Bachelor Thesis:

Local Governments Role in achieving Environmental Sustainability in Waste Management

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Abstract:

In a time of growing public environmental awareness, this thesis offers research on the role local governments can take furthering the environmental sustainability in waste management, by using a qualitative case study approach on the case of Münster, Germany. The research is building on the concepts of the circular economy, the role of local governments in an international framework and the difference between current and best practices, from an environmental sustainability perspective. The research finds that there are current waste management practices that do not seem compatible with the principles formulated in the legal framework. But although the research shows that the city of Münster has made use of many different measures, that are discussed as being possible ways for local governments to influence the environmental sustainability of waste management, the limited data fails to establish that conclusion, while creating further possibilities for future research.

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1. Introduction

Over the last decade, a new sense for environmental sustainability has been developing. Questions such as climate change, plastic pollution and over exploitation of the earth and its resources became an increasingly salient topic in politics and the public (European Comission 2020, Umweltbundesamt 2020 & Bloomberg 2021). These developments were only strengthened by the public discourse surrounding the climate change activist movement, especially Fridays For Future, which has made a strong impact on public discussion in Germany and the corresponding international treaties addressing future changes that must be implemented to stop irreversible damages to the planet and the quality of life on it, guaranteeing intergenerational and intragenerational ethical obligations, for example the Paris Climate Accord (United Nations 2016, Deutschlandfunk 2019).

One sector that is deeply interconnected with the research topic of environmental sustainability is waste management as it is responsible for possible harms to the planet but, at the same time, also a part of the solution to many environmental questions. The last decades have seen much European and national legislation, creating a framework of quotas, guidelines, and hierarchies (EUR-Lex. 2008, 1-8 & European Environment Agency 2021). Further, some effort was made in recent years to phase out the sale of certain plastic single use plastics, which have started to disappear from stores, and the German government has discussed further plans to ban plastic bags (Deutsche Welle 2019). Overall, the European Union and national legislation aim at implementing a circular economy model, changing the role of waste management in the life cycle of products.

Still, there is much room for improvement in the regulation of waste, especially concerning packaging, where coloring and mixtures of different plastics materials make their recycling or reuse impossible (Deutschlandfunk 2019). The waste management hierarchy that was established by the above-mentioned legislation prioritizes prevention and reuse over recycling while the quotas that were implemented through them and through the Kreislaufwirtschaftsgesetz mainly impose recycling rates (e.g. §14 KrWG), so more efforts could be made to encourage waste prevention and provide the needed education (EUR-Lex. 2008, 1-8 & European Environment Agency 2021). Therefore, this research aims at answering questions about the role of local waste management policy and how they attempt to combat current problematic waste management practices.

The significance of the research conducted in this thesis for science and society results from addressing the question whether local governments can solve problems of current waste management practices. As the research area of waste management not only has a direct impact on environmental sustainability but is also within the immediate reach of the citizens, it can trigger and influence change; change that is tangible. On the other hand, it is a topic that, aside from certain popular issues like plastic pollution of the oceans and shores, is often overlooked in its wider implications.

From a scientific perspective, other objectives of the conducted research are to show where current practices might need to be addressed, to evaluate possible changes and what can be done to tackle a complex issue like environmental sustainability in waste management at local level.

2. Research Questions

As should be clear from the introduction to this thesis, this work explores questions about the role that local governments play in addressing issues of environmental sustainability in waste management and what specific measures were used in the case of the city of Münster, Germany.

Therefore, the main research question of this thesis is the question: What can local governments do to achieve better environmental sustainability in waste management? The question is aimed at discovering the role local governments can play in an internationalized policy field such as waste management and it creates the need to understand the role that environmental sustainability plays in the context of waste management, that of local governments within waste management policy, as well as practices in waste management that do not contribute to enhance environmental sustainability or are even detrimental to it.

The corresponding sub questions that are going to be answered are first: What problems arise from the current waste management practices in terms of reaching a circular economy? Based on the theory put forward that the implementation of a circular economy is important to create a more environmentally sustainable waste management sector, this sub question is aimed at creating an understanding of what can be considered problematic in the current practices of waste management and why. Data that is presented in Section 5. Data and Documents is used to show whether current practices are indeed problematic as the theory in Section 3. Theory and Concepts would suggest.

The second sub question is: What is the city of Münster doing to combat those identified problems in their current waste management practices? This second sub question uses the case

of Münster to explain what they have done and what they have planned to combat those problems that need to be addressed in the circular economy and the broader field of environmental sustainability. The question uses the theory from the following section 3. explaining the role local governments can play when tackling unsustainability in waste management and the limitations that arise from various factors. In researching this question documents from the city of Münster and the city's waste management organization are used to provide the necessary data to answer the question.

