve as a trigger for adults to change behavior at home and thus indirectly "educate" their parents to separate waste. With the schools as partners, the initiative could be ideally ongoing, would become a habit for the young generations and enter as a practice people's homes, which is important in order to bring about permanent behavior change. Some of the mothers, who were interviewed, confirmed that apart from the knowledge attained regarding composting while helping their children, their overall awareness relating waste management issues on the island increased. It is difficult to estimate the extent of the impact children had on the parents through the project. Nevertheless, children will influence the environment on the island for a longer period and supporting them in adapting and changing their daily practices with habits, which support the sustainability of the natural ecosystems, is decisive.

6.6 Stakeholders and their role

For initiating the project, it was paramount for several stakeholders to collaborate and each one of them played a key role. The municipality collaborated to a small extent in the launch of the project. They gave the permission to the association to hold events at the school venues and place the composters in the yards of the schools and the creative center, which are under their care.
"RE:THINK" was an important collaborator which helped by passing on their know-how and shared the insights of their experiences with the association. "RE:THINK" with the assistance of one of its members played a role as project coordinator together with "Sustainable Samothraki" by accompanying the project in the process of planning phase and the organizational details. The support also included the wooden composters with the logos on them, which gave an image to the initiative, as well as assistance in the informative events in

the beginning of the initiative. Three wooden composters were acquired from them and placed in the schoolyards.
The schools were key collaborators by accepting to have the project and the informative event take place at the school venues.
The center for crafts and creative activities for children in Chora was involved in the first year of the initiative. The idea was for the initiative to be present in all the territory of the island the schools in Kamariotisa and Lakkoma and the creative center in Chora located on the south of the island. Eventually when the project was running, the association removed the composting box from the creative center to the school in Kamariotisa because the same kids, which went to the primary school, were the ones who visited the creative center. Therefore, the kids were bringing the compost at the school and not at the creative center. However, the crafts center played an educational role.
The "Parents and Teachers" Association which is a small community of people which are active in the social events of the island were supportive of the initiative as well.
The teachers were also important partners in keeping the project ongoing and motivating the children to bring compost with them. The figure of the teacher as a role model for children was essential in the participation level of the pupils in the project.
Parents were also stakeholders since the children participating are primary school pupils and of course the willingness, the motivation and the source of information was pouring from them, but the support of the parents was vital. The parents are the ones who make the cooking at home and therefore the assistance from the parents to separate the organic material and taking care of putting it in the green buckets was an unquestionable must for the success of the project.
The Institute of Social Ecology in Vienna has also played an important role as a partner in providing resources and assistance whenever needed. In fact, the cost of the composting initiative was covered by the SUSAKI project, which the researchers of the Institute of Social Ecology applied for, for fostering sustainable practices on the island of Samothraki.
Overall, it was not achieved to having the stakeholders engaged fully, but it was succeeded to having a number of the parents and the teachers and some assistance of the municipality. The contact and the collaboration were kept strong and vigorous with the school through constant presence and persistence from the side of the association by calling, checking up if everything is functioning, and showing interest to the needs of the school for the initiative at any given moment (Expert Interview). The second year of the initiative was slightly easier for the coordinator of the project since her son started attending school, so when picking him up she could easily look at the state of the compost without needing to make a special trip intentionally like the first year.

6.7 The role of Sustainable Samothraki Association throughout the initiative.

From the side of Sustainable Samothraki there were several members involved in making this initiative possible and assisting in the different responsibilities.
One person was responsible for the organization and logistics of the project. Another person was involved in building the composters, which would be placed in the schoolyards. They were transported in parts and needed to be assembled. Another responsibility covered was creating publicity with writing, making posters and leaflets. For the first informative evening with teachers and parents, leaflets were prepared and given to the children to pass to their parents and notify for the event. In general, whenever there has been an event the association has produced some bits of publicity.

The coordinator argues that support has been provided in the form of educational material, and it has been ongoing. The teachers on the island change quite frequently, for example currently at the school in Lakkoma there is a new team of teachers, which were not aware of the educational material for the initiative. The plan from the coordinator was to go to the school and bring the educational material and have a meeting, but that was not possible as the schools closed in November 2020. The reason was the lockdown imposed by the government in Greece to curb the spread of the corona virus. Hence, the meeting was postponed but the materials were sent by email.

The cooperation between the association and the teachers has been outstanding in the last two years. The teachers take over the project during the school year. Hence, the role of the association during the school year has been connected to coordinating with the teachers. Troubleshooting when they needed something, bringing leaves and brown material to neutralize the compost material of not being too liquid or having flies gather. The kids have been very involved with the initiative, so currently in one of the schools there are already three composters placed. This has to do with one of the teachers who has been very involved and motivated, and she had a background on environmental studies. Unfortunately, she has left the island this year, which is relevant because the initiative is dependent on the motivation each of the stakeholders brings and especially teachers. So, this is where the association steps in as well, in coordinating and talking and finding a teacher motivated to take on the project.

In the small school in Lakkoma, at the moment there are very enthusiastic people and there has been some really good coordination with them in the past and cooperation but that is not in all schools the same. In the school in Kamariotisa the headmistress is not willing to really get involved herself, so it all depends on the teachers who are capable and willing to take on the responsibility.

Another form of support provided has been in the end of the school year event in 2019. Certificates were handed out to kids who had brought the most organic waste to reward their active participation. The teacher who had been in charge, kept notes on the amount of organic waste brought to school by the kids.

A key event has been the point when the compost at the school was ready. An activity was organized in October 2019 with the children. *"The compost bin was opened and emptied and sieved it, the kids saw the compost which was produced because of the organic waste brought by them. The children were very enthusiastic they stuck their hands in the soil, they smelled the soil, and it was great. The kids loved it. In the end some plants were planted with the soil produced."*

The coordinator elaborates further: *"That was the best part of the whole project. The production of the compost and children seeing it. Moreover, being stopped afterwards in the supermarket by the head teacher of the school saying: „I never realized, that that's what was it all the about. You really produce all that soil." And I said yes, we really produced all that. She was quite surprised that we actually did do what we said we were going to do. We did produce soil."*

6.8 Phases of the implementation of the project

The first phase of the initiative, which started in summer 2017, was planning. It was a highly coordinative phase between the local coordinator, the project leader which was a member of "RE:THINK" and another member of the association which was the connection person to the Institute of Social Ecology in Vienna. This phase included several long skype conversation and phone calls between the mentioned team, discussing and deciding over the budget, and organizational details in various aspects.

The launch took place in January 2018 and with it the second phase of the initiative started. The launch consisted of an informative evening with parents and teachers. Three composters were acquired from "RE:THINK" for the start of the project. After that the installation of the bins followed in three locations accompanied with an educational seminar in each of the location by the expert from "RE:THINK". The target group for the training were parents and teachers but also members of the public which had interest. A key part of the launch were educational materials and games prepared which were made available for the teachers. The games with educative purpose, like a maze with what can be composted, were made with the children. The children got an "invitation letter from the Ministry of Environment" where they were asked for their help with the composting by making the educational games. This was a method used to motivate children to get involved in the initiative in a way, which is pleasant for them and at the same time a learning process. Publicity for the initiative was made through giving interviews on the radio, and a press release for the local television network.

After that, the phase, which is also currently ongoing, is characterized by maintenance, meaning to be supportive and assist whenever possible and needed. The coordinator describes: "*the time period of the 6 months from the launch until the summer was distinguished by visiting the school bringing leaves and supportive material and occasionally, we did some games about composting just to go over the concept of what can be composted and what cannot".*

On the first year, the association engaged in organizing an end of the school year event. The last day of the school year in Greece is a full day of activities, and the association contributed to the program by organizing activities for one hour. One of the activities was looking at the composter, opening it up and analyzing it with the children. Weather it was smelly, or too dry or too liquid. This was only one aspect of the activity, but in essence, it included various environmental aspects and information. By the end of the school year the composter was approximately half full, indicating that there was not a big amount of organic waste brought. The coordinator reveals that in terms of the actual amount of organic waste composted the first year was not to be considered a success.

