

Understanding the factors influencing waste management policy decisions: A comparison between two waste management systems in the Netherlands.

Nathan de Wolde – S3463737

Group 5 – Ina Horlings

Inhoudsopgave

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Summary

This research aims to discover the factors influencing waste management policy decisions in municipalities in the Netherlands. The question is: What factors influence policy makers decisions in choosing a household waste management system? In order to answer this question, an analysis of academic and grey literature has been conducted. Policy documents regarding the waste management strategies of three Diftar municipalities have been compared with three source-separation municipalities. To conduct the analysis, the waste triangle was used. The waste triangle is a practical tool for waste policy makers to build their policies. The research started open-minded and without a hypothesis because there was too little research to build a hypothesis on. This analysis found for Diftar policy environmental and political reasons were important and for source-separation economic factors.

Introduction

Background

Since the emergence of mass production of consumer goods after the Industrial Revolution, human influence has had an increasing impact on people's living environment (Wang et al, 2016). Our increasing emissions of greenhouse gasses will alter the global climate and result in an increasing number of environmental problems for humanity (Allen et al, 2010). To mitigate our influence on the planet and its climate, we need to make societal adjustments. Not only do we need to decrease production and produce in a more sustainable way, we also need to start recycling old materials in order to reduce the amount of waste. The planet's natural resources are finite which means that we need to use them more consciously. Already, there are numerous examples of initiatives of recycling such as, for example, batteries within the European Union (Rombach & Friedrich, 2007) or the use of PET bottles in concrete (Choi et al, 2005). A big part of waste produced by humans is household waste, which is hard to process due to its widely differing content. Therefore, this waste is mostly dumped on ever-expanding waste sites, polluting the ground and subsequently the ground water (Raman & Narayanan, 2008). In developed countries the average citizen produces 500-750kg of waste every year (Karak, Bhagat & Bhattacharyya, 2012). In the Netherlands, the average citizen produces 550kg of household waste (CBS.nl, 2020). This collection of household waste is the duty of the municipality and their choice of waste management systems can differ. In the Netherlands, two household waste management systems seem to be dominant, namely: 'Diftar' and source-separation. The Diftar system is a system used in the Netherlands where the charges for waste collection by the municipality depended on the amount of waste offered by the citizen. In figure 1 a visual representation of Diftar can be seen. The first bin offers a lot of waste and therefore the owner has to pay a lot of money. The last bin offers little waste and thus he pays a little. The intention of Diftar is not waste separation, but rather waste prevention. In essence with Diftar, the polluter pays for its environmental impact. The costs are higher when waste is not separated or prevented. Therefore waste collection with the Diftar system is based on an economic incentive for the citizens. If they are economically conscious, they try to limit their waste production as much as possible. The other system, source-separation, contains less freedom for the citizens. Here, different types of waste are collected separately. A visual representation of source-separation can be seen in figure 2. Waste is collected in separated bins, compost, plastic, paper and residual waste, and then recycled into useful resources. Residual waste is dumped on landfills but can also be incinerated. To stimulate the participation in separation, the citizens are not able to provide a lot of residual waste. With source-separation the municipality organizes a low amount of collection trips for residual waste and provides collection services for the other types of waste. Subsequently, they are more or less forced to separate in order to dispose their waste. Little research has been done regarding the factors influencing waste management policies in municipalities. Therefore this research attempts to shed a light on the factors influencing the policy makers decisions to pick a household waste management system.



Figure 1: Visual representation of Diftar

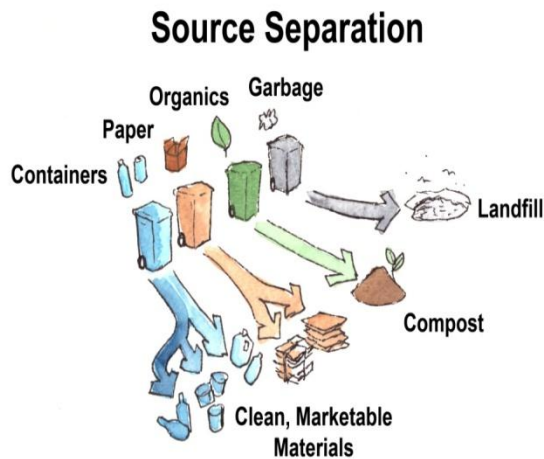


Figure 2: Visual representation of Source separation

Research problem

Municipal waste is one of the most substantial categories of waste generation. Its management has a high influence on environmental components, both positive and negative (Altmann & Chotovinský, 2018). Its decomposition on landfills contributes up to 4% of the emitted greenhouse gases (Papageorgiou et al, 2009). The options of disposing of household waste are incineration, recycling or composting (Bhada-Tata & Hoornweg, 2012). If all other options fail, waste is disposed upon landfills where it is stored until it can be processed properly. For recycling and composting, the separation of waste is an important factor. Those methods only work when only the target waste is used, otherwise the end product will be tainted and unusable. Therefore, it is important to find the most efficient way of managing this type of waste to make our current lifestyle more sustainable. Policy makers mainly have three options for waste management: two door-to-door options and the use of pneumatic systems. The difference between the door-to-door options (Diftar and source-separation) is the incentive placed for the citizens who need to separate their waste. Waste can be separated voluntarily with an economic incentive, or it can be separated more or less forced because otherwise it piles up in their homes. However, since not every municipality uses the same waste collection system, there is still debate on which collection systems are most efficient. It might also be possible that the most efficient method differs per region or municipality. The objective of this research will be to explore the benefits of certain waste management systems. Since little research has been done on the topic of influence factors of waste management system, this research aims to fill that gap. Knowledge regarding these factors can help guide future policy decisions. During this research two door-to-door systems will be compared, namely the Diftar system and the source-separation system. From both systems, three municipalities are reviewed on multiple influencing factors, namely, environmental, economic, political and convenience factors. These factors are established by academic literature and theories used in decision making practices. The question of this research is: What are the factors influencing the policy makers' decisions in choosing a household waste management system?

Structure of the thesis

This research will begin with a theoretical framework that explains the current institutional situation regarding waste management policies and combines it with important researches from the field of waste management. This will form the basis of the hypothesis of this paper. The methodology of the

research is explained next. After that, the results of the analysis are explained, interpreted and placed against the background of existing research. In case no strong linkage with existing research can be found, a logical reasoning is used to explain the phenomena. Lastly, the conclusions of this research are explained and discussed, taking the limitations of the research into account.

Theoretical framework

Studies have been conducted on different elements of waste collection systems. However, researchers focused little on the influences of different factors on the policy decision. In the collection of waste, participation of the population plays a crucial role. Without their involvement waste separation at a household level would be unsuccessful (Babaei et al, 2015). Another factor which influences the choice of waste collection system is governmental expertise and financial capabilities. According to Bolaane (2006), a lot of municipalities continue with their conventional collection system due to inexperience with different options and fiscal constraints. In other words, the population's participation, financial costs and expertise seem to be decisive factors. Yet, Source separation is a popular management system due to its environmental and economical benefits (Bernstadt et al, 2012). However, it does provide logistic and operational challenges. Garbage vehicles are very fuel-inefficient. Separating waste at the source would require more collections with trucks and thus increase environmental and economic costs (Nguyen & Wilson, 2010). Economic actors naturally want to limit these costs (Chen et al, 2018). Therefore, costs also play an important role in the policy decision. This tendency to decrease costs especially play a major role for the Diftar system, since this system is based on this behaviour. Other alternatives like pneumatic waste collection, where waste is collected via a sewer or pipeline, have been proven to be highly costly and also not as environmental friendly as door-to-door collection, especially when implemented in older neighbourhoods (Teerioja et al, 2012). Therefore, the pneumatic system is not included in this research.