3. Theory and Concepts

In the following paragraphs, the theoretical basis of the conducted research is discussed and the relevant concepts of environmental sustainability, the circular economy and the role of waste management in the circular economy are defined. These theories and concepts are derived from scientific literature and other publications through a careful review of the selected material. First the concept of sustainability and the distinction of environmental sustainability is discussed. Furthermore, the economic model of the circular economy is explained, its connection to the topic of environmental sustainability and its anchoring in the legal framework is shown. In the last section 3.3. various different elements of current practices in waste management are explained. Among other things, the legal framework and what it means for the freedom of action for local governments is addressed, where scientific literature sees deviations between best and current practices and what possible approaches and limitations there are to improving current practices at the local level.

3.1. Environmental Sustainability

As already implied in the introduction, the concept of environmental sustainability plays an important role in the research conducted. Therefore, it is important to define the concept of environmental sustainability and to clarify how it differs from the general concept of sustainability. The concept of sustainability is most commonly divided into the social, environmental and economic pillars and is defined by a balance between present and future impacts of a certain actions. Thus, environmental sustainability describes a system in which current practices and current use of resources do not damage the livability of the earth and the atmosphere, or as the Brundtland Commission has formulated it "development that meets the needs of the present without compromising the ability of future generations to meet their own

needs" (EUR-Lex 2021). The concept of sustainability therefore presupposes those finite resources are understood as such and that they are not wasted. In addition, the emissions that arise as a consequence of resource use must remain within a framework that guarantees the preservation of livability. Therefore, efficiency in the use of resources plays a central role in the concept of sustainability (Goodland, R. 1995, 10-11).

The role that waste management plays in achieving environmental sustainability is characterized by its role in the model of circular economy, where preventing resource waste is the key objective. Therefore, environmental sustainability takes priority over other notions of sustainability in this research, as the priority results from the establishment of the circular economy in the legal framework of waste management and the circular economy is aimed at achieving environmental sustainability. An action could therefore be considered more environmentally sustainable if the action creates less strain on the environment. This, for example, would mean that an action is more environmentally sustainable if it leads to less resources or energy being wasted and that, again, makes prevention a highly environmentally sustainable measure as it saves resources and energy used in the production of a good, as well as in its disposal once it reaches the end of its life cycle. On the other hand, incineration, for example, means that a good has been produced and resources and energy were used in the process, while in incineration only energy can be recovered. Overall incineration as a waste management method therefore has a larger impact on the environment than prevention, making it less environmentally sustainable.

3.2. Circular Economy

This next section explains the circular economy, which has been mentioned in the previous section. The benefits of the circular economy over the conventional economic model are laid out as well as the role of waste management within the circular economy model. Thereby explaining why the European and national lawmakers see that the circular economy should play a prominent role in the future of waste management. In addition, the definition of the circular economy is further used to point out the mismatch between theory and the reality of waste management in practice.

The circular economy model is the antithesis to the common model of the linear economy. In the linear economy the lifecycle of products starts with the extraction of resources to be used in production or to supply the energy for said production, then the product is used by the consumer

and is discarded when it no longer serves its purpose - which leads to valuable materials ending up in waste streams and thereby wasting finite resources. The increasing consumption of resources, together with the reckless waste of them, will at some point negatively affect the standard of living due to the high costs of material, the degradation of the environment and the unavailability of resources themselves (Andrews, A. 2015, 307-309). In addition, the energy demands of resource extraction and production of goods generate unnecessary amounts of greenhouse gases worsening the environmental sustainability (Brears, R. C. 2018, 2-11).

As a solution to these problems the model of circular economy was developed, in which resources and products are kept in a closed loop, where they are recovered at the end of their lifetime or reused if possible. Waste management has a central role in the circular economy, changing its purpose from discarding waste to recovering resources. The idea of the circular economy is not all that new; to some degree closed loop waste streams have been a part of the everyday life of German citizens for decades, starting with the recycling of glass and paper or the German Pfandsystem (deposit refund system) (Nelles, M. et al. 2016, 6-7 & Brears, R. C. 2018, 13-14). Due to its obvious benefits in environmental sustainability and the higher degree of independence from new resource extraction, the EU strengthened the role of the circular economy repeatedly (EUR-Lex. 2008). There are practical restrictions to resource recovery, though. Materials often cannot be infinitely recovered, for example due to contamination, thus there still is some demand for new materials. Additionally, many recovery processes are energy intensive. These limitations make reuse and prevention increasingly important part of the circular economy as it is less energy intensive (Neumayer, E. 2000, 156).