In the beginning of the new school year in October 2018, a very motivated teacher with a master's degree on environmental education joined the initiative. She had done composting before in other schools as well and had a know-how which was an asset for the initiative. Especially positive was the fact that she was teaching at the largest school on the island. The coordinator argues that from that point on, her role became mainly supportive. The teacher was a positive role model bringing organic waste from home by herself and the children became very engaged, and were bringing considerable organic material as well. By spring 2019, the association needed to bring a new composter to the school in Kamariotisa. It was decided that the composter from the cultural center be transferred to the school since the children attending the creative center were the same going to school in Kamariotisa. The coordinator argues that: "*A nice development was that the association got the buckets. The success of the initiative relies on the motivation of each of the partners. The success was obvious because the teacher was willing to spend her time and breaks to go with the children so that they could empty their own buckets into the composter. They would then go by themselves, wash the buckets at the taps at the schoolyard, and put them back. They had a special shelf at the back door of the school, the children started to become responsible themselves. They could take the fork and stir up the compost, so children I think became more involved with her on board."*

Monitoring of the amounts of the organic material brought by the children was also kept starting from that year for the school in Kamariotisa.

6.9 Level of participation and success of the project

The initiative of Sustainable Samothraki "Composting: Nature's Way of Recycling" was applied at the primary school in Kamariotisa, the primary school in Lakkoma and the handicrafts center for children in Chora. The project was launched in February 2018 and three teachers from the two schools incorporated the composting project in their school program.
As aforementioned Sustainable Samothraki together with "RE:THINK" prepared educational games for the children which were intended to be both informative as well as encouraging for them to participate in the initiative. From the participating schools only the school of Kamariotisa kept track of the compost amounts, which the children were bringing to school.

In the school of Kamariotissa, four classes got involved in the composting initiative. The green bucket the children brought from home to school has the capacity of carrying 4.5 litres. The data provided by the teacher Kamariotissa are stated below (Bergler et al. 2020):

- 130 children go in the Kamariotissa school
- 36 children from 4 classes were actively participating in the program
- 337 buckets were collected for the school year 2018/2019
- 58 buckets were collected by four teachers participating
- 279 buckets were brought by the children

The estimated organic material gathered in the school year 2018/2019 was 330 kg.

In the school in Lakkoma there was no data gathered in relation to how many buckets was brought or to the amount of organic material generated in the school year. The only information which a teacher provided in the interview is that 20 children were actively involved in the project (Bergler et al. 2020). The lack of data is also related to the fact that it was the first year of the initiative, the participation is on a voluntary basis, based on the personal motivation of the teachers. Furthermore, the initiative is characterized also by a learn by doing approach.
In the interviews conducted in the summer school 2019 the children were asked *"what would you like to do when you grow up?".* The answer from several children was that they would like to do something relating to protecting the environment and keeping it clean (Bergler et al. 2020). This answer suggests that the educational games and the participation in the initiative has had an impact on the children and fostered ecological awareness. The initiative has been welcomed positively from the parents as well as the local community. Especially positive feedback was that parents who work in the military or coast guard intend to continue the project and expressed that they would spread it in the other cities, which they could be appointed in the future.
These answers are indications that the initiative has had an impact in the community. The major achievement is the awareness about organic waste composting created among children and parents. Lastly, the willingness of all stakeholders to continue the initiative is promising in terms of its sustainability and the potential to expand.

6.10 Enabling factors

According to the coordinator after accomplishing the initial planning phase, the most facilitating factor enabling the project was the cooperation with the teachers. This was a key enabling factor for the progress of the initiative.
The teachers were very positive both in the schools in Lakkoma and Kamariotisa and the creative center. At the creative center as mentioned before the children did not bring much organic waste, because they were the same children who were going to the school, therefore

they brought the organic material at the school mainly. Regardless of this, the role of the teachers at the creative center was encouraging, for the children to participate in the project, both through the positive attitude and the motivation to compost even the smallest organic waste produced when the children were there. The teachers would give importance to the initiative and talk about it with the children. The school in Kamariotisa is the biggest one on the island, it was key that one teacher was on board with the project the first year and in the second year another teacher joined the project as well, bringing enthusiasm and expertise about composting in schools. Prove of the important role teachers play is that in the last two weeks of the school year 2018/2019 three children were responsible of checking the compost, indicating the learning process has been successful.

Indispensable help for the initiative was the funding from the SUSAKI project through which it was possible to afford the needed equipment such as the composters in the schools and the small composters for the participants. Through that funding, in the second year of the project little green buckets were acquired to give to the children. Although the association had provided little plastic upcycles with lids and handles that the kids had decorated and used to bring their organic waste from their homes. Those were provided at the start of the project from the association but this were somewhat more professional looking. Moreover, they look nice on the kitchen surface, and special stickers were created with the association's logo and a nice slogan. That was also another element of support, in enhancing the project and increasing interest.

6.11 Obstacles

The interviewees through their participation in the project have identified a number of obstacles, which in their opinion have impeded a larger participation and achievement of the project. They referred to the challenges they themselves needed to go through from the side of project management from the coordinator and the side of participants, which if overcome, would enable a bigger participation on the project, foster an effortless project operation and generate higher impact on the community. These challenges mainly relate to the practicality of the project, accessibility to the composting sites, matters of general convenience but also the attitude of people.

Relating the practicality, an issue mentioned was relating to the transportation of organic materials (Bergler at al. 2020). Both teachers and parents brought up the fact that the bus driver was complaining about the smell of the organic waste and was opposing its transportation with the school bus. A parent also did not find it reasonable that a six -or seven years old children carry the bucket with organic material to school. Given the fact that they already have to carry quite a heavy school bag.

The matter with the accessibility to the project was mainly brought up and regards mainly parents especially the ones, which were actively involved in the composting initiative. The impediment is that the initiative is highly dependent on the school venues and the opening hours of the school. Parents are welcome to help the children with the composting project by separating the organic material at home and put it in the buckets, but only the children are allowed to bring it to school. Furthermore, this can only take place during the time the school is operating. In the weekends and holidays (e.g. eastern holidays, Christmas holidays and summer months) when the school is closed composting does not take place. This lack of accessibility is a barrier and stops the process of composting becoming a habit for the families that are willing to do it. Parents who would like to get involved and take care of separating the organic waste on a daily basis cannot. The dependence of the composting with the operation

time of the school is a complication also from a coordination perspective. The coordinator explained that in the summer months it could be needed to check the condition of the composting material on the bins, but it is not possible since the schools are closed.
Through the interviews, a pattern was recognized, that mostly interested on the composting project were "neo-locals" which are the inhabitants not originally from Samothraki but get appointed to the island from their work, this regards families, which a member works in the military and coast guard. A factor relevant to this observation is that many of the new families moving to Samothraki for few years do not have a house with a garden or animals to throw their organic material.

The attitude of the parents and teachers towards the initiative played also a major role in the performance and implementation of the initiative. It was discussed by many of the stakeholders the lack of interest some of the parents had towards the composting initiatives. A justification often mentioned was the fact that they have animals at home, and they close the loop of organic waste by using it as fodder for the animals. Closing the loop is without doubt the ideal solution from a sustainability perspective, however there is also organic material, which animals do not eat. If the parents would be willing, they could separate that organic flow from the mixed waste.
There was the case as well that some of the children were enthusiastic to participate in the initiative, but the parents did not put an effort in the separation of waste because they considered this as a "dirty" task.

A lack of motivation from the majority of teachers was also observed. A teacher involved in the composting project discussed that in one of the schools out of thirteen teachers only three were actively involved in the project. One of the teachers, which was conducting the composting with her pupils, would do the composting tasks on her own without involving the children. One of the main aims of the project was not necessarily a high composting rate but the educational process for the children. When they do not get involved than there is no learning process-taking place.
The municipality according to the opinion of the interviewees does not seem to regard waste as a priority but the issue with the ferry puts a pressure on them.
The main obstacle noticed by the coordinator has been the attitude of people, the apathy towards the subject from the side of many teachers, students, and parents. The fact that many people do not see an importance of tackling this topic.
"An example of the apathy is even one of the headmistresses of one school, to whom also a composting bucket was given. The idea behind was that teachers are role model for the children, when they would bring compost material at the school more children would be motivated. She never used the bucket. That is why the event with planting plants with the compost produced had a surprising effect for many who did not see the project as something meaningful."
The coordinator argues that the reason behind the apathy is the lack of motivation to do anything above and beyond the basic duties. The refusal to be responsible for extra things and not seeing this kind of initiatives as important. This is combined with the mentality which is present not only in Samothraki but in many parts in Greece. An attitude which is hard to overcome of considering that some things may have been successful somewhere else but *"that will never work here".* This attitude implies the failure of any initiative without even trying it. This mentality has been a major obstacle and continues to be a difficulty in expanding the project out of the schools. The coordinator explains that it is not difficult to try to bring the composting project to the neighborhoods like the case of Kalamata. The problem is that

very few people are motivated and have expressed enthusiasm towards such a step. The good news is that, some families (with the parents working in the navy or military) plan to continue composting also in the next places that they move to, and would mention it in the new schools.