Since little research has been done regarding the influential factors of waste policy decisions, this research attempts to limit its expectations. Even though Diftar is based on an economic principle, this does not immediately result in an increase of importance for economic factors. It might be the case that environmental factors are more important for the source-separation management system, but since this also results in higher collection trips by garbage trucks this cannot be said with confidence. Therefore this research was conducted without a hypothesis but rather with an open mind to find out the influencing factors.

The factors which will be researched are loosely based on the waste triangle, the triangle is rarely used in academic literature but often used in practice. The waste triangle, as can be seen below in figure 3, is used in the researched waste management policy documents and is used in many municipalities in the Netherlands. This triangle displays the balance which can be found in household waste management policies.



Figure 3

The triangle shows that a policy decision needs to have a balance between three factors: environmental factors, economic factors and service factors.

Environmental factors have been subdivided into two more distinct consideration: Emission of greenhouse gasses due to incineration and emissions of greenhouse gasses due to garbage trucks because of their fuel use.

In this research, the costs component of the waste triangle is presented as a sub-factor of the economical factor. The sub-factor costs consists in this research as the costs for the citizens. The second economic factor is resource retention. This research has deliberately placed resource retention as a sub-factor of the economic factor because most municipalities view resource retention as a source of revenue rather than as an environmental improvement. The last sub-factor of economic benefit regards any economic benefit which can result from the waste management system. These economic benefits are applicable to the region, not to the municipality itself or the households.

For the purpose of this research, service factors have been made a sub-factor of the overarching political factor because other factors, like public and private pressures or citizens resilience, also influence the policy makers decisions in political ways. This research regards service factors as the services provided by the municipality to facilitate the waste disposal of citizens. This can be for example the amount of collection trips or a waste monitor. A prime example for one of the public and private pressures is the waste processing company. This company often provides the municipality with policy options which subsequently influence, to some extent, the basis of the policy. Citizens' resilience or participation is added on the basis of the research by Babaei et al (2015) in which they state that citizens participation and thus their capability to participate is a determining factor for the success of a policy.

Lastly, the factor of convenience, that is, the (in)experience with a certain policy and the costs of changing a waste disposal system, has been added on the basis of Bolaane's research from 2006. The consideration of continuing the existing policy due to 'convenience', for it is known and cheaper, is a factor which might not be admitted by a lot of municipalities. It might, however, be a factor which influences a lot of the decision making. In this research, convenience is a municipal consideration. If the municipality is neglecting their duty of providing a proper waste management system due to convenience, the result becomes visible in a failing budget or insufficient research. A

successful municipality has the knowledge and funds to pick the most suitable waste management system and thus convenience is a small influencing factor.

The combination of these factors which might influence the policy makers decision resulted in the conceptual model which is displayed in figure 4.

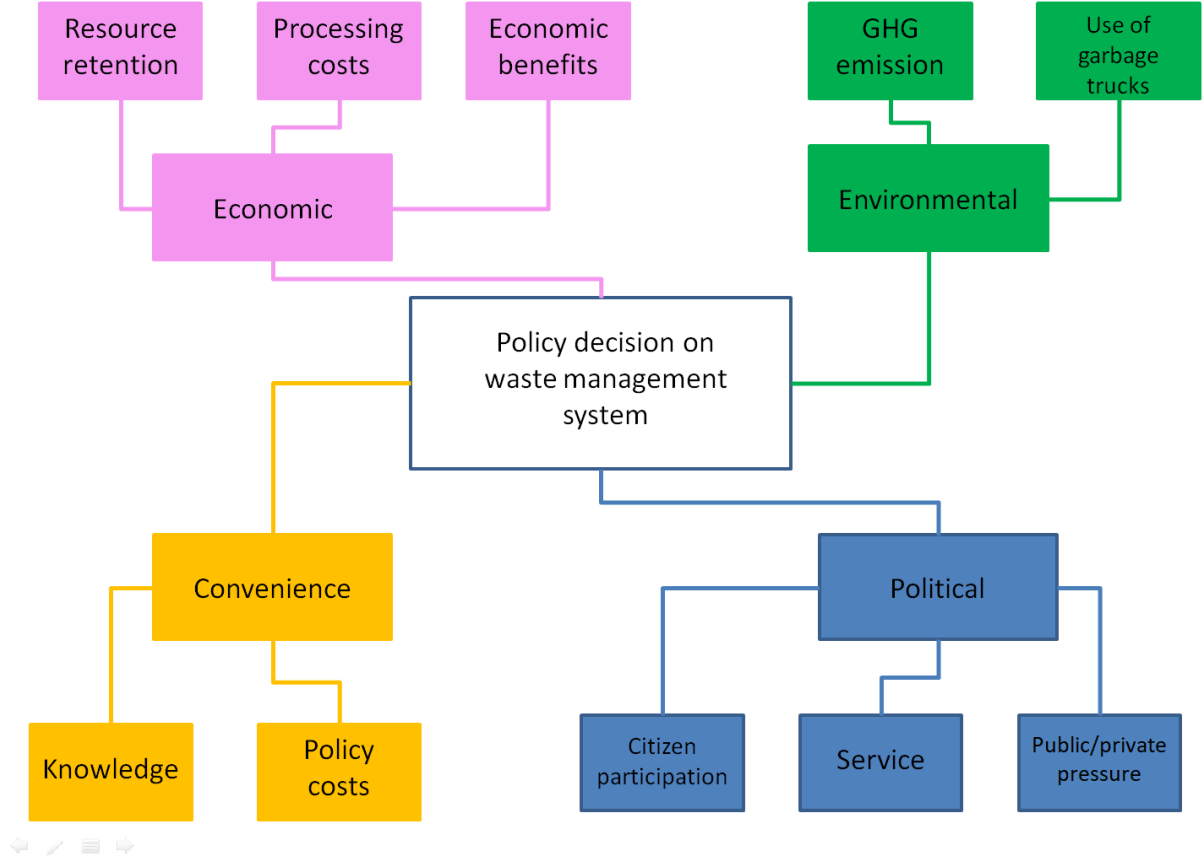


Figure 4: conceptual model

An important thing to note would be the cause and effect relation. This research uses the policy documents of the waste management policies to find out which factors influence the waste management system. Therefore it is possible that this research finds the results of the waste management decision rather than the cause. It is possible that factors which have to be taken into account because of the chosen waste management policy are dominant in the following policy document, because they are the weak spot of the chosen waste management system. However in this research it is assumed that a municipality used the influencing factors to choose a suitable waste management system. It seems illogical to pick a waste management system first and then consider which factors are important for a policy. Showing the consequences rather than pointing out the strong points of their decision would put the municipality in a bad daylight and highlight their incompetence. Therefore it is more logical that a policy document would predominantly show the strong points system to gloss over the faults of the waste management system.

Methodology

For this research, a qualitative research methods has been chosen. An analysis of grey literature has been conducted to find out which factors influence the policy makers and their importance in the policy choice. A qualitative research was chosen because factors which influence the policy decisions are subjective. The factors influencing policy decisions are different for every municipality. Similar factors can influence a policy decision in a different way, resulting in whole different reasons behind a policy decision. These type of reasoning behind an influencing factor or policy decision are not visible in quantitative research.