3.3. Waste Management and Practices

This following section introduces different elements that are important for the further research conducted in this thesis. First, in a short paragraph, the legal framework surrounding waste management legislation, the multiple levels of government involved and what they regulate with what scope, is presented. Second, the deviations between best practice and current practice are discussed, highlighting the role of incineration, recycling and prevention. In the last paragraphs, several possibilities for influence through local governments are discussed, as well as limitations resulting from a globalized production and consumer choice.

Research does not take place in a legally empty space, the existing legal framework consists of legislation made on multiple levels of government. Through those various levels of legislation,

the scope that is open to the policy maker becomes narrower, as legislation of a higher level has precedence over lower-level legislation. Much of the current waste management legislation is from the EU level and dates back as far as 1973. The directive (75/442/EEC) laid the foundation by establishing principles and introduced first practices connected to the circular economy model (Johnke, B. 1992, 303). The following EU directive 2008/98 of the European council and parliament directive, defines the waste hierarchy that is the current ground principle of waste management legislation, creates recycling goals for packaging waste and seeks to strengthen the circular economy (EUR-Lex. 2008, 1-8 & European Environment Agency 2021). These regulations were translated into German federal law as the Kreislaufwirtschaftsgesetz (circular economy act) (Umweltbundesamt 2020). Another piece of federal legislation that has further relevance for this thesis is the Verpackungsverordnung (packaging ordinance) of 1991, as it led to the implementation of the Duales System Deutschland, an organization of the packaging production sector, which to this day is in accordance with the polluter pays principle responsible for the recycling or discarding of the waste generated from their products (Azevedo, B. D. et al. 2021, 773). The states are more involved in the oversight and create guidelines for the cities to achieve the goals set out by the federal government and the EU (NRW 2021). Lastly, cities mostly use statues to regulate the day-to-day about waste management (Münster 2019).

The legal framework that was presented in the paragraph above has two very important takeaways that are a big influence on the further research in this thesis, on the one hand the waste hierarchy that has been established through the directive 2008/98/EC, which states a hierarchy from the most to least desirable waste management practices, starting at waste prevention, reuse, recycling, energy recovery and lastly disposal. On the other hand, it establishes the economic model of the circular economy as a goal of future legislation.

In practice, the German waste industry is dominated by the role of waste incineration and the recuperation of energy - and it has been over the last five decades. Waste incineration is not only a source of greenhouse gases (although often argued as negligible as the recovered energy is a substitution of energy partly created using fossil fuels) but also takes away the ability of many recyclable materials to be recovered (Umweltbundesamt. 2008, 2-18). Therefore, the heavy use of incineration is not only less desirable from the perspective of the waste hierarchy but is also not entirely compatible with the idea of the circular economy and the closed material loops it entails. Another problem resulting from the current legal framework, however, is that it largely regulates recycling, while there is less regulation of the prevention of waste generation

and the reuse of products. This might be due to the complexity of governing the influences on waste generation. Many authors have found that the strongest influences on waste generation are socio-economic factors, like economic development, income levels and the standard of living, therefore explaining the need for decoupling economic variables from waste generation as is proposed through the circular economy (Mazzanti, M., Montini, A. & Zoboli, R. 2008, 64-65). Furthermore, other authors also have acknowledged the missing waste reduction legislation, which lead them to discuss other variables that might influence waste management, such as waste management behaviors (intentions). They argue that for individuals to take part in waste reduction behaviors a person must be aware of one's individual impact on the environment by generating waste. Following this reasoning there is an argument to be made that waste management education can create a more environmentally sustainable outcome (Minelgaite, A. & Liobikiene, G. 2019). That education can play an important role in waste management is often discussed, a further factor where it could positively influence current waste management outcomes is in the role of combating misconceptions about recycling. Even when becoming more efficient, recycling is not perfect, but people seem to be questioned their own consumption and waste generation less, as they think it is not necessary. They believe recycling is enough, while being ignorant about unrecyclable packaging or the right way to separate waste (Hawlitschek, F. 2021).

But there are other ways to prevent waste, encourage reuse of products and improve recycling. One measure that always must be considered when trying to influence a consumer's behavior, is the extra effort that goes along with taking the step, therefore measures that do not create an extra effort can improve practices (Hawlitschek, F. 2021). Another measure that can be taken are promotions to consumers that emphasize certain product choices, choices that create less waste for example or products that are better recyclable. Further local governments can support local repair shops or other instruments that strengthen reuse efforts (Bildingsmaier, W., Fritzsche, A. & Kranert, M. 2017, 118-125).