6.12 Evaluation of the project

The relationship with the schools and the teachers is a delicate relationship. It is based on finding the balance between encouraging, motivating, and providing all the needed assistance in the direction that the teachers take over the initiative. On the other hand, taking care of not requiring more than they would be willing to do because it could risk the schools terminating the initiative. Drawing from this line of thinking maybe having more active people on the island would have helped in having more outcomes and participation. The project has required much effort and time dedication and is based on voluntarily work. Regarding the lessons learned given the circumstances on the island, more support from the association would have been needed. What could be done better from the side of project management in the future is having a group of people overviewing the initiative and would improve the communication with the schools, as one local coordinator is not enough.

The opinion of the coordinator is that the success of the project depends on the viewpoint and the goals, which are taken into consideration. In terms of having an impact there are children now which are informed about composting, know how it functions, and probably would continue practicing it in their lives. There are families on the island who were not aware of the concept of composting, and through this initiative, the awareness has been created. The coordinator knows some families that by their own initiative being inspired by the project, have installed composters on their yards. The awareness on the island has risen about the issue of composting and this is a certain level of success. The feedback of a teacher also regards that a habit of separating organic material has not been established yet. Nevertheless, considering the fact that this started as a pilot project from zero and it is continuing and has had a certain impact it is a success.

The coordinator expresses about the success level of the initiative that: *"[...] just the fact of composting being more on people's minds and some families will be taking it on board it is a success. The fact that we are accepted in the school, and we continue to be there, that is a success. They could have asked us to leave after the first stage but the fact that we continue to be there and keep going with the project it's a success of a certain nature I would say*."
On the other hand, her contemplation is that it remains to be seen whether the impact will be long lasting and to what extend will the project unfold on other areas on the island as to make a meaningful change to the amount of organic material being diverted from being exported with the mixed waste to the mainland. The aim of Sustainable Samothraki would be reached, and the initiative would be considered a success when composting would become a practice, which is adopted on a widespread basis.

For adults to change their behavior and practices is more challenging and takes time (Bergler et al. 2020). The parents and teachers recommended as well that at some point, effort from the municipality must be put, to address waste management on the island with the whole Samothrakian community. This fact suggests that the first recognition of the importance of waste management has been sown in the community.

6.13 The effectiveness of the initiative in paving a policy pathway towards organic waste management and composting

The matter in Samothraki is that there are several major issues to deal with and this is combined with a very slow working ethic. This applies not only to Samothraki but Greece in general. An example of this mentioned by the expert is a flooding which happened in September 2017 on the island. It caused considerable damage particularly in Chora and some of the roads got badly destroyed. The roads damaged through that occurrence have only been able to get reconstructed in autumn of 2020 which gives an impression of the slow-moving pattern of work in Greece.

Immediately after the unpleasant event with the waste on the ferry took place, the municipality contacted the association and showed interest in trying to reduce the amount of organic matter on the mixed waste by placing some composters in Kamariotisa in the summer season. This proposal has not been accomplished yet and the motivation from the municipality does not seem so high towards the separation of waste and composting of regarding it as a priority.

Drawing from the above-mentioned examples the coordinator considers that the initiative has been successful in spreading the idea of composting on the island of Samothraki but does not believe that the initiative has had such a big impact in paving a policy pathway towards organic waste management.

She concludes: "*I think the seed has been planted but I don't know if it has come to fruition quite yet."*

6.14 Evolvement of the initiative since the summer school and future plans

After the summer school 2019, the local authority in Komotini, which is responsible for recycling, has expressed interest in relation to the composting project in the schools. The interest was connected to the organizational details of the initiative and obviously, it has attracted the attention from some municipalities in the region. The discussion regarding municipal composting projects has commenced.

A pleasant development for the association, due to the news about the initiative have circled in the region, has been that the local coordinator was invited in an event organized by a local group called "Common Ground". They are active in Alexandroupoli for discussing land use matters with citizens, and the event was the concluding of a project they had accomplished. The event was held in February 2020, at the local chamber of commerce in Alexandroupoli. Various people from all over Greece were invited to speak about the soil and land related projects they were involved in. This has been very positive outcome since it gives the insight that the project has gained a reputation outside the island as well.
Despite that, there seems to be a regress or stagnation of the initiative in the last year due to several factors and changes that have taken place. The managing board of the association Sustainable Samothraki has changed in the beginning of 2020. There is a different president, secretary and cashier and there has not been much advancement in relation to the project from their side. This has to do with the fact that an adaptation time is needed for the new board to get accustomed to the responsibilities which come with managing an association. The coordinator reveals that this is a new experience for most of the board members and has had an influence on the progress of the initiative.

In autumn 2019, the event of emptying the composter and planting some plants took place. Additionally, in January a third composter was brought to the bigger school in Kamariotisa. After that, the corona virus pandemic emerged which influenced the advancement of the project. Furthermore, the teacher who was very involved in the initiative is not living on the island anymore. Fluctuation of teachers on the island is a problem that has been mentioned from the coordinator as well as in parent and teacher's interviews. The combination of these two factors of the teacher leaving the island and the lockdowns of the schools in the school year 2020/2021 has caused the project to be on hold in a certain way.

The initiative is continuing, and the hope is that the new members of the association and the managing body will provide some more input in the next time. Preferably, there would be one more person assisting on the local level. Having a team would make it possible to be more dynamic and achieve more. The purpose would be to start with composting in the early summer before the school closes. Normally the future plans would have been, organizing an event in spring 2021 where composters would be emptied, and plants would have been planted in the flower beds at the school. Furthermore, ideally the aim of the association mentioned already in the summer school 2019 would be to continue composting in the school for the next generation of children and additionally expand the initiative in other areas on the island. The coordinator believes that it is possible to expand the project on the island without much difficulty. This has not yet taken place, but the association hopes to start that process in spring 2021. One option has been the military base where the army families live. They have been the most active families in the composting initiative because they are in the island for a couple of years and live in flats thus not having a garden to compost themselves or animals to feed with the organic material like most of the island inhabitants do. These were the practical reasons why they have been the families contributing the most. Therefore, providing composters on the military base would give the people the freedom to compost independently from school opening times or holidays.

Another idea is initiating neighborhood composting where each neighborhood would be equipped with composters where they can bring their organic material. Samothraki is an agricultural island as well as a touristic one. For that reason, there are places appropriate in all villages on the island where composting could be done systematically, but also in the tourist areas and the hotels. The coordinator describes a talk, which has taken place between her and the owner of one of the main hotels on the island. This hotel does not have a fully functioning kitchen, but it serves breakfast for almost 60 people every day during the summer. There is quite an amount of organic material such as eggshells, coffee grounds that are accumulated and do not need to be packed and sent to the mainland. There are quite some areas where composting could branch out on the island with not much effort. If it becomes a practice which is adopted on a more wide-spread bases, that would be success.

6.15 Improvement suggestions

In the end of each interview, a question was asked to all participants about: *"what are their improvement suggestions for the initiative?"* One of the most mentioned suggestions was the installation of the composting sites in public spaces or facilities where everyone could have access to composting their waste. Parents who work for the military whose children were participating in the initiative expressed to be very kin to the establishment of a composting bin on the military ground.

The lack of information and awareness, relating this topic and the existing initiative, must be tackled with an information campaign. One recommendation was that once the structure

could be established policy changes such as fines and tax reliefs could be some measurement, which could be introduced to incentivize the composting practice on the island.