In an attempt to research the factors influencing policy makers three municipalities were selected from both waste management system, resulting in a total of six analyzed policy documents. Two municipalities were previously contacted for another type of research which was unable to proceed due to unforeseen circumstances. This earlier type of research involved interviews. But because of the mitigation measures to limit the spread of the COVID-19 virus it was impossible to obtain representative interviews. Therefore it was decided to research the policy documents. The two contacted municipalities, Groningen and Meppel, both offered their support in choosing municipalities with comparable household waste management systems which explains the current selection of municipalities in this study. Their advise resulted in the selection shown in table 1.

Selected municipality	Type of waste management system
Hilversum	Source-separation
Meppel	Source-separation
Tynaarlo	Source-separation
De Wolden	Diftar
Groningen	Diftar
Hoekse Waard	Diftar

Table 1: Selection of municipalities

After the selection of the municipalities, the policy documents regarding the household waste management systems were collected. This was done in one of two ways, either by contacting the municipality directly or by searching on their websites for the public policy documents. After obtaining the documents, passages were colour-coded on the basis of the following topics: environmental, economic, political and convenience. This provided a clear overview of the factors' frequencies and their importance within the documents. Afterwards, the sections were further divided as can be seen in table 2. The factors are based on the theoretical framework.

Article	What is being said?	Importance	Interpretation
Environmental			
Greenhouse emissions			
Use of garbage trucks			
Economical			
Resource retention			
Processing costs			
Economic benefits			
Political			
Citizen			

resilience/participation			
Public opinion/service			
Public/private pressures			
Convenience			
Policy costs			
Knowledge			

Table 2: Factors researched

In the first column, what is being said, of the table every variable will contain the marked statements made in the document. In the second column, of every overarching factor a conclusion of their importance in the policy document is made. This importance is based on the amount of colour-coded markings in the document. If a factor is marked frequently these factors are perceived as more important. Also qualitatively the markings are analyzed. If a marking clearly states that one factor is more important to the municipality than the other, they will be weighted as more important. The last column consists of a small summary on the topic which can be inferred from the content of the policy document and is mainly based on the quotes placed in the first column. This column contains the researchers interpretation of the policy.

Results

The results will be discussed in the following chapter by looking at the results of economic, environmental, political and convenience factors for both systems. For every factor, the results for the Diftar system will be looked at first and after that the source-separation systems results will be discussed.

Political

The Diftar system is a system based on economic consequences for citizens and to stimulate these citizens to decrease their residual waste by prevention or separation. By charging higher prices for more residual waste, citizens should have the incentive to produce less waste to save money. Despite this, the analysis showed that from the point of view of the municipalities the Diftar system was influenced more by environmental and political factors than by than the expected economical factors (see appendix). This analysis showed that many municipalities who chose the Diftar system, high service levels were important. They stated frequently in their policies how they wanted to improve and maintain high service levels for their citizens. Public opinion played, therefore, also a big role as it provides a clear measure of effectiveness of the service level. Some municipalities like the municipality of Hoekse Waard used their citizens satisfaction as a tool to measure the effectiveness of their policy. Every year they send out a survey to find out what rating their waste management service received from their citizens. High happiness meant that their policy was a success. The municipality of Groningen, on the other hand, used a questionnaire to take citizens opinion into account when making their policy decision. Both the municipalities of Groningen and De Wolden used soundboard groups or citizen organizations to inform their citizens about their plans and also become aware of their desires based on their feedback. The importance of political factors, mainly public opinion, citizen influence and high service level, might be explained through the research of Babaei et al (2015). Babaei's research stated that citizens' participation is a determining factor for the success of a waste management policy. The Diftar system's success in separation is based on the willingness of the citizens to separate their waste with the economic stimulus or on their own

initiative. If the population has high resilience and willingness to adapt to a new lifestyle involving waste separation, the system will be a success (Babaei et al, 2015). By providing high service levels, a municipality can lower the threshold to separation and make separating waste a more attractive option. Increasing service levels can, therefore, increase the participation rate of citizens and thus ensure the success of the Diftar policy system. The analysis showed that political factors are important for Diftar municipalities. Especially service levels and public opinion play a significant role in the decision making for waste management policy.

The importance of political factors for source-separation is, according to this analysis, focussed on different sub-factors. With the Diftar system, public participation and opinion can be pointed out as the most important sub-factor for political concerns. However, with source-separation the public and private pressures seem more dominant. Most source-separation policies stem from national regulations, which are then implemented locally. The municipality of Hilversum is a prime example where the whole regulation is based on the national policy of VANG. This is a policy where the government tries to stimulate municipalities to transform their waste into resources. It is understandable that source-separation is then the preferred choice. Source-separation seems to be one of the most successful ways to process waste back into resources. On the other hand, the example of Tynaarlo, where the municipality switched from Diftar to source-separation, private pressures played a major political role. The waste processing company, which is not a part of the municipality, at first gave advise to the municipality regarding the economic and environmental consequences of their waste policy. However, these results were disappointing when actually implemented because there was a bigger environmental impact and economic costs were higher. Therefore, the municipality consulted the company again. The company advised the second time to switch to source-separation since that would be environmentally and economically better. Comparable to the Diftar system, the citizens opinion of the waste policy is an important factor in the policy. However, contrary to Diftar, with source-separation the importance of citizens participation is lower. Since with source-separation there is no choice whether citizens want to separate or not, less participation is needed. From the analysis it can be concluded that political factors are important for both policy decisions, but the sub-factors influencing the policy are different. For Diftar, public opinion and participation is important and with source-separation public and private pressures are weighted heavier.

Environmental

According to this analysis, Diftar municipalities also seemed more occupied by reducing residual waste for environmental reasons compared to source-separation. Residual waste has a lower recyclability, results in more incinerated waste and more environmental pollution. Diftar municipalities increased their efforts to prevent as much waste as possible to reach the incineration oven. Measures were mainly taken to prevent residual waste all together. Groningen promotes the reuse of waste rather than the recycling of waste. Reuse is focussed on the extending of the lifecycle of products. For example, a lot of goods do not even turn into waste but are repaired or reused by other users. This is a necessary move away from consumer culture and throwaway culture (Gregson et al, 2013). It can be stimulated by the municipality by improving links between waste collection organizations like thrift shops and the waste processing companies (Alexander et al, 2009). This communication would result in a higher level of reuse of waste by bringing reusable waste to thrift

shops. Not only do Diftar municipalities concern themselves with the prevention of waste, but also with the mitigation of waste incineration consequences. Waste incineration proved to be higher in Diftar municipalities compared to source-separation. The municipality of Hoekse Waard, for example, admitted that their waste consisted of three quarters of recyclable materials, while the municipality of De Wolden admitted that half of their waste was still separable. One can assume that more of this waste would have been separated if source-separation was used. Therefore, finding solutions on how to profit from incineration seems more pressing in Diftar municipalities. Since more waste is incinerated, higher profits from this type of energy retention can be achieved. Examples of these profits of waste incineration is the energy recovery during incineration, as is the case in Hoekse Waard. According to a case study in Romania by Vaida & Lelea (2017), this can result in an energy recovery of up to 80%. However, waste incineration, even with some energy recovery, is not an environmental solution unless until further improvements are made (Johnke 1991). Municipalities with Diftar seem more open to new and inventive solutions regarding the waste management system. The municipality of Groningen stated that they actively are encouraging entrepreneurs to test new solutions regarding waste processing. This analysis showed that environmental concerns are an important factor for Diftar municipalities. They are pressing as the use of incineration is higher and other solution than separation are needed to minimise residual waste.