Lastly, there are many limitations for local governments to create better waste management practices, this is a result of the narrow scope local policy makers have to influence the wider legal framework of waste management. The production processes are highly globalized and hard to regulate, especially the complications due to obsolescence of certain products, which can be a result of products being used only working for a certain time, products not being able to keep up with developments or societal changes that make them undesirable (Bildingsmaier, W., Fritzsche, A. & Kranert, M. 2017, 111-112). Another reason is that products and packaging

are often not created in a way they can be repaired or even recycled, this is in modern days often a problem of composite materials or dyed products which hinder recycling (Deutschlandfunk 2019 & Hawlitschek, F. 2021). Solving these problems cannot be addressed on the local level.

4. Methods

The following section 4.1. discusses the method used in this thesis and states the reasoning behind it, while also giving an insight of the steps taken using the method.

4.1. Qualitative Case Study

As stated in the introduction to methods section, the following paragraph discusses the research method used and the reasoning behind the choices made. This research is based on a qualitative case study. Qualitative case studies are a common sight in social sciences and public administration research. The added value of a qualitative case study is that it can be used in research areas, which do not seek to establish a generalization with broad implications, but when seeking to establish an understanding of the nature of a complex research problem. Further, qualitative case studies are particularly well suited to building extensive and in-depth descriptions combining various types of data and can be adjusted for different scopes of research (Baskarada, S. 2014, 1-7).

The research method was chosen as it can establish an understanding of a complex research problem. The research surrounding waste management is very complex as many different variables come into play, the legal framework, the globalized market, different technologies and materials that can have very different outcomes in terms of their environmental sustainability. In order to create this research literature was reviewed on the different environmental implications from waste management practices and on measures that local governments could implement, or that can influence unwanted environmental problems. Then a case was chosen and information regarding it was gathered to be analyzed in the context of the of the literature surrounding, waste management practices and their environmental effects as well as what the city of Münster could do and has done to counteract them.

5. Data and Documents

In the following section two different kinds of data that are used in the answering of the given research question are presented.

The first type of data consists of quantitative data from the federal government and the city of Münster, that display the wider problem of waste generation and of the incineration of recyclable material. Data from the city of Münster is presented that show how much waste is collected there and how much of the recyclable materials end up in the general household waste stream.

The second type is a content analysis of public documents that the city of Münster and its waste management organization provide. These include educational material which is aimed towards waste prevention, waste reduction and recycling measures as well as documents that discuss the future goals and steps that were taken in the city to better the recycling efforts, such as the implementation of the Wertstofftonne (valuable material bin). The content of those documents is presented and is of use in the further analysis of what the local government in Münster can do in order to create better waste management outcomes.

5.1. Quantitative Data

The quantitative data that is presented in the following paragraphs and that is needed in the analysis in the next chapter of this thesis in order to display the wider problem of waste generation and the incineration of recyclable material consists of publicly available information from the city of Münster and the federal bureau of statistics. The data was chosen to show whether there are trends in the development of generated waste and what the role of incineration is in regard of recyclable material. Furthermore, it was tried to find data on how to the separately collected recyclable materials in Münster are being processed, however, these are processed by a private company that does not provide any information on recycling. So, on recycling the only publicly available data that could be found is the data of the federal bureau of statistics.

The most recent published data from the city of Münster's waste balance 2019 provides several pieces of information that are of interest for the further thesis. First, the total amount of waste and the different waste groups into which it can be divided are given. For the year of 2019 the data shows that 171.403t were collected. The largest subgroups were residential waste with 67%, commercial waste 19% and bulky waste 10%. The materials in which the waste can be sorted are wood, paper, plastics, metals and other finer or heavier substances. In Münster, all of

the materials are subject of incineration, except the 3% of metals. The materials wood, paper and plastics are used in what is called energetic utilization or energy recovery (AWM 2019, 4-11). The waste balance also provides data on the waste generated per person annually for the 14 years between 2006 and 2019. It is presented in the Tab. 1 below.

Tab. 1 Waste Generation in Münster

Year	Waste Generation (per capita in kg)
2006	476
2007	485
2008	478
2009	475
2010	468
2011	459
2012	438
2013	431
2014	479
2015	426
2016	435
2017	428
2018	421
2019	417

(AWM 2019, 18)

The federal data that is needed to explain the rate at which materials that are separately collected in Germany are recycled, provides an overview of how much packaging waste is generated in a year, what materials were used and how much of the resources are recovered. The recycling rates between the different materials show large differences. While paper, glass and metals are recycled to between 90 and 100%, only 55% of plastic packaging is recycled. The other 45% are to a large degree incinerated or were brought outside of the country. The data is presented in Tab. 2 and the amount recycled of each material was calculated (Statistisches Bundesamt 2021).