One long-term action from the coordinative perspective would be the collaboration of the municipality with the association. The minimum thing would be that the leaves of the tress or the organic waste which is collected by the municipality to be composted publicly. For a larger scale impact, a project could be initiated creating awareness and making publicity towards the benefits of organic material composting and the diversion from the mixed waste. The need of the municipality to get involved and provide the necessary equipment and infrastructure was suggested also by the parents interviewed.

Another suggestion would be targeting specific stakeholders in the community that produce a considerable amount of waste besides the households such as hoteliers and restaurateurs. These people are mainly not living on the island and come for the summer season. They have an association called the “professionals association”. Working with these groups to see how composting could be organized to function for these branches and motivate them to participate would be an option. The approach would be that they could give something back to the island with their participation. One thought the coordinator had was for each business composting there could be a sticker which they get, which would disseminate their effort in reducing the organic waste amount being exported to the mainland. It could as well be put into their websites, and this way would raise their profile in relation to their involvement in promoting environmental sustainability. This could serve as an incentive for these businesses getting involved.

As much of an incentive is also the fact that the kind of people that visit the island of Samothraki are people that are interested in nature conservation and sustainability and appreciate nature. That is what Samothraki has to offer, so trying to highlight that and help to cultivate this idea of catering to the taste of the kind of people that come here. So probably something like that would be a good long-term strategy and with the collaboration of the municipality even more impactful.

7 Discussion and action setting strategies.

The extensive literature on waste and the island studies taken into consideration for the purpose of this master thesis together with the findings from the interviews provide a thorough understanding of the issues which Samothraki Island is confronted with in regard to waste management.
Based on the six functional elements of waste management ,starting from waste generation, waste handling at the source, collection, transport, processing and transformation, and disposal as described by Vergara and Tchobanoglous (2012), enough information has been gathered through the research to be able to say that the waste management structure of the island of Samothraki currently is not effective and has considerable need for improvement. The urgency for improvement has been acknowledged both from the municipality as stated on the municipality plan of 2015 as well as from the expert interviewed. The Municipality itself in the municipality plan 2015 and the expert provide concrete information on what is lacking and what is needed for the management system to be fully functional and efficient.

The framework table from Pelikan and Halbmayer (1999), was applied to demonstrate the possible and needed intervention strategies on the person level and context level which could be carried out to influence the advancement towards environmentally friendly habits, nature preservation and a clean environment. The framework table is used in the same way also for the case study "Composting: Nature's way of Recycling" to reflect the most important messages resulting from the interviews. This includes the improvement recommendations and advice for the further development of the initiative provided by the different stakeholders interviewed.
On the person level the analysis is connected to literature on household attitude and behaviour towards waste. This literature has a crucial role because it could assist the managing institutions in understanding the attitudes and behaviour of people and which factors play a role in the creation of those behaviours. Tackling those factors could influence a shift towards the development of environmentally friendly habits of citizens towards source separation, reuse, recycle and composting which the municipality plans to promote and practice on the island. The active participation of citizens in the recycling plans of the municipality of Samothraki through source separation is decisive for the success of the numerous aims set. Refsgaard and Magnussen (2009) and Keramitsoglou and Tsagarakis (2013) emphasized that accessibility to recycling opportunities and the knowledge created through awareness campaigns or informative events have an influence on the citizens source separation and recycling attitude (Babaei et al. 2015). Study from Barr and Gilg (2005) has also come to the conclusion that convenience and effort perceived with recycling, which is similar to the accessibility mentioned above, influences the citizen in undertaking the behaviour.
Working on these factors is key for the managing authorities to achieve success in the aspiration to have an effective waste management structure, which promotes the reuse and recycling of waste and prevents as much waste as possible in landing to a landfill. Especially since it is acknowledged that, there is a difference between the willingness of the citizen to act or the behavioural intentions and the actual behaviour, the citizen practices (Barr and Gilg 2005). An important outcome from the literature review is that when the waste management system and recycling program in Samothraki would become well organized the citizens participation would increase. The same applies to the success of the composting initiative.
For the situation level, the municipality identified a number of improvements needed as stated in the municipality plan of 2015. In addition to that, the expert also expressed

improvement recommendations in the interview. Those are summarized, in the table below, as possible intervention strategies that the municipality could carry out.

Table 8: Employing the "Action Setting" concept from Pelikan and Halbmayer for suggesting improvements on the Municipal Solid waste Structure on Samothraki Island.

Action /Behavior	**Possibility structure**	**Relevance Structure**	**Intervention Strategies**
Person	***Could do*** ***(****Personal knowledge and abilities****)***	***Want to do*** *(Personal aims and preferences)*	***Intervention on the person level***
	Proper separation of waste at home. Recycle and compost.	Want to recycle.	Awareness about the WMS on the Island of Samothraki. Provide information material on waste separation. Awareness about the benefit of diverting recyclable waste and organic material from the mixed waste.
Situation/ Context	***What is possible*** ***(****Situational Infrastructure and possibilities)*	***What should be taking place*** ***(****Situational values and norms)*	***Intervention on the situation***
	To have the necessary number of waste bins for mixed waste and recycling. Municipality acquire the needed green bins, waste trucks (recycling, mixed, brown) Receive the blue bins for recycling from HEERCO.	The necessary equipment must be provided. More work force should assist the waste management structure. Collection and proper management of construction waste	The waste bins be spread throughout the island. Inform the citizens of their location and what is possible to recycle. Employ more workers for the MSW structure. The municipality engage to assist the citizens to collect the construction waste and manage properly.

		Livestock waste be managed through the municipality service.	Provide solutions to stop illegal dumping
Intervention Strategies	***Make possible / Preven***	***Advertise/ Prohibitions/ Instructions***	
	Make possible the recycling of lamps and batteries. Placement of the needed waste bins throughout the island Municipality to improve the communication and prove reliability with the companies cooperating.	Advertise the current existing initiatives addressed in the MSW structure. Stop illegal dumping. Municipality make contracts with private sector companies for the recycling of the electronic and big bulky waste (furniture, mattresses).	Municipality to facilitate through provision of an efficient infrastructure the citizens in the management of their waste so that the illegal dumping of waste is not practiced anymore. Provide economic solutions for the management of construction waste. Awareness campaign about recycling. Municipality if needed employ one more employee or make a better separation of responsibilities. So that someone is accountable for the communication and execution of the project responsibility. Introduce fines to the stakeholders which dump construction waste illegally.

First of all, as mentioned by the expert herself for change to be fostered the municipality itself must put an effort and consider the issue of waste a priority. The necessary infrastructure and equipment must be provided for the citizens to be able to separate waste. Waste bins for separating different flows must be available in a proper number in all villages on the island, in a manner that it is accessible, and convenient for all citizens. This way not only people who are aware would recycle but also people which normally would not. The municipality must become well organized and inspire reliability with its collaborative partners by establishing a regular communication. Additionally, more people might need to be employed.

Paramount strategy the municipality must pursue in order to attract the interest of people on the importance of waste management for the environment and the municipality is by informing them. By raising awareness about the high cost of the waste management system and the problematics on the island starting from illegal dumping, low source separation and the overburden on the summer season.

A way to tackle the problematic of waste from construction is to substitute the import of environmentally jeopardizing construction materials, with resources that are available on the island (Eckelman and Chertow 2009, Noll et al. 2019). As the expert interviewed revealed, sheep wool can be found thrown away in the nature. Sheep wool has been traditionally used, in the textile industry, for the production of carpets, covers, and garments to mention a few. Sheep wool possesses good absorption and desorption properties, which minimize its risk of mould growth in comparison to synthetic insulation materials (Korjenic et al. 2015). Research conducted on the material reveals that wool could be a sustainable option for insulation panels, which could be used in the construction of buildings. The EU encourages a shift to preferring natural building materials and a sustainable architecture and considers energy efficiency of buildings a priority (Korjenic et al. 2015). Using it as an isolation material in construction would have a double benefit. On the one hand, it would prevent its illegal disposal and on the other hand, its use would assist in the aims set by the EU of using environmentally friendly construction materials. This could be an example of utilizing locally available construction resources for the context of the island of Samothraki.