The other separation system, source-separation, is thought of as a more successful policy when a goal of high recyclability of waste was set. With the separate collection of the source-separation system, higher quantities of waste are collected and processed together. This means that it becomes easier to recycle, since no separation is needed. The analysis confirmed in both Diftar policies and source-separation policies that the separation rate, thus recyclability of waste, was higher in the case of source-separation. These findings are supported by the findings of Bernstadt et al (2012) in their study in Denmark, who also found that source-separation has a higher separation rate. Their findings showed that almost 80% of their waste could be recycled. This analysis showed that most municipalities started out at around 50-60% of their waste being recycled. With the implementation of source-separation they attempt to recycle 80% of their waste. The improvement of the separation rate and recyclability of the waste seems not to stem from environmental reasons. The analysis showed rather that economic motives were more important. Aside from this higher rate of recyclability with the source-separation system, this analysis found barely any other environmental considerations. There are no mentions of other environmental improvements being made aside from the use of source-separation. This might be explained by Vassanadumrongdee & Kittipongvises (2011) who claimed that source-separation is one of the more sustainable ways for waste management, as is also admitted in both types of policies discussed in this analysis. Therefore, one can assume that if the municipality is already using one of the more sustainable ways of waste management, new improvements of their system is not one of the priorities. An example of improvements which are not found in source-separation municipalities is the energy retention during incineration. Hence it is understandable that the policies focus more on other aspects which needs improvements.

Economic

The most important feature of the Diftar system, different tariffs for different amounts of waste offered, is based on a economic principle that people naturally want to decrease their costs (Chen et al, 2018). As Puig-Ventosa & Sastre Sanz (2017) argued, an economic stimulus is a powerful tool to regulate waste behaviour. However, the analysis showed that economic factors were not

predominantly expressed in the policy documents. Economical factors which were expressed in the documents were mainly processing costs for the municipality and economic benefits which a system could provide for the region, thus discussing the costs for the municipality instead of looking at the costs of the citizens. With the Diftar system, the municipality does not collect most of the waste separated. If separation for resource retention takes place, this is at the treatment plant or with other third parties. For example, in the municipality of De Wolden and Hoekse Waard, paper is collected by separate organizations. Since resource retention is not the responsibility of the municipality, it was mentioned little in the policy documents. With the Diftar system, after the collection and delivery of the waste at the processing company, the responsibility of the municipality is finished. If the company wants to separate or incinerate is their choice. Economic benefits from the Diftar system has been found by the analysis mainly regarding thrift shops and other organizations granting products a second life. An increase in employment, especially for people with a distance to the job market, is one of the most mentioned benefits. However, the most important sub-factor seems to be processing costs. The processing costs with the Diftar system seem mainly based on the separation rate of the citizens. When a lot of residual waste needs to be incinerated, costs are high. However, since the Diftar municipalities are not in direct control of the separation rate, they have to find other incentives to decrease costs. Probably in almost all Diftar municipalities, an increase in service level or environmental gains are stated to be more important than costs. This results for some municipalities for higher costs levels, which have to be paid by the citizens, increasing processing costs. This shows that Diftar municipalities are more concerned at minimising costs for citizens.

To the contrary of the Diftar findings, in source-separation municipalities, economic reasons seem to be one of the more important features. Resource retention seems to be the most important sub-factor and the other two factors seem to follow naturally from it. The findings seem to support that resource retention lowers processing costs and increases economic benefits and this reasoning is not unfounded. Successful resource retention by high amounts of separation, which is the goal of source-separation, lead to a high recyclability. This high recyclability in turn results in resources which can be used for the production of products. The raw resources gained from waste recycling, therefore, generate a revenue. This revenue can be used to either lower the processing costs for citizens or for the economic benefit of the region. Between processing costs and economic benefits there can be a trade-off (Creason & Podolski, 2001). Lower processing costs result in lower costs for citizens but also lower revenues for processing companies. Lower revenues mean lower economic benefits. This analysis showed, however, that the preference of municipalities choosing source-separation is rather on maximising revenues gained by resource-retention. A clear example is the municipality of Meppel, where almost the whole policy document is focussed on the opportunities which source-separation offers for decreasing costs and generating revenue. For the municipality of Tynaarlo, source-separation offers a way to decrease costs on the long run and as the municipality of Meppel claimed, source-separation also offers quick short term money. It can be concluded from this analysis, that the economic factors influencing source-separation policy is mainly about costs saving. The high amount of resource retention results in a revenue which is mainly used to decrease costs but could also be used for other economic benefits. Since it is a policy which lowers costs on both the long and short term, it can be seen as a policy which is beneficial when a municipality struggles with their fiscal policy.

Convenience

Lastly, policy decisions influenced by convenience. This analysis found that for two of the Diftar municipalities, Hoekse Waard and Groningen, convenience did not play a big role. The municipality of Groningen stated that they were actively searching for new innovative ideas on how to deal with waste. They claim to encourage entrepreneurs to test their ideas in their municipality and are not afraid to invest in new systems. Hoekse Waard chose to start their improvements by using implementations which were easy to implement and would result in relative high gains. This does mean that future improvements require a lot more effort. Yet, they claim to be able to increase their efforts in order to improve the waste management system and increase citizens happiness. One municipality, however, the municipality of De Wolden, had some more difficulties with convenience. They stated in their policy document that they struggled with budget. This meant that they were unable to implement their waste management system entirely to their desire. An imbalance in the need for funding and the funding provided shows that the municipality prefers a cheap and convenient waste management system than to allocate funds to pick the most suitable option. For them, convenience poses a more serious factor in the policy decision. Essentially they were forced to continue on the only possible path to them. This path was to continue with their current system, even though they knew that there were better systems available. They were practically unable to choose their own path.

The situation of the municipality of De Wolden can be compared with the case of Tynaarlo. Tynaarlo was using the Diftar system before they switched to their current source-separation system. This switch from Diftar to source-separation was not, however, voluntarily. The municipality of Tynaarlo had done a research in collaboration with their waste management company regarding the costs and environmental consequences of their waste management policy. In their research, the municipality of Tynaarlo assumed that the surrounding municipalities had chosen for Diftar as well. Because of this assumption, they calculated that the Diftar system would be the cheapest and most sustainable waste management system. But in reality, their surrounding municipalities had chosen for the source-separation waste management system. This mean that costs were higher and environmental gains were limited. This forced the municipality of Tynaarlo to the source-separation system as well. The case of Tynaarlo again shows that convenience can play a major role in policy decision. If the policy decision is based on insufficient research or collaboration, it can result in the need to overhaul the whole policy. The other source-separation municipalities, of Meppel and Hilversum, did not face these problems. They had done their research properly and frequently monitored the situation and subsequently it seems like their policies worked fine. This analysis showed that convenience plays a minor role in policy decision making, if the two categories are properly managed. A municipality needs the funds to be able to pay for the policy costs and they need the proper knowledge to pick the suiting policy.

Discussion

There is an important consideration to take into account when reviewing this research. The research has taken place amidst a global pandemic, which limited the research considerably, and the review of policy documents regarding waste management system was chosen as an alternative. In an ideal situation another method, which can arguably be considered better, could have been chosen, namely

in-depth interviews. In-depth interviews would have provided a direct insight in the mind of policy decision makers, while the analysis of policy documents is more prone to interpretation. Another weakness regarding the chosen method can be observed in the results. The current results show factors which were addressed in the policy document. When looking closely at the results, it can be noted that the factors which showed dominance and thus were considered important were different factors than the theory of both waste management systems. Diftar system, which is based on economic impulses, showed political and environmental factors as important while source-separation, which is argued to be the most environmentally friendly system, showed economic factors as important. These results can be seen as influencing factors of the policy decision, but can also be seen as consequences of the policy decision. It can be argued that the decision of the policy maker was based on different factors which are currently invisible in the policy, namely the strong points of a waste management system. These strong points wouldn't need any addressing and the weak points needed extra attention. Therefore would the weak points become dominant in the policy rather than the strong points. This is however not very likely, most policy documents are written down in a way which shows the competence of the municipality rather than its shortcomings.