Tab. 2 Recycling in Germany by Material

Packaging Material	Waste Generation (in 1000t)	Recycling Rate (in %)
Glass	1901	98
Plastics	1282	55
Paper, Cardboard etc.	1303	90
Metals	346	100

(Statistisches Bundesamt 2021)

5.2. Documents

In the following paragraphs in the Data and Documents section, four documents from Münster's city-owned waste management organization (AWM=Abfallwirtschaftsbetriebe Münster) and two documents from the city of Münster itself and their content is presented, when including relevant information. These documents are public and are released on the respective websites of the city of Münster and the AWM. First the AWM's sustainable waste management concept is presented followed by various documents about the waste prevention, reduction, and recycling efforts of the AWM, waste management education that is provided and the introduction of the Wertstofftonne as a new waste separation and collection effort.

The sustainable waste management concept 2016 is a 50-page document in which the AWM presents their future concept for waste management. This type of concept is a part of the overview implemented through the state of North Rhine-Westphalia and entails in addition to quantitative data about the city's waste generation, future measures that are planned to strengthen waste prevention and utilization. In the concept, the use of public relations to support environmental sustainability is explained. It is stated that the AWM is introducing the public to possibilities of waste prevention and giving answers to their questions. These materials are provided through printed flyers and brochures, while also being available online. In the course of this section, the content of the material provided will be discussed in more detail.

In addition, the AWM publishes an annual sustainability and business development journal. The public relations work includes many campaigns promoting the AWM's services and urging consumers to use them. In addition to campaigns, the AWM as a local organization creates a presence at festivals and events, where they make use of possibilities to educate on concrete problems like the collection of E-waste, while also introducing products like reusable bags as an alternative to plastics and other single-use products. The education efforts through events

are complemented by extra offerings for schools, for which they offer games, books and video material, as well as opportunities for field trips and holiday programs. Furthermore, they create offerings that promote reuse and waste prevention which will be further presented in this section (AWM 2016, 6, 18-21).

In the main part of the concept the different types of waste and their collection methods are presented, as well as changes planned or expected until 2025. The major change that is predicted, is the implementation of a new collection system for packaging and products from similar materials, such as plastic and metals. This change is predicted to be a result of the implementation of the Wertstofftonne. The expected changes are from introducing more recyclable material from the residual waste stream, into the light packaging waste stream (AWM 2016, 31-34).

Overall, the planned and existing measures presented in the sustainable waste management concept 2016 can be divided into three groups, the public relations work promoting waste prevention, reuse and recycling, the educational programs aimed at schools and the planned implementation of the Wertstofftonne, which is supposed to introduce more recyclable material into the recycling waste stream. But it is also stated that the resources for educational programs are scarce (AWM 2016, 41).

In this next paragraph the public relations work and the material that the AWM provides on their website is presented. The website of the city's waste management organization contains some educational material explaining in the introduction how much waste is generated by each citizen and how that is broken down per day. Second, they explain the importance of the prevention of waste and of reducing consumption, while also promoting reuse, recycling and composting. They present the reader with questions that should be used in questioning own consumption patterns, such as: Do I really need this? Can this be repaired or reused? Could I rent this or by it used? Have I thought about how it needs to be disposed? Further, they provide everyday tips on where you can fill up water bottles for free or buy unpackaged goods, how to limit packaging material and other everyday tips that reduce the use of single use-products or prevent their use. Another section of tips is aimed at preventing food waste through certain buying practices or food sharing services and more efficient use of products bought. To promote reuse, they provide an online swap meet for used products and stations where you can place things that you no longer need for others to take, while also promoting places where you can rent everyday items or buy secondhand clothes. Lastly, they provide information on where you can go to repair electronics and bicycles, while also providing information on upcycling

projects, where new value can be generated from old products by changing their use (AWM 2021a).

This following paragraph takes a closer look at the educational programs that the AWM provides. The educational program is divided into three categories, learning sites, learning materials and waste counseling for refugees. There are learning sites for preschoolers and young kids that help them to understand waste prevention, waste separation and waste utilization through games. For schools there is an adventure trail on the local landfill that introduces the students to the idea of the modern resource-efficient circular economy, from the right way of waste separation to waste prevention, recycling and climate protection. The learning materials provided reach from games to more complex materials for high school students that tackle the same core ideas of understanding waste management and the most important related practices. The last educational program is aimed at the introduction of refugees to the complicated system of waste separation and mainly bridge language barriers by providing material in many different languages and in addition provide stickers with the most important information for the different waste bins (AWM 2021b).