Of foremost importance is that citizens understand the important role they play in protecting the environment by separating waste flows, thus diverting waste, which can be recycled, reused, or composted from landing in the landfill. This would be of benefit both for the environment as well as for the public health. Through awareness and feeling part of the effort, they can be motivated to change their behavior and practices.

The plan of the municipality with the three green spots if applied and operated properly could tackle and resolve the problematics such as illegal dumping of waste and open air burning and increase the amounts of waste being recycled on the island. The plans are overarching but for them to have a meaning they must not stay in paper but be put to practice.

Table 9: Providing suggestions for the improvement of the composting initiative "Composting: Nature's Way of Recycling".

Action /Behavior	Possibility structure	Relevance Structure	Intervention Strategies
Person	***Could do*** *(Personal knowledge and abilities)*	***Want to do*** *(Personal aims and preferences)*	***Intervention on the person level***
	Separate the organic material. Home composting. Promote composting in the community. Increase awareness about the need and benefits for recycling and composting. Change habits and behavior towards waste.	Continue being part of the initiative. Have open access to composters for everyone to put the organic materials. Spread the idea of composting to their families and in other places where they get appointed.	Provide information about the composting initiative for children and the community in Samothraki. Information campaign regarding what can be composted. Clarify the participating stakeholders of the initiative that the composting project is not in competition with the practice of using organic material as fodder for animals, but an additional practice of managing the remaining waste.
Situation/ Context	***What is possible*** *(Situational Infrastructure and possibilities)*	***What should be taking place*** *(Situational values and norms)*	***Intervention on the situation***
	Increase the participation of children in composting. Closer collaboration with the municipality and other stakeholders.	Composting possibility for all the people on all villages. Expand the composting out of the schools. Have composters in areas where all the people can	Awareness on the necessity and benefits of organic waste composting among the citizens on the island Motivate teachers to take over the initiative and organize it in their classes.

		access it at any given time. More support on a local coordinative level must be provided by the Sustainable Samothraki Association.	Increase reachability by organizing events where compost is used for planting plants in common areas.
Intervention Strategies	***Make possible / Prevent***	***Advertise/ Prohibitions/Instructions***	
	Divert organic waste from the mixed waste. Prevent organic waste being shipped to the mainland.	Advertise the composting initiative. Advertise and provide information and know-how on organic composting on the garden. Empower people who have a garden to practice composting.	Place composters on the military base. Establish collaboration with the municipality. Establish collaboration with other stakeholders such as business owners to expand composting on other areas of the island.

The composting initiative has been well received; in the schools from all engaged stakeholders and has continued every year since the launch in 2018. Composting of organic material on the island directly benefits the waste management structure by reducing the volume of waste, stabilizing waste, sterilizing waste and in the end producing something valuable for the community and closing the cycle of waste (Vergara and Tchobanoglous 2012). Many families in the island did not let their children participate in the project with the excuse that they have animals at home and feed them with the organic material. A point stated in the table is that it must clarified for the children and parents that composting of waste is not promoted as something, which is more beneficial than feeding the animals with it. Quite the contrary using the organic material as fodder for the animals is an excellent way to close the life cycle of the waste and composting can be for the families who have animals a complementary practice for the organic material that animals do not eat.

However, more than how much organic material is being composted the education element has been the main aim of this project. The fact that the topic of composting, has been successfully introduced in the community, gained importance, and the willingness of the participants to continue being part of and even spread the idea in the next places they will live, is a major achievement.

The next steps and proposals for the improvement of the initiative and its expansion to other areas of the island were also discussed from the different stakeholders and are summarized in the table. Essential for the increase in participation in the initiative is the accessibility of the composting bins in areas outside the schools and more effort put by the municipality, the association, and the citizens themselves in expanding the initiative.

8 Conclusions

This study examined implications waste has on the environment and the society with a particular focus on difficulties islands face in terms of waste management. The research of this thesis has provided an in-depth understanding on the way the waste management structure on the island of Samothraki is organized. The results of the research carried out bring attention and elaborates on the most imperative challenges the waste management structure is facing. Important is the fact that the island must export its waste to the mainland by ferry leading to a high cost of management and at times complications. Illegal dumping and open air burning of waste are practices which still take place on the island. There is a low recyclability rate that is directly related to the lack of proper infrastructure, lack in equipment such as waste bins for mixed waste and for recycling waste. Furthermore, there is a shortage in the workforce and the cars available, making it difficult for the management system to cope especially in the summer season where it gets overburdened through tourism and the waste flow almost doubles. Seasonal variations in the summer months means that the island from a population of 2840 must sustain and manage the waste of 7000 people daily in the highly touristic months. In the meanwhile the financing of the SWMS remains the same source, which are the taxes paid by the island inhabitants. The extensive research reveals that the waste management structure of the island is not efficient and needs immediate improvements.

However, the municipality has major plans as stated in the municipality plan 2015, and has identified clear strategies it wants to undertake to improve the waste management system. The plans are discussed with the expert interviewed, in terms of how beneficial they are. Especially the plan of constructing a landfill on the island is highly questionable in terms of its appropriateness for the island of Samothraki and the environment since the municipality is lacking the expertise to operate the landfill after its construction. High aspirations are visible on the plan where main aims are the construction of three green spots to provision for adequate recycling possibilities for waste flows and composting of organic material.

The proposals are ambitious from the side of the municipality, and this is connected to the pressure they have as part of a country in the EU to abide to the EU directives and goals.

The literature review has provided a visualization of the waste management situation in Greece and the failure of the country to reach the goals it has agreed to, through the participation in the European Union Directives on Waste. Especially the conspicuous problem Greece has with the management of landfills must trigger the municipality to consider thoroughly if the construction of a landfill on the island is an ideal solution. Nevertheless, the ambition on paper does not seem to match with the actions since from the expert interview it was made clear that the municipality must make more effort in tackling the waste issue and consider it as a priority.

Having said that, a major benefit of this study is the information gathered through the expert interview on the existing initiatives, which are present in the Municipality of Samothraki for which little was known about. Hopefully, the municipality will increase the effort to promote and improve those existing projects.

The assessment of the waste problematic provided on this master's thesis can help the municipality to identify the most emergent improvement needs and best solutions feasible

for the island while taking into consideration the protected status of the island as a Natura 2000 area. The integration of the factors identified as influencing the behavior and attitudes of people towards recycling by the managing authorities can be a significant enhancement for good decision-making choices.

The analysis of the case study on “Composting: Nature’s Way of Recycling” tackles on the potential composting community projects have in raising environmental awareness and triggering a start of change in habits in the society. An especially important conclusion is that through environmental education children can play an important role as a bridge to different generations in raising awareness and promoting change in the society. Children were transmitting the information about the importance of source separation of organic material, the benefits of composting, and more importantly encouraged an awareness creation, about the waste a household produces, among their parents and the older generation. More than the quantitative amount of the compost produced the decisive benefit of the initiative has been the fact that the theme of composting started being discussed in the households on the island.

Through this initiative the young generation, which will be the future generation having an impact on the environment, learns and gets confronted with the need to protect the environment and catalyzes a change in habits.

The small surface of the island with a low population, can be observed as a benefit to the ability to manage it easily, and be able to organize the system easier in terms of carrying out composting and recycling. This study concludes, as the case study of Corfu referred to, that the ideal solution for the island of Samothraki is a good separation of waste flows at the source and diverting organic waste from being shipped to the mainland. Utilizing organic material on the island can be beneficial for the community as a resource as well as saving costs of management.

An encompassing message from the research, for the waste management authorities is that; creating an efficient solid waste management structure will require not only developing policies, the provision of the necessary infrastructure and equipment, but also making sure of creating awareness in the community to encourage the engagement of people which is key to the success of recycling and composting aims.

9 List of References

Babaei, A. A., Alavi, N., Goudarzi, G., Teymouri, P., Ahmadi, K. and Rafiee, M., 2015. *Household recycling knowledge, attitudes and practices towards solid waste management*. Journal of Resources, Conservation and Recycling, 102, 94-100.

Barr, S., and Gilg, W. A., 2005. *Conceptualising and analysing household attitudes and actions to a growing environmental problem. Development and application of a framework to guide local waste policy.* Journal of Applied Geography 25, 226-247.