One of the chosen factors, convenience, is an interpretable factor. The lack of mentioning of convenience factors can be interpreted in two ways. Firstly, one can look at the lack of convenience factors as a clear example of convenience by the municipality. The current policy is working and, therefore, there is no reason to change much about the policy. This means that the municipality is lacking will to explore new strategies, subsequently acting in a convenient way, meaning that convenience is important. The second way, which has been chosen in this research, is that if policies have to change, the municipality has shown convenience before choosing their policy. The municipality does not allocate enough funds or does not do a proper research to achieve the best waste management system. This behaviour of convenience results in a policy which is not sustainable and therefore it had to be changed. This interpretation has been chosen because it does more harm to neglect the waste policy due to convenience than maintain a successful policy due to convenience.

Conclusion

This research attempted to find an answer to the question: What factors influence policy maker's decisions in choosing a waste management policy? To find an answer to this question the research looked into the publically published policy documents of six Dutch municipalities which use either the Diftar system or the source-separation system. To establish which factors were most important for the policy, the waste triangle was loosely used. This triangle, though not familiar in academic literature, is used in most practical situations and helps a policy maker to build a balanced policy. The triangle shows that a policy should find a balance between three factors: Environmental, costs and service. The triangle was broadened for the scope of this research with the addition of more factors and the subdivision of factors into sub-factors. Also, based on the research of Bolaane (2006) the factor convenience was added to find out whether this played a role. The Diftar system is a system used in the Netherlands where the charges for waste collection by the municipality depended on the amount of waste offered by the citizen. If more waste is offered, higher charges are asked. The analysis found out that for Diftar two factors seem most important: Political and environmental factors. With regard to political factors, public opinion and participation were shown to be more

pressing concerns in the decision making. Within the environmental factors, new innovative ideas to process waste were encouraged. In contrary, for source-separation environmental factors seemed of little influence. This might be due to the fact that the system is already perceived as the most sustainable systems. Therefore, there was little incentive for the municipalities to increase the sustainability of their system. However, the analysis found that economic factors were dominantly found in the policy documents, especially the economic benefits source-separation would provide. This benefit would stem from resource retention. The separation of waste seemed important for the generation of revenue, which could be used for economic gains, rather than the environmental gains.

Therefore, it can be concluded that different factors play different roles in the waste management policy choice. Not only is there a difference between the factors which influence the policy decision, there is also a difference in the underlying causes of those factors. With Diftar, economic concerns are more focussed on minimising costs, while for source-separation it is about maximising resource retention. Political reasons differ between the two systems as well: Diftar is more concerned on the public opinion and service levels, source-separation on the other hand is more influenced by public and private pressures. Environmental factors consist of different considerations as well. Since the source-separation system is regarded as one of the most sustainable waste management system, the municipalities employing the system have little incentive to make their waste management system even more sustainable. In contrary, Diftar municipalities are actively searching for new ways to make their waste management system more environmentally friendly. For convenience little can be concluded. Too few and diverse cases have been found, which means no solid conclusions can be formed. The research does however support that if a municipality ensures the proper funding and research for a waste management system, it can build a working system. The cases of this research which struggled with convenience problems showed to have ineffective and broken systems.

The waste management policy could be further explored by looking into different waste management policies. There are a myriad amount of other ways to dispose of waste. The pneumatic system or underground garbage collection have not been taken into account. These waste management system are more focussed on the physical collection of waste and are barely explored by municipalities due to their high costs. However, they could pose a solution in a world which is continually crowding and subsequently producing increasing amounts of waste.

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Appendix 1: Hilversum

Hilversum	What is being said?	Importance	Interpretation
Environmental	<p>-“The ambition is to lower the environmental impact and pressure. Therefore a circular economy is important”</p> <p>-“Clean, complete and safe are our base.”</p> <p>-“Most resources are won by using a source-separation system. With end-of-chain separation the eventual separation rate is lower”</p> <p>-“We hope that by providing a separate bin for plastics, people will consciously help with a cleaner public space”</p>	<p>Little has been said regarding the emission of pollution substances. They mention that by decreasing their residual waste they decrease their burden on the environment. This is due to less resources used and lower incinerated residual waste.</p>	<p>To mitigate its environmental impact, the municipality of Hilversum wants to be able to recycle high grade waste. This is best done by using source-separation. The separated waste will result in more waste being turned into new resources. This has an added effect of lower CO2 emissions due to less waste incinerated.</p>
Greenhouse emissions	<p>-“By reusing waste we can save energy. So separating waste helps the environment”</p>		<p>According to the municipality of Hilversum, not only does less incineration of waste help save energy, but also less production means a lower environmental burden.</p>
Greenhouse emissions due to garbage trucks			
Economical	<p>-“We want a budget neutral policy”</p>	<p>Economical reasons are second. They are mentioned regularly after the service level arguments to implement this policy.</p>	<p>For the economical reasons, resource retention seems to be the most important. The municipality wants to be ahead of market changes and minimize their resource use and increase their resource production through waste. By separating their waste they get a higher amount of resources and therefore are interested in the policy. The added side effect of lower processing cost of less incinerated waste seems like an added benefit. These gained resources will help the municipality by having lower</p>

			prices. They also want to provide jobs in the system for people with a distance to the labour market.
Resource retention	<p>-“Resources and recycling are an important theme. By reusing waste, we can save resources”</p> <p>-“Reusing resources helps mitigate scarcity and have an economic value.”</p> <p>-“Waste should be seen as a winnable resource”</p> <p>-“ With end-of-chain separation the eventual separation rate is lower and therefore more expensive”</p>		The municipality of Hilversum focuses on resource retention mainly because they expect scarcity on the market. They expect due to the scarcity an increased resource price. They mainly seem to want to recycle their waste to mitigate increase resource costs.
Production costs	<p>-“By reducing residual waste we avoid expensive incinerator costs. Which in turn will result in lower costs for citizens.”</p> <p>-“The processing costs will become new yields”</p>		The municipality hope to decrease the costs for the processing of waste by profiting from the revenue generated by the gained resources. Also due to lower incinerator costs the costs to dispose of waste will decrease
Economic benefits	<p>-“By stimulating the prevention of waste, products will be made more sustainable, less resources will be used and the chance of recyclability is higher”</p> <p>-“We want to increase the amount of work for people with a distance to the labour market”</p>		By integrating more people with a disadvantage on the labour market in the waste processing process, the municipality of Hilversum hopes to employ more people. They also hope that by stimulating the people to reuse and prevention of waste, producers will adapt to that change by providing more sustainable product. Those sustainable products would require less resources and result in higher recycling rates.
Political		1 Political reasons can be stated as the clear priority. The national policy of VANG has heavily influence the policy and the policy seems	The municipality of Hilversum is heavily invested in the service of their citizens. They value the happiness of their citizens above all. This becomes clear due to its priority in the document, its amount of mentions and the level of detail in which it is

		mainly based on serving the citizens of Hilversum due to the high mentions of provided services. It is also mentioned first in the goals and bases of the policy.	described.
Citizen resilience	<p>-“For a proper waste management policy we need to find a balance between management system, citizen acceptance, marketing and communication”</p> <p>-“Citizens need to separate 106kg more waste. This is an average of 2 kg a week.”</p> <p>-“The implementation will require higher participation by citizens but not in an increase in staff”</p>		The policy Hilversum has implemented is naturally depended upon the resilience of the citizens. They demand high standards from their population. In return they try to communicate well and provide high service levels.
Public opinion/Service	<p>-“By increasing our service level we hope to increase source separation.”</p> <p>-“We want to tailor separation for every building type. Citizens with a disability will also get a tailored situation”</p> <p>-“The satisfaction of citizens about the management system should be equal or increase.”</p> <p>-“We want to increase our service level to increase the separation rate”</p>		The municipality of Hilversum seems to have a top priority in the service levels for their citizens. The policy goes into detail on how they can help different types of building adapting to the system or their exceptions for disabled people. They provide these high service levels in the hope to increase separation rates.
Public/private pressures	<p>-“The policy is made based on the national program of VANG (From waste to resources)”</p> <p>-“We want to bring separate parties together as much as possible. More cohesion and coordination in the waste chain are important”</p>		Most of the policy build by the municipality of Hilversum are based on the national policy of VANG. To implement these policies on a local scale they asked for the input of local stakeholders. They did this to integrate and ensure their participation in the system.