This last paragraph presenting the documents of the AWM revolves around the implementation of the Wertstofftonne. As it was explained in the sustainable waste management concept, the implementation of the Wertstofftonne was planned as a new waste separation and collection measure. In 2020 the Wertstofftonne was implemented for the whole city of Münster. With the implementation, the AWM provided material that tackles the most important questions consumers might have. The provided material states that while the best waste is the waste never generated, effective resource protection requires an efficient separate collection. It further states that the new collection method is not only easier but also more logical and model projects in two city districts show a high acceptance of the measure. The implementation was discussed for several years, but the organizations commissioned to handle packaging waste did not support the cities plan. The implementation was then supported through new federal packaging law in 2019, which broadened the scope of decisions cities can make. The other information that the AWM provides and has importance for this work is the before-mentioned new waste types that can be collected through the Wertstofftonne, toys, pots and pans and many other products made from plastics and metals now can be disposed through the new measure (AWM 2020).

Lastly, two documents from the city of Münster and their implications for waste management are presented. The documents are part of the sustainability strategy 2030 of the city of Münster

and have little overlap with waste management but there are still two measures that the city promotes in this area. On the one hand, the city wants to implement sustainable consumption patterns, for which the city wants to increase markets for sustainable products, increase the lifetime of products and create a sharing and swapping mentality to help conservation of value (Münster 2021a, 4-5). In the other document, the city aims at strengthening the use of reusable products like bottles, coffee cups and plans to create markets and events where people bring their own containers. And lastly, the city measures seek to limit the use of single-use products for public festivals and events (Münster 2021b, 24-25).

6. Analysis

In this following section of the thesis, the data from 5. Data and Documents is analyzed using the theory and concepts that were discussed in 3. Theory and Concepts. In the beginning, the theory and data are used to answer the first sub question: What problems arise from the current waste management practices in terms of reaching a circular economy? Then the second sub question is answered: What is the city of Münster doing to combat those problems of in the current waste management practices? At last, the answers to the sub questions are used to answer the main research question set out by this thesis: What can local governments do to achieve better environmental sustainability in waste management?

6.1. Sub Question I

In this first part of the analysis section, the first sub question is discussed. In order to answer that question, theories and concepts are used, especially the concept of the circular economy as it is characterized in 3.2. Here, the key element is that resources are kept in a closed loop where they can be recovered at the end of their lifetime. The concept already provides several assumptions on which resources can be recovered or are most likely recovered following current waste management practices, that is for example glass and paper (Nelles, M. et al. 2016, 6-7 & Brears, R. C. 2018, 13-14). Further, in the waste management practices section 3.3., the ground principle of the waste hierarchy is discussed. In the waste hierarchy incineration takes a smaller role while waste prevention, reuse and recycling are prioritized over incineration (EUR-Lex. 2008, 1-8sta). The before-mentioned waste management practices would be more compatible with the economic model of the circular economy as they reduce the resource usage. In the opposite to the waste hierarchy, the current practices show that incineration plays a

central role (Umweltbundesamt. 2008, 2-18). Therefore, it would suggest that incineration is to some degree not compatible with the circular economy model, as long as recyclable materials do not get recycled but incinerated.

When looking at the quantitative data, we see data from Münster and from the federal level that suggest that there are still relatively large amounts of recyclable materials that end up in waste incineration. The data from Münster shows that the residual waste that is collected through the city's waste management organization, the AWM, still contains recyclable materials such as plastics, metals and paper and only the metals are extracted from the waste streams (AWM 2019, 4-11). Therefore, a large amount of waste that has not been separately collected cannot be recovered anymore and cannot be reintroduced into the closed loops of the circular economy. The data from the federal level creates an even larger question about the role of incineration as a waste management practice not compatible with the circular economy, as even from the separately collected wastes the incineration rate of plastics could be up to 45%. This would mean that more than 500.000t of plastic packaging cannot be recycled and reintroduced into the waste stream (Statistisches Bundesamt 2021).

As an answer to the first sub question the following can be concluded, that current waste management practices create several problems for the circular economy. On the one hand, too many resources are pushed out of the closed loop, on the other hand, important concepts such as recycling, waste prevention and reuse seem too weak to promote an efficient circular economy. Following this answer, the second sub question therefore is revolving around the measures the city of Münster has taken in order to reduce the resources lost in the closed loop due to incineration. As well as, how to enhance waste prevention, reuse and recycling.

6.2. Sub Question II

In these following paragraphs the theory and concepts of how current problems in waste management practices can be combated by local governments, is combined with the measures that the city of Münster is using to combat the afore-mentioned problems, in order to put the taken measures into context. The problems of current waste management practices as presented in section 6.1., are the incineration of recyclable resources and the connected need to minimize the loss of resources, leading to the rising importance of waste prevention, reuse and better recycling.