Bačova, M. and Stričík M., 2018*. Comparison of the development of waste generation and waste management in the EU*. Taylor & Francis Group, London, ISBN *978-1-138-05885-9*

Bakas, I. and Milios, L., (2013). *Municipal waste management in Greece.* European Environment Agency.

Bai, R., and Sutanto. M., 2002. *The practice and challenges of solid waste management in Singapore.* Waste Management 22(5): 557–567.

Berg, B. L., 2007. *Qualitative research methods for social sciences*. Boston: Pearson.

Bergler, E., Fleischmann, B., Huda, K., Marcos-Valls, A., Papageorgiou, D., Perzl, M., Rolshoven, M. P., Seitz, Th. and Singh J. S., 2020. *Primary Schools Composting on the Greek Island of Samothraki: A case Study. 6th Summer School on "Aquatic and Social Ecology" on Samothraki, Greece.* Social Ecology Working Paper 184.

Bernad-Beltrán, D. Simó, A. Bovea, M. D. 2014. *Attitude towards the incorporation of the selective collection of biowaste in a municipal solid waste management system. A case study.* Waste Management 34 2434–2444.

Compost Network. *Bio-Waste in Europe.* [Accessed on the 03.06.2021]. *https://www.compostnetwork.info/policy/biowaste-in-europe/*

Damerell, P., C. Howe, and E.J. Milner-Gulland, 2013. *Child-orientated environmental education influences adult knowledge and household behaviour.* In: Environmental Research Letters, 8(1), p.015016.

Denzin, N.K, and Y.S. Lincoln, 2005. *Handbook of qualitative research*. 2nd ed. Thousand Oaks, London, New Delhi: SAGE Publications.

Deschenes, J. P. and Chertow, M., 2004. *An island approach to industrial ecology: towards sustainability in the island context.* In: Journal of Environmental Planning and Management, 42:2, 201-217.

De Feo, G. and De Gisi, S., 2010. *Public opinion and awareness towards MSW and separate collection programmes: A sociological procedure for selecting areas and citizens with a low level of knowledge.* In: Elsevier Waste Management 30, 958- 976.

Eckelman, J. M., Ashton, W., Arakaki, Y., Hanaki, K., Nagashima, S. and Malone-Lee, Ch. L., 2014. *Island Waste Management Systems. Statistics, Challenges, and Opportunities for Applied Industrial Ecology.* In: Journal of Industrial Ecology,18:2.

Eckelman, M.J., and M.R. Chertow. 2009. *Using Material Flow Analysis to Illuminate Long-Term Waste Management Solutions in Oahu, Hawaii.* In: Journal of Industrial Ecology 13 (5): 758–74.

EIB, 2010. *JESSICA Instruments for Solid Waste Management in Greece*. In: European Investment Bank (2010).

Ekathimerini. *Natura site protection streamline*. [Accessed on the 20.02.21]. https://www.ekathimerini.com/news/250362/natura-site-protection-streamlined/

Ellen Macarthur Foundation. *What is the Circular Economy?* [Accessed on the 22.01.2021]. https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy

EPRS, 2017. *Towards a circular economy – Waste management in the EU.* European Parliamentary Research Service, Scientific Foresight Unit (STOA). European Parliament. (PE 581.913).

European Commission. *Waste Prevention and Management*. [Accessed on the 20.10.20]. https://ec.europa.eu/environment/green-growth/waste-prevention-and-management/index_en.htm#:~:text=The%20Directive%20defines%20a%20'hierarchy,be%20the%20very%20last%20resort

Eurostat. *Greece 2019.* [Accessed on the 14.12.20]. https://ec.europa.eu/eurostat/documents/10186/10994376/EL-EN.pdf

European Commission, 2015. *Waste management: Commission refers GREECE to the Court of Justice of the EU over illegal landfill.* [Accessed on the 16.12.20]. https://ec.europa.eu/commission/presscorner/detail/en/ip_15_6224

European Commission. *DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2008/98/EC on waste.* [Accessed on the 7.01.21] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015PC0595

European Commission*. EU Waste Legislation.* [Accessed on the 7.01.21] https://ec.europa.eu/environment/waste/legislation/a.htm

European Commission. *Waste*. [Accessed on the 10.01.21] https://ec.europa.eu/environment/waste/landfill_index.htm

European Environment Agency. *Diversion of waste from landfill.* [Accessed on the 20.01.21] https://www.eea.europa.eu/data-and-maps/indicators/diversion-from-landfill

European commission. *Waste laws, waste, and recycling*. [Accessed on the 18.02.21] https://ec.europa.eu/environment/topics/waste-and-recycling/waste-law_en

Fetzel, T., Petridis, P., Noll, D., Singh, J. S., and Fischer-Kowalski M., 2018. *Reaching a socio-ecological tipping point: Overgrazing on the Greek island of Samothraki and the role of European agricultural policies.* Land Use Policy 76, 21–28.

Fischer-Kowalski, M., Löw, M., Noll, D., Petridis, P. and Skoulikidis, N., 2020. *Samothraki in Transition: A Report on a Real- World Lab to Promote the sustainability of a Greek Island.* In: Journal Sustainability, 12, 1932.

Fischer-Kowalski, M., Xenidis, L., Singh, J., S. and Pallua, I., 2011. *Transforming the Greek Island of Samotharaki into a UNESCO Biosphere Reserve. An Experience in Transdisciplinarity.* In: GAIA 20/3, 181-190.

Fischer-Kowalski, M., & Weisz, H. (1999). *Society as Hybrid Between Material and Symbolic Realms: Toward a Theoretical Framework of Society-Nature Interaction*. In: Advances in Human Ecology, 8, 215-252.

Fischer-Kowalski, M., Xenidis, L., Singh, Foolmaun, R. K., Chamilall, D. S. and Munhurrun, G., 2011. *Overview of non- hazardous solid waste in the small island state of Mauritius*. In: Resources, Conservation and Recycling 55(11), 966-972.

Fischer-Kowalski, M., 2015. *Social Ecology.* Institute of Social Ecology, Alpen-Adria University, Vienna, Austria. In Elsevier.

Foolmaun, R. K., D. S. Chamilall, and G. Munhurrun. 2011. *Overview of non-hazardous solid waste in the small island state of Mauritius.* In: Elsevier. Resources, Conservation and Recycling 55(11): 966–972.

Geels, F.W., 2005. *The dynamics of transitions in socio-technical systems: a multilevel analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930).* In: Technology Analysis & Strategic Management 17 (4), 445–476.

Gidarakos, E., Havas. G., and Ntzamilis, P., 2006. *Municipal solid waste composition determination supporting the integrated solid waste management system in the island of Crete.* In: Journal of Waste Management 26, 668-678.

Greece Terrabook. *Samothrace Villages*. [Accessed on the 5.03.21]. https://greece.terrabook.com/samothrace/chapter/villages/

Haberl, H., Fischer-Kowalski, M., Krausmann, F.,Weisz, H. and Winiwarter, V., 2004. *Progress towards sustainability? What the conceptual framework of material and energy flow accounting (MEFA) can offer*. In: Land Use Policy 21, 199-213.

Haas, W., Krausmann, F. W., Wiedenhofer, D., and Heinz, M., (2015). *How Circular is the Global Economy? An Assessment of Material Flows, Waste Production, and Recycling in the European Union and the World in 2005.* In: Journal of Industrial Ecology 19:5.

Hussy, W., Schreier, M., & Echterhoff, G. (2013): *Forschungsmethoden in Psychologie und Sozialwissenschaften für Bachelor. Springer-Lehrbuch*. Springer Berlin Heidelberg, Berlin, Heidelberg, s.l.

Katsanos, G., Venetis, Ch., Iliopoulos G., and EPTA (2010*). Establishment of Waste Network for sustainable solid waste management planning and promotion of integrated decision tools in the Balkan Region (BALKWASTE).* In: Euroconsultants

Keramitsoglou, K.M., Tsagarakis, K.P., 2013. *Public participation in designing a recycling scheme towards maximum public acceptance*. In: Resources. Conservation. Recycling. 70, 55–67.

Kohlbacher F. 2006. *The Use of Qualitative Content Analysis in Case Study Research.*

In: Forum Qualitative Social Research 7.