	-“The municipality has the challenge to implement national policy.”		
Convenience	-“To realize our ambitions we need to change our current management system” -“With the implementation of underground containers, we need to take into account the possible switch to diftar.” -“After implementation of the policy we will monitor the situation to see where problems arise and how we can solve them”		The municipality of Hilversum implemented the system of source-separation based on their researches and those subsequent perceived benefits. Whether these will turn out to be true will be closely monitored. Otherwise the municipality will always be able to change to a different strategy like diftar. They are aware of the difficulties a new system can provide and are making sure that problems will be dealt with in time and adequately. Policy costs are minimized where possible, but at the same time the funds are used in such a way that the invested costs will always result in yields.
Policy costs	-“policy costs are depended on the amount of separation by citizens. The more separated, the lower the costs are.”		The policy costs in Hilversum are mainly depended on the participation by the citizens. If separation rates are high, costs are relatively lower compared to low separation rates. Therefore the main costs are in the service, to provide an incentive to the population to separate their waste and lowering policy costs.
Knowledge	-“We will monitor and evaluate yearly our policy.” -“We researched what we need to do to reach our goals.” -“We have conducted a few tests to determine the success of our policy”		The municipality of Hilversum has done their research before they chose a policy strategy. Therefore they know what to expect. After their implementation they will continue to monitor the situation to be sure it works as they had hoped and to know where they can improve the policy.

Appendix 2: Meppel

Meppel	What is being said?	Importance	Interpretation
Environmental	<p>-“By separating waste we help create a sustainable society”</p> <p>-“In a sustainable society, producers take responsibility for their products and how they can be recycled”</p> <p>-“For now we assume that source-separation will result in a higher degree of separation”</p> <p>-“We strive for a clean and sustainable society”</p> <p>-“In our attempt to become a society without residual waste, we currently accept 30kg per citizen a year”</p> <p>-“We are capable of recycling more, but because government policy only wants to facilitate, we let recycling be dominated by the market functions.”</p>	<p>Sadly, environmental reasons seem to be lacking in this policy document. A few are mentioned with one or two words, but they seem to be more of a positive side effect rather than the main goal. Therefore this factor seems to be the third most important factor. The goal to limit residual waste comes forth from environmental concerns, but the main consequence which is noted over and over is not environmental. Therefore it seems like environmental reasons seem to create a problem, which can be fixed by the municipality with other more important benefits.</p>	<p>The main problems concerning the environment the municipality of Meppel is concerned about is the scarcity of resources. They make very clear that there is a lot of potential in residual waste which we can benefit from. They try to encourage separating residual waste because post-separation has a lot bigger polluting impact upon the environment.</p> <p>There is a drive to limit the amount of trips made by garbage trucks. However this effect is mitigated by the need of increased trips to pick up separated garbage.</p> <p>The municipality of Meppel strives to decrease its amount of residual waste to 30 kg per inhabitant per year. The strive towards this goal to make Meppel a sustainable society. This goal is mainly to survive the expected scarcity of resources.</p>
Greenhouse emissions	<p>-“A downside of separation at the treatment plant is the increase emissions.”</p>		<p>The municipality tries to reduce greenhouse gas emissions by making the absolute minimal amount of collection trips. It became clear in the report that as soon as a collection trips made by garbage trucks seemed not viable anymore, it was cancelled.</p> <p>The municipality of Meppel partly chooses to encourage a source separation system because post-separation results in more pollution during separation and processing. The encouragement is done by limiting the collection trips made by garbage trucks to increase the amount of separated waste.</p> <p>However this does mean that the trips removed from residual waste are replaced by trips made</p>

			by garbage trucks picking up separated waste.
Greenhouse gas emissions due to garbage trucks	<ul style="list-style-type: none"> -“The collection frequency will decrease” -“We will decrease our collection frequency for residual waste” -“By cancelling the collection of KCA, we do not have to hire a truck anymore” 		
Economical	<ul style="list-style-type: none"> -“By reducing household waste, we can decrease costs for citizens.” -“Waste should be labeled as resources” -“We should be aware of the volatile price of paper” -“To cover our expenses, we decrease our collection trips and invest these savings in the new infrastructure” 	In the municipality, it seems that economical factors are the most important when dealing with household waste. In the policy document, countless times the economical opportunities household waste provide are mentioned. The main reason to choose for a source-separation system seems to be economical benefits, especially the ability to gain resources out of waste. The policy is consciously busy with maximizing profits which are hidden in waste. The document makes very clear that all costs made by the municipality should be covered.	The municipality of Meppel seems very conscious of the financial benefits which source-separation could provide. They researched the potential the system had and chose to invest in the more sustainable option. Especially the increased amount of resources gained and decreased costs for inhabitants were appealing.
Resource retention	<ul style="list-style-type: none"> -“In the coming decades many resources will become scarce, therefore prices will rise. Waste can largely be used anew, it is a resource for a new product or material. Different types of waste can generate revenue” -“We can make quick profits by separating compost, old paper and 		Resource retention seems to be the main goal of the whole policy. In almost every section the opportunity to extract valuable resources out of our residual waste is mentioned. These regained resources would have a positive economic impact which would be easy to achieve. They stress the importance of viewing waste as a resource rather than waste. The only problem

	plastics.”		regarding this topic seems to be the volatility of the market. There is no constant certainty over the price of the recycled materials.
Production costs	<p>-(Goal) “We want the costs for residual waste to be as low as possible”</p> <p>-“Costs of processing residual waste is higher than that of separated waste. In many cases it even generates revenue.”</p> <p>-“with source separation, we have to process lower amounts of waste which will result in lower processing costs. Therefore we strive for a halving of costs for citizens”</p> <p>-“The municipality costs will be covered with their activities”</p>		<p>The municipality is keen to decrease costs for the inhabitants. This is done by maximizing profits out of waste. Since the retention of resources with source-separation is higher, this means that they can charge lower costs to the inhabitants. The costs made by the municipality are covered by the monetary profits from retention system.</p> <p>Since the source-separation system was recently put in place, initially the costs might be higher. Due to the need of behavioral change of citizen, the amount of separated waste might be initially low. The garbage trucks will however provide their designed service from the beginning, so probably reach lower yields.</p>
Economic benefits	<p>-(Goal) “We want the positive results of our policy to be for the benefit of the citizens”</p> <p>-“Compared to diftar, investments and savings are directly for the municipality”</p>		<p>The main economic benefit of the use of source-separation according to the municipality seems to be the resource retention. When waste is separated at the source, more can be converted into useable resources and these give numerous advantages. By selling these resources, the citizens of Meppel have to pay lower charges to dispose their waste. The resources could also be sold to local industries at lower prices to boost their production.</p>
Political		<p>Political reasons would be the number two factor influencing this policy. The success of this policy was dependent on the participation of the population and their views upon the system. To win their</p>	<p>The source-separation system implemented by the municipality of Meppel provided a change in household waste management system. This system required a lot of adaptation by the population. Since citizens participation this was the key to the policies success, the municipality heavily invested in educational programs</p>