First, the problem of the incineration of recyclable material and the combating measures are discussed. The measures that the city of Münster has taken to combat the current practice, is the implementation of the Wertstofftonne, in addition to using education to combat problems rising from the lack of knowledge of the consumer. The implementation of the Wertstofftonne, was a measure that aims at making waste separation in Münster easier and more logical by creating a better alternative to former collection methods for packaging waste. The benefit of the Wertstofftonne is that it allows for the disposal of more than just packaging waste, allowing to dispose of products that in the past had to be discarded separately, but often ended up in the residual waste. The Wertstofftonne now allows for the disposal of products that are made from similar materials as the packaging (AWM 2020). This measure is one that creates less effort for the consumer to separate wastes and recycle. As it was discussed in 3.3., the decrease of effort plays an integral role in the acceptance of an implemented measure (Hawlitschek, F. 2021). As the implementation of the Wertstofftonne makes it easier to separate more recyclable material from the residual waste streams, while creating requiring less effort as the former waste collection system, it makes for a good instrument to combat the problem of recyclable material to be incinerated.

The further measure that the city of Münster uses to combat the problem of recyclable material being incinerated, is education to improve the consumers role in waste separation. This is important in order to fight misconceptions and improve understanding of the practices (Hawlitschek, F. 2021). In the focus of the education campaign are on the one hand children and on the other hand people that immigrated to Germany and are not familiar with the German waste management system yet. Here the city of Münster focusses on education for refugees, as they make up a large part of immigrants in Münster. The educational material that is used is adjusted to fit the needs and preferences of the audience, creating playful solutions for kids and simple and logical solutions for refugees (AWM 2021b).

The second problem, addressing the importance of prevention and reuse, is combated through a number of different instruments using education and the public relations work. First, local governments can promote waste prevention and reuse through emphasizing certain product choices (Bildingsmaier, W., Fritzsche, A. & Kranert, M. 2017, 118-125).). The city and its waste management organization promote reusable products, such as reusable bags or the limitation of single use products at public events. Further, they make it easier to use reusable products by providing stations where bottles can be refilled and by creating more possibilities where unpackaged goods can be bought (AWM 2016, 18-21, AWM 2021a & Münster 2021b,

24-25). In addition, the AWM's online presence is used as an instrument to raise awareness, which as Minelgaite and Liobikiene (2019) argue is an important part of improving waste prevention and reuse. They argue that the consumer needs to be aware of one's individual impact on the environment by generating waste (Minelgaite, A. & Liobikiene, G. 2019). The website presents the consumer with her or his own share of the problem by showing them how much waste they generate per day, which is a measurement that is close enough to the consumer that it can put waste generation into context. Furthermore, the reader is confronted with a number of easy questions that one should ask themselves when planning to buy products. These questions, on the one hand, create awareness for the things that consumers should consider when buying products and further question unsustainability of consumption patterns (AWM 2021a). Lastly, the AWM provides information about local repair shops for electronics and bicycles, while also providing an own online marketplace and stations, where people can trade or give away products that are still working but are not longer in use (AWM 2021a). These instruments take up a large part of the online presence and support reuse. It could also be argued that the instruments provided by the AWM do not create much extra effort on the consumer's part in comparison to simply disposing of waste. This, as already explained, makes the use by the consumer more probable (Hawlitschek 2021). These instruments are one example of what Bildingsmaier et al. (2017) would argue are instruments that cities can use to encourage reuse (Bildingsmaier, W., Fritzsche, A. & Kranert, M. 2017, 118-125).).

In conclusion the second sub question, What is the city of Münster doing to combat those problems of in the current waste management practices?, can be answered as following. The city of Münster has used the implementation of the Wertstofftonne, educational programs, as well as public relations work to address the problems of inefficiency of recycling and the need for prevention and reuse. The measures that the city uses in order to combat these problems of the current waste management practices, are also widely supported by the theories that were presented in 3.3. as measures cities can use to create more sustainable waste management practices.

6.3. Main Research Question

In this last chapter of the Analysis the answers to the sub questions that have been answered are used with the addition of some additional data, theory and concepts. The main research question seeks to answer the question of what can local governments do to achieve better environmental sustainability in waste management? Due to the limited scope of the research, the method used

and the data analyzed, this thesis cannot have the aspiration to give a universal answer but it discusses what the city of Münster does to achieve better environmental sustainability in waste management.

First of all, we look at the legal framework in which the local government in Münster acts. As is shown in in the beginning of 3.3. the waste management legislation for Münster is dominated by the EU and the federal government, while the role of cities is to a large degree limited to implementing and executing the regulation that was decided on the upper levels of government. The city of Münster still has the possibility to influence the environmental sustainability of waste management through their own waste management organization or with decisions that fall into the realm of local policy making. Therefore, the reasoning behind the first sub question was to clarify what problems exist that could need addressing by a local government and the question connected the problems of the current waste practices with the concept in which they should ensure more environmental sustainability, the circular economy. The result is that the role of incineration especially in terms of the treatment of recyclable material is problematic, not because of the direct impact on the environment but due to the large amount of material that is not retained in the closed loops of the circular economy. This means that there is always a large need for further material and this could increase the energy consumption. This also means, as recycling potential especially of plastic is limited, prevention and reuse as well as better recycling are areas of key importance that must be addressed to achieve better environmental sustainability (Statistisches Bundesamt 2021).