Korjenic A., Klarić, S., Hadžić, A., and Korjenic, S., 2015. *Sheep Wool as a Construction Material for Energy Efficiency Improvement.* In: Journal Energies, 8, 5765-5781.

Leeming, F.C. and B.E. Porter, 1997*. Effects of participation in class activities on children's environmental attitudes and knowledge.* Journal of Environmental Education, 28, 33–42.

Lune, H. and Berg, L. B. 2017**.** *Qualitative Research Methods for the Social Sciences.* Pearson Education Limited Edinburgh Gate Harlow Essex CM20 2JE England.

Ma, J., and Hipel, W. H., 2016. *Exploring social dimensions of municipal solid waste management around the globe – A systematic literature review.* In: Journal of Waste Management 56, 3-12.

Greek National MAB Committee, 2011. *Samothraki Biosphere Reserve Nomination Form: Final Official Document; Unesco MAB Programme*: Samothraki, Greece.

Maxwell, J.A., 2008. Designing a Qualitative Study. *The SAGE handbook of applied social research methods*, *2*, pp.214-253.

Mayring, P. 2014. *Qualitative content analysis: theoretical foundation, basic procedures and software solution. Klagenfurt.* Leibnitz Institut für Sozialwissenschaften. SSOAR Open Access Repository.

Meuser, M. & Nagel, U. (1991): *ExpertInneninterviews - vielfach erprobt, wenig bedacht: ein Beitrag zur qualitativen Methodendiskussion.* In: Garz, D., & Kraimer, K. (Hrsg.), Qualitativ-empirische Sozialforschung: Konzepte, Methoden, Analysen (441-471). Opladen: Westdt. Verl.

Mohee, R., Mauthoor S., Bundhoo A. M. Z., Somaroo G., Soobhany, N., Gunasee, S., (2015). *Current status of solid waste management in small island developing states: A review.* In: Elsevier. Waste Management 43, 539-549.

Morrison, R. J., and Monro, J. A., 1999. *Waste management in the small island developing states of the South Pacific: An overview.* Australian Journal of Environmental Management 6:4, 232-246.

Municipality of Samothraki, 2015. *Local waste management plan of the Municipality of Samothraki, Samothraki,* November 2015.

Noll, D., Lauk, Ch., Gaube, V., and Wiedenhofer, D., 2020. *Caught in a Deadlock: Small Ruminant Farming on the Greek Island of Samothrace. The Importance of Regional Contexts for Effective EU Agricultural Policies".* In: Sustainability 12, Nr. 3: 762.

Noll, D., Perkovic, M., Petridis, P. and Singh, J., S., 2017. *Waste Management on small islands: A case study from Samothraki, Greece*. In: Sustainable Mediterranean, 73.

Noll, D., Wiedenhofer, D., Miatto, A. and Singh, J., S., 2019. *The expansion of the built environment, waste generation and EU recycling targets on Samothraki, Greece: An island's dilemma.* In: Resources, Conservation and Recycling 150, 104405.

OECD, 2020. *Environmental Performance Reviews: Greece 2020.* Organization for Economic Cooperation and Development. [Accessed on the 5.02.21]. https://www.oecdilibrary.org/sites/132fd602en/index.html?itemId=/content/component/132fd602-en

Pelikan, Jürgen M. and Halbmayer, E., 1999. Gesundheitswissenschaftliche Grundlagen zur Strategie des Gesundheitsförderden Krankenhauses. *Das gesundheitsfördernde Krankenhaus. Konzepte und Beispiele zur Entwicklung einer lernenden Organisation*. Weinheim, 13-36.

Petridis, P., Hickisch, R., Klimek, M., Fischer, R., Fuchs, N., Kostakiotis, G.,Wendland, M., Zipperer, M. and Fischer-Kowalski, M., 2013. *Exploring local opportunities and barriers for a sustainability transition on a Greek Island*. Social Ecology Working Paper 142. Institute of Social Ecology, Vienna, 2013.

Petridis, P., 2012. *Perceptions, attitudes and involvement of local residents in the establishment of a Samothraki Biosphere Reserve, Greece.* In: Eco-mont 4, Number 1.

Petridis, P., Fischer-Kowalski, M., Singh, J., S. and Noll, D., 2017. *The role of science in sustainability transitions: citizen science, transformative research, and experiences from Samothraki Island, Greece*. In: Island Studies Journal 12, 1, 115-134.

Read, A., 1999a. *''A weekly door-step recycling collection, I had no idea we could!'':*

Overcoming the local barriers to participation. In: Resources Conservation and Recycling 26, 217–249.

Refsgaard, K., and Magnussen, K., (2009). *Household behaviour and attitudes with respect to recycling food waste - experiences from focus groups.* In: Journal for Environmental Management 90, 760-771.

Samothraki History. *Old Samothraki*. accessed [13.12.2020].
https://www.sites.google.com/view/samothraki/history

Schwaiger, N., 2017. *Exploring Sustainable Tourism on Samothraki. Current State and Perspectives.* Alpen – Adria Universität Klagenfurt.

Singh, A., 2019. *Managing the uncertainty problems of municipal solid waste disposal.* In: Journal of Environmental Management 240, 259- 265.

Skordilis, A., 2004. *Modelling of integrated solid waste management systems in an island.* In: Resources, Conservation and Recycling 41, 243- 254.

Sustainable Samothraki. *Sustainable Samothraki Association*. [Accessed on the 28.10.2020].
http://sustainable-samothraki.net/local_action/sustainable-samothraki-association/

Christina Tekalec (2020). *Applying the Multi-Level Perspective on Sustainability Transitions to Seestadt Aspern (Vienna) and Hyllie (Malmö)*. Master thesis Alpen-Adria-Universität Klagenfurt.

Tsompanoglou, K., (2017). *Solid waste management in Samothraki Island*. (Summary of Municipality Management Plan 2015 ideas).

UNEP, 2015. *Global Waste Management Outlook*. United Nations Environmental Programme.

UNESCO *Biosphere Reserves*. accessed [15.12.2020].
https://en.unesco.org/biosphere

Vergara, E. S., and Tchobanoglous, G., 2012. *Municipal Solid Waste and the Environment: A Global Perspective.* Annual Review of Environmental Resources, 37: 277- 309.

Watson Farley and Williams: *The New Greek National Waste Management Plan.* In: Watson Farley and Williamson (2015).

Wallner, H. P. (1997) *Industrial Ecosystems as Activity Centers for Sustainable Development of Industry.* (Oslo: European Roundtable on Cleaner Production).

Winiwarter, V. (2016). Perspectives on Social Ecology: Learning for a Sustainable Future. In H. Haberl, M. Fischer-Kowalski, F. Krausmann, V. Winiwarter (Eds.) *Social Ecology. Society-Nature Relations across Time and Space* (pp. 577-589). Cham: Springer. http://www.sustainable-samothraki.net/

Yin, Robert K. (2003a). *Case study research, design and methods* (3rd ed., vol. 5). Thousand Oaks: Sage.

10 Appendix

Appendix 1: Interview Guidelines Summer School 2019

Questions to the project coordinator

1. What drove this initiative? What were the motivations that led to create the project?
2. Which were the main phases of the project?
3. How did you pick your target groups? Were all schools invited to participate in the initiative?
4. What were the enabling factors for the initiative?
5. What were the barriers that slowed down the initiative?
6. Which means did you use to involve the children?
7. Which games did you design?
8. What worked best, what not?
9. Have you received feedback?
10. Did Sustainable Samothraki provide support during the ongoing project?
11. What kind of data have you recorded related the project?
12. What will the compost be used for?

Questions to the school children

1. Did you participate in the project? If not, why?
2. What did you do?
3. How did you understand it?
4. What can you compost?
5. How many buckets did you bring to school? Who brought the most and why?
6. How did you like it? Why? Why not?
7. Would you like to do it at home?
8. Was it difficult to convince your parents?
9. What do you want to be when you grow up?
10. Do you know what happens with the waste? Who collects it and where does it go?
11. Did you talk to your friends about it?
12. Will you continue to do it in the summer/next year?