		<p>participation the municipality put a lot of effort into convincing and stimulating the population into working with the program. Therefore this is clearly one of the more important factors.</p>	<p>and provided fiscal and social stimuli to encourage source separation. Clear examples would be higher service level for separated waste or lower charges for waste processing. The whole policy emerged from national laws with the advice of producers. However the municipality does point out the flaws of this national law and how recycling could be improved if the national laws were improved</p>
<p>Citizen resilience</p>	<p>-“To succeed we need to realize a change in our way of thinking” -“A collaborating role is wished for to make this policy a success” -“From our research we know that citizens are willing to help improve the environment and want to separate their waste for that. Citizens are willing to take their responsibility” -“Especially in high-rise, people lack the space to keep an extra bin.”</p>		<p>Since the municipality proposed an entirely new waste collection system in this policy document, they relied heavily on citizens resilience. The population had to adapt to a new waste collection system and put more effort into disposing of their waste. This was implemented based on a research which showed that people are willing to take responsibility to improve our environmental situation. Regardless, the population is the main factor of success in this system. Therefore it was paramount to inform them of the benefits of source-separation.</p>
<p>Public opinion/Service</p>	<p>-(Goal) “We want citizens to be stimulated to prevent residual waste” -“Where possible we will increase our service levels” -“We want higher service levels for separated waste” -“More than in a diftar municipality, the citizen must feel the stimulus through infrastructure and service”</p>		<p>To compensate the sacrifices made by the population, the municipality would increase service level regarding waste collection. More collection trips would be made by garbage trucks to help facilitate the policy change. However these increase service levels are only applicable to separated waste. In contract, residual waste service levels would decrease. Therefore the stimulus to separate waste would be higher. Public opinion would increase due to an increase informed population who would be consciously trying to better the environment.</p>
<p>Public/private</p>	<p>-“We have high</p>		<p>The municipality has build their</p>

pressures	<p>ambitions, however as seen in other places in the Netherlands this should be doable.”</p> <p>-“The way we collect drinking cartons is dependent on the national laws.”</p> <p>-“Because of private interests of the producers, costs are unsure on the long term”</p> <p>-“With the advice of producers, a local policy has been chosen”</p> <p>-“With the current governmental laws, aluminum and cans are not recycled. We believe however this is doable”</p> <p>-“The government does not enforce their policy regarding the obligation of the producer to ensure their packaging can be recycled”</p>		<p>waste management policy according to national laws. That means that they chose their policy with the advice of producers and on the basis of local waste management infrastructures. This means that producers do have more or less a say in the chosen policy. The municipality also mentions the flaws of the current situation. It is the responsibility of the producer to make sure for the reuse or financial collection efforts of collecting their products after their use. However this is not enforced with all product. Mainly the batteries and other severely polluting products are doing this. If this would also be employed by producers of plastics, cartons and cans there would be a lot more waste that could be recycled. Sadly there is no way for a municipality to enforce this.</p>
Convenience	<p>-“Currently it’s easy to dispose of your residual waste, just throw it in the grey bin. However this way we lose a lot of valuable resources.”</p>	<p>Convenience is the factor which seemed to have played the smallest role in this policy. The whole household waste management has been changed, therefore one cannot say that the municipality of Meppel sticks to their old convenient way.</p>	<p>The municipality of Meppel has chosen to implement a new policy regarding the management of household waste. They have chosen to attempt a new strategy, so are consciously trying to invest in new ideas. Therefore one cannot say they try to save money by sticking to their old policy. By changing to a new system they gain knowledge as a municipality but also share more knowledge with their population. Therefore both profit from the policy change</p>
Policy costs	<p>-“By using already in place infrastructure, we decrease policy change costs”</p>		<p>The change of policy to source-separation is a challenging ordeal and not without a change in policy costs. The change would not directly improve the financial situation due to increase investment costs. However on the long run this policy would demonstrate to be more sustainable. The fact that the</p>

			<p>municipality took this leap shows that they do not stay in their convenient old pattern but try to improve their situation by attempting to employ new strategies, even at an higher costs.</p>
<p>Knowledge</p>	<p>-(Goals) “We want citizens to be informed of waste separation” -“We want to gain experience with giving and receiving feedback to the citizens”</p>		<p>Since the system was only attempted on smaller scales, the municipality was required to attempt To inform the population of the benefits was crucial to the success of the policy. This meant that the municipality had to put serious effort into educating the population through meetings and seminars.</p>

Appendix 3: Tynaarlo

Tynaarlo	What is being said?	When is it being said?/ Priority/ Importance	Interpretation
Environmental	<p>-“The main focus was on environment and costs”</p> <p>-“Resource management results in a lower quantity of residual waste”</p> <p>-“Emphasis on the prevention of garbage”</p> <p>-“For now it is a nice middle way to let organizations collect waste paper, but in the long run we might have to centralize it to increase environmental gains ”</p>	Environmental reasons are mentioned second in the policy document. When discussing every type of waste it is almost always mentioned how this particular type of waste has to be processed to achieve the maximum amount of environmental gains. The policy has been changed due to lower environmental gains when using diftar	As clearly is stated in the document, environmental reasons with play an important role. The municipality is mainly focused on reducing the amount of residual waste. This is to prevent this waste of ending up in an incinerator which will result in higher CO2 levels.
Greenhouse emissions	<p>-“In the future we will look at the CO2 emissions and the influence of resource management on public spaces”</p> <p>-“This way, less GFT ends up in incinerators. This gain in GFT waste can be used for compost”</p>		The municipality of Tynaarlo seems aware of the consequences of neglecting residual waste management upon the environment. They consciously try to avoid increasing CO2 levels by reducing their residual waste and by choosing the right policy.
Greenhouse emissions due to garbage trucks	Nothing has been said regarding CO2 emissions from garbage trucks.		
Economical		Economical reasons are third because the policy had to change due to lower economical and environmental gains with diftar. They stress the importance increasing source separation to achieve maximum amount of financial gains.	Economical reasons seem important, but mainly to fund the rest of the design.
Resource retention	-“the separation of plastics result in environmental gains and in term financial		Even though the municipality of Tynaarlo change from

	benefits”		diftar to source-separation. Little has been said regarding resource retention. They mainly focus on the benefit of resource retention for environmental gains. Economic gains seem like a side benefit.
Production costs	<p>-(Goals) “Decreasing costs for citizens”</p> <p>-“making in term the step towards resource management. In the long run, resource management results in lower waste management costs”</p> <p>-“In the future, costs will play an important role.”</p>		Reducing costs on the long run seems the main focus of Tynaarlo’s fiscal policy. By implementing a new waste management system they hope to achieve lower production costs on the long run
Economic benefits	<p>-“Currently, organizations collect paper to collect money. We encourage this to increase people’s awareness of the value of money. However by centralizing this process we could achieve a higher financial gain.”</p> <p>“In a society where more and more state subsidies are taken away from organizations, we feel like this is a nice middle way.”</p>		The municipality of Tynaarlo seems care greatly for the benefits of their citizens. They lower the total economic benefit slightly by letting organizations collect waste paper, to ensure their continued survival. Since organizations receive ever less state subsidies this can help them stay afoot.
Political		<p>Political reasons were last. Even though they did stress the importance of the participation of the population, this was mainly to minimize resistance rather than needing their input. Since they previously used diftar but this didn’t work due to lack of knowledge of surrounding municipalities, this can’t be regarded as a</p>	<p>The municipality of Tynaarlo recognizes the importance of citizen participation in their policy. Therefore they try to implement natural stimuli, high service levels and informative was to dispose of their waste. However due to a different circumstance outside of the municipality they are forced to change their policy. Because of this</p>