The second sub question then discusses the measures the city of Münster has taken and shows the role they can play when wanting to address the problems that were discussed in the last paragraph. It shows that the measures are for the most part services that are provided but are not compulsory to use for citizens. These services consist of various programs promoting education, addressing just as many different audiences. The public relations work which promotes more sustainable consumption patterns and lastly the implementation of the Wertstofftonne, which introduces more recyclable material into the recycling system, instead of being all incinerated with the residual waste. The measures taken by the city represent the best practices that are discussed in 3.3. well and therefore it can be argued that they are good measures to take for Münster if they want to strengthen the environmental sustainability of the city's waste management sector. What the concrete impact of these different waste management practices, on the actual waste management outcomes is, cannot be answered by this thesis. An indication that might show that there is an effect of the measures the city of Münster has taken,

is that the waste generation per capita in kilogram in Münster (Tab. 1), show a decreasing trend in the years of 2006-2019 (AWM 2019, 18).

In contrast, it is relatively clear what limitations local governments have in their influence on environmental sustainability in waste management. As discussed at the end of 3.3., the narrow scope of local policy makers is not able to regulate the globalized production that has a large influence on waste management. For example, the obsolescence of products, as a byproduct of technological developments or societal trends, might not even be addressable on an international level, while planned obsolescence might be addressed by international or federal lawmakers (Bildingsmaier, W., Fritzsche, A. & Kranert, M. 2017, 111-112). The other problem mentioned in 3.3. that is also not addressable by the narrow scope of the local government are regulations on guidelines of packaging making it more recyclable (Hawlitschek, F. 2021). Lastly, an example of limitations of the local governments influence on more environmental sustainability can be seen in the implementation process of the Wertstofftonne, where negotiations with the service providers of the Duales System were stagnating until the federal government created a new packaging law. Only then the city was able to address the issues and continue with the implementation (AWM 2020).

The answer to the main research question is that local governments, as can be seen from the example of Münster, can react to certain problems of current waste management practices and take action against them with various measures and instruments. Since it is at least possible to take measures against unwanted developments with the help of public relations and voluntary education programs and simplified procedures like the introduction of a new collection system. However, the success in achieving environmentally more sustainable outcomes, through these procedures cannot be concluded from this work.

7. Conclusion

This thesis can be located in the broader field of environmental sustainability in waste management. In the specific, this thesis attempts to elaborate how local governments participate in achieving more sustainable waste management. In order to answer the question to what extent local governments have an impact on environmental sustainability, three research questions are formulated, of which the main research question is answered with the help of the sub-questions. The first sub-question is asked to get an insight into the major problems of the current waste management practice. The second sub-question then aims to present the actions of the city of

Münster in the context of the options available to it and other local governments. These measures are then evaluated in response to the main research question and an attempt is made to contextualize the results with the help of further theory and data.

The main takeaways from the research are that even in the modern western world there are problems in waste management, especially how much of the plastic waste is not recycled and instead is incinerated. From that a need for waste prevention and in general the development of environmentally sustainable consumption patterns can be derived.

In contrast, it is surprising how many services the city of Münster offers through its waste management organization. Not only are measures taken, but those fall within the range of instruments that are prevalent in the discussed theory. While the data and methods used in this thesis cannot prove the extent to which the measures taken by the city have a direct impact, the trend in reduced per capita waste generation in Münster is shown in Tab.1.

Then what is the significance of the results of the conducted research, are they generalizable? What are the weaknesses or limitations of the conducted case study? As indicated in the last paragraph, the results of this research show that cities can enact measures that the theory would support; that they can influence the environmental sustainability of waste management. Whether this is causally true in the case of Münster cannot be answered by the case study. The measures that a given city can take are very specific to the legal framework in which the city operates, so there is the possibility that measures taken by the city of Münster cannot be implemented by other local governments, in other countries or states. Therefore, it can be criticized that the research conducted in this thesis is very limited in the conclusions and generalizations that can be drawn. On the other hand, the many measures Münster has taken and the declining trend of waste generation in Münster that were discussed in this thesis could influence further research into the correlations and causations between measures as taken by Münster and the developments seen. In a research project with more resources a larger number of cases could be used to achieve a better insight into what the effect of each measure taken by Münster is.

8. Literature

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