Questions to the parents

1. What happens with the waste in your household?
2. Do you have animals? Why? Why not?
3. When you heard about the project what was your first impression?
4. Did you talk about the issue of waste in the past?
5. Are you more aware about the issue of organic waste now?
6. What was working? What was impractical?
7. What are you doing in the summer with the organic waste?
8. Do you experience waste as a problem on the island?
9. What do you think motivates people to take care of the environment?
10. Would you continue composting and recycling when moving somewhere else? Did you spread the word about the composting?

Questions to the teachers

1. What's your role in the project?
2. What motivates you to participate?
3. Was waste before an issue that you were aware of?

4. What were the barriers of the project?
5. What worked? What did not work?
6. How could more kids/families get motivated?
7. Were there learning outcomes?
8. Was the project successful? If so in which way?
9. What do you think motivated the people who participated to do so?
10. What was the motivation and incentives?
11. Was the feeling of competition and discrimination created by the kids?
12. Will you continue participating in the project next year?
13. Suggestions for improvements?
14. Do you think that the awareness could be spread (to other places they will live) somewhere else?
15. Did you get feedback from the parents?

The interviews with the hotel owner and the researcher emerged spontaneously. Therefore, we didn't have a list of explicit questions.

Appendix 2: Interview guideline Expert Interviews 2020/2021

Questions to the municipality employee

Waste management structure

1. How is the waste management structure developed in Samothraki? Where are the collection points and how is the itinerary until the waste gets treated?

1.1. How often is the waste collected (is it scheduled, or it depends on the amount of waste?

1.2. How many waste collection trucks are available on the island /operating? How much is the average weekly/monthly waste generated?

1.3. Are the trucks for differentiated waste collection category(recycling/mixed)?

1.4. How many people are working for the waste removal (their position, driver)?

1.5. Number of available bins on the island?

1.6. Where are the bins located, are they far from the residences? How many location points on the island? Is there a map available where the collection spots are marked?

1.7. How many different types of bins (recycling, mixed, paper)?

1.8. What gets recycled on the island?

1.9. How is the material and quality of the waste bins?

1.10. Do they get cleaned? Do they need to get changed often because of getting broken from climatic conditions?

1.11. Are they signed properly so that the citizen understands what kind of waste gets disposed in which bin?

2. Is there illegal dumping taking place on the island? If yes where in which location and what products get disposed there?

Cost of waste

3. How many times does the ferry come to pick up the waste? Does it depend on the waste generated on the island or is it scheduled times regardless of the waste generation?

3.1. What are the complications with the ferry transport?

3.2. How much does it cost to ship the waste from Samothraki to the mainland?

4. Is the cost of management for the waste which gets recycled subsidized?
5. How much is the waste tax for the islands in Greece and Samothraki in particular?
6. How much is the cost of waste management for the island yearly?

Waste Flows and the Municipality Plans

7. What are the amounts of waste? How did the waste flow and composition change in the years? Are there improvements from previous years?
8. Is composting or management of organic waste an issue discussed on the island? What are the specific plans of the municipality for organic waste?
9. What do restaurants and hotels do with the organic waste?
10. Seasonal variations?
11. What happens with agricultural organic waste sheep wool, animal rests from slaughtering etc.?
12. What are the municipality plans for the near future in terms of the waste management?
13. What are the Greek legislations/standards that islands must fulfill according to the national plan (recycling, composting in %)?
14. What is the perception of the local community in terms of the need for improvement in order to abide to the EU legislations?

Traditions

15. Do you see the transformation from an agrarian society to a touristic island in terms of waste generation and composition of waste?
16. What role do traditions or habits play in the waste disposal of Samothraki or Greece?

Expert opinion

17. What is your opinion on the opportunity structure of waste removal on the island of Samothraki? Where do you see a need for improvement?

Questions to the project coordinator

1. What are the main challenges of the household waste management on the island of Samothraki?
2. What are the challenges of organic waste management on the island of Samothraki?
3. What is the story behind the creation of the “Sustainable Samothraki” Association?
4. What were the driving factors for starting this initiative?
5. What kind of support did the Association Sustainable Samothraki provide during the initiative?
6. Who are the stakeholders that helped in the accomplishment of the composting initiative? What has been their role?
7. How were you able to get all the stakeholders on board?
8. What have been the key phases for the implementation of the project?
9. Which were the factors that facilitated the implementation of the initiative?
10. Which have been the obstacles that you had to overcome along the way?
11. How did you choose your target group? How did you motivate the children to participate in the project?
12. Are there any lessons learned from the how the initiative was implemented so far? Would you say that the project has been successful?
13. How did the project evolve within the 2019-2020 period? Did the Association manage to expand the composting initiative in other areas of the island?

14. How effective was this initiative in paving a policy pathway towards organic waste collection in households and spreading the idea of composting?
15. What might be easy wins and what might be mid or long-term actions required to gain wider acceptance and impact from the composting project in the future?

Appendix 3: Field notes template

The information is used in an anonymous way if the opposite is not explicitly mentioned.

Principal information

Date
Name
Sex
Location
Role
Setting

Appendix 4: Information on the interviewees

Code	Date	Sex	Location	Setting	Role
C01	23rd of June, 2019; 30th of June	Female	Chora, Samothraki	At the interviewee`s home	Project coordinator
C02	24th of June, 2019	Male and female	School in Lakoma, Samothraki	Single Interviews with the children in turn	Students who have been participating in the initiative
C03	24th of June, 2019	Female	Harbor of Kamariotissa	Interviews with three mothers together at a Café.	Mother of a student who has been participating in the initiative
C04	24th of June, 2019	Female	Harbor of Kamariotissa	Interviews with three mothers together at a Café.	Mother of a student who has been participating in the initiative
C05	24th of June, 2019	Female	Harbor of Kamariotissa	Interviews with three mothers together at a Café.	Mother of a student who has been participating in the initiative
C06	25th of June, 2019	Female	Chora, Samothraki	Interview at a Café	Mother of a student who has been participating in the initiative
C07	25th of	Female	Chora,	Interview at a	Owner of the

	June, 2019		Samothraki	Café	Café and also a mother of a student who has been participating in the initiative
C08	25th of June, 2019	Male	Chora, Samothraki	Interview at a Café	Owner of the Café
C09	27th of July, 2019	Female	Chora, Samothraki	Interview via Skype	Teacher at the school in Kamariotissa
C10	27th of July, 2019	Female	Chora, Samothraki	Interview at a Café	Teacher at the school in Lakoma
C11	28th of July, 2019	Female	Kamariotissa	Interview at the interviewees home	Mother of a student who has been participating in the initiative
C12	28th of July, 2019	Male	Kamariotissa	Interview at a Café	Former major of Samothraki
C13	28th of July, 2019	Male	Kamariotissa		Owner of a hotel
C14	30th of June, 2019	Female	Therma	Interview at the Varades camping	Anthropologist
C15	27th of November, 2020	Female	Skype	Skype	Municipality employee
C16	5th of January, 2021	Female	Skype	Skype	Project Coordinator

11 Contact

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WORKING PAPERS SOCIAL ECOLOGY

Band 1
Umweltbelastungen in Österreich als Folge menschlichen Handelns. Forschungsbericht gem. m. dem Österreichischen Ökologie-Institut.
Fischer-Kowalski, M., Hg.; Wien (1987)

Band 2
Environmental Policy as an Interplay of Professionals and Movements - the Case of Austria. Paper to the ISA Conference on Environmental Constraints and Opportunities in the Social Organisation of Space, Udine 1989.
Fischer-Kowalski, M.; Wien (1989)

Band 3
Umwelt & Öffentlichkeit. Dokumentation der gleichnamigen Tagung, veranstaltet vom IFF und dem Österreichischen Ökologie-Institut in Wien, (1990)

Band 4
Umweltpolitik auf Gemeindeebene. Politikbezogene Weiterbildung für Umweltgemeinderäte.
Lackner, C.; Wien (1990)

Band 5
Verursacher von Umweltbelastungen. Grundsätzliche Überlegungen zu einem mit der VGR verknüpfbaren Emittenteninformationssystem.
Fischer-Kowalski, M., Kisser, M., Payer, H., Steurer A.; Wien (1990)

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Umweltbildung in Österreich, Teil I: Volkshochschulen.
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