		very important factor for them.	change, they seem to ask more from their citizens than before.
Citizen resilience	-“By implementing a financial stimuli we hope to increase separating of compost”		This quote seems to implicate that compost separation can only be improved by implementing financial stimuli.
Public opinion/Service	-(Goals) “Keeping up the service levels.” -“We strive to keep the amount of garbage containers to a minimum” -“Implementing the policy in phases to increase the support base and limit resistance”		Even though the municipality strives to keep their service levels high, these quotes clearly implicate that the result of policy change will result in lower service levels. They put considerable effort into keeping the population happy to be able to change their policy. Which means that without those efforts the population would be unhappy, probably due to lower service levels.
Public/private pressures	-“Results of diftar were disappointing. Since a few other municipalities have chosen for diftar, the treatment plant could not optimize end-of-chain separation and lower yield were achieved.” -“only a little amount of other municipalities have chosen for diftar, which meant the process could not be optimized. To improve results we will start using source-separation.”		As becomes clear in the policy document, Tynaarlo has chosen wrong in their waste management system. By being one of the only municipalities in Drenthe choosing the diftar system, they stumbled upon lower optimization and were more or less forced to change.
Convenience		Convenience is first. Even though convenience had the least amount of quotes, the policy had to change because the previous system didn’t work. They were	The municipality of Tynaarlo has made a minor mistake by choosing for the waste management system diftar which could in this situation not be optimized. They chose

		<p>unaware of what others were planning and those consequences. This lack of knowledge resulted in the need to redesign their waste management policy.</p>	<p>for this policy because it seemed like the most sustainable one. However due to lack of knowledge it was the opposite. If they were more aware of their colleagues plans they could have prevented this mistake. Regardless, they did change their policy as soon as they realized their policy did not result in the expected results.</p>
Policy costs	<p>-“To limit the costs of changing, it is important to ask for participation of citizens.”</p>		<p>The municipality of Tynaarlo seems mainly interested in their citizens participation to minimize their policy costs. This is an understandable choice because their policy would fail without the support of the population.</p>
Knowledge	<p>-“Teaching the citizens the value of garbage and the negative consequence of residual waste” -“Because of lack of knowledge, organizations collecting waste paper and selling that sometimes do not receive market conform prices.”</p>		<p>The municipality of Tynaarlo seems to be struggling with knowledge. First of all their lack of knowledge or collaboration with other municipalities in Drenthe resulted in their current policy change. Secondly, they let organizations collect waste paper. However due to lack of knowledge of the market they receive lower prices for their efforts. In contrast, the municipality does stimulate their population to be conscious about waste.</p>

Appendix 4: De Wolden

De Wolden	What is being said?	Importance	Interpretation
Environmental	<p>-“The national government has set a goal of reusing 50% of our primary resources”</p> <p>-“People born in 2000 will not be able to mine all resources from the earth anymore”</p> <p>-“The council thinks it’s important to invest attention on societal sustainability in time”</p> <p>-“De Wolden needs to prioritize sustainability over service and costs”</p> <p>-“We want to decrease our average residual waste per person to be 100kg or less”</p>	As is clearly formulated in the policy document, for the municipality of de Wolden environmental reasons are a priority over service and costs. However since the municipality is financially not able to implement every policy they want to this is not the biggest factor in the choice for a waste management policy.	Even though the municipality of de Wolden shows its noble ambition by stating that they value environmental reasons before service and costs, it is worth remembering that they also state that they are not able to implement all policies due to high costs. Nevertheless it becomes clear where the priorities are for the municipality and they are doing whatever they can to reduce their amounts waste as much as possible. As long as the ambitions are in the right place, the funds which are available will be well spent.
Greenhouse emissions	<p>-“By incinerating less waste, lower amounts of CO2 are emitted”</p> <p>-“We want to perform an energy transition from fossil fuels to sustainable energy sources like sun and wind energy”</p>		The municipality of de Wolden tries to convert their ideals of being environmental friendly by reducing their amounts of residual waste. By doing that they emit less CO2. They are also searching for solutions to replace fossil fuels for sustainable energy.
Greenhouse emissions due to garbage trucks	-“Due to the current supply of waste we can lower the amount of collection trips.”		By monitoring closely, the municipality of de Wolden knows how to minimize their collection trips.
Economical		Economical reasons are the third most influencing factor in this policy document. A lot of attention is paid to find a solution for the implementation and costs of the policy and the limited financial	The municipality has clearly financial troubles regarding their waste management policy. They state that they have a fundamental shortage for the waste management policy. There is still a lot to improve in the management system with still over 50% of the waste consisting of resources.

		<p>situation. However despite their environmental strain, the municipality does seem to value environmental reasons above economical as becomes clear when they say costs might increase to make the policy more sustainable.</p>	<p>Nevertheless they do value environmental concerns above economical which might explain some of their financial struggles. They say that they could increase their spending to have a bigger environmental gain.</p>
Resource retention	<p>-“We strive to apply techniques to reuse as much as possible, to use as little resources as possible.” -“50% of residual waste consists of resources which can be separated.”</p>		<p>The municipality of de Wolden is more focused on reuse than the separation of the resources. They stimulate their population to reuse and they take responsibility for most of the separation by doing end-of-chain separation.</p>
Production costs	<p>-“With an additional tax on incinerating waste, the government hopes to decrease the amount of residual waste” -“To make the system more sustainable, higher costs can be charged” -“There is a structural shortage in our policy costs” -“With the use of diftar, the structural costs will decrease”</p>		<p>The municipality of de Wolden is aware of their financial problems regarding the waste management policy. Therefore they take measures to mitigate this structural shortage. Higher costs can be asked to provide a better sustainable system, which shows their favoritism towards environmental concerns above financial.</p>
Economic benefits	<p>-“Together with local thrift stores we start an initiative to clean up entire attics for free, sellable items and non sellable items. In return the thrift store gets a small compensation and can recycle this waste for free.” -“More fair way of dividing policy costs, big boost to sustainable initiatives. However the system can lead to disadvantages to people with high amounts of waste outside their control</p>		<p>Due to their priority of environmental reasons above economical, there are little economic benefits from their policy. Costs might even increase. However the municipality does try to ensure that the polluter pays with their diftar system. This only has the negative side that people who produce large amounts of waste outside of their control are the victim. The municipality also tries to</p>

	(like medication etc.)”		find creative ways to dispose of peoples waste like offering encouraging thrift stores to clean up attics for free. Those thrift stores can then benefit for selling some items and they can dispose of the waste for free at the municipality.
Political		The least important factor seems to be political reasons. There have been political considerations, however despite the national regulations which have to be followed there seems to be little political reasons which influenced the decision making.	The municipality of de Wolden seems dedicated to their citizens. They have regular meetings with representatives and when making this policy document they had several discussion nights. However due to other priorities these opinions still weigh less in the document. The main result of these nights were the improvement of information given to the citizens.
Citizen resilience	-“Some people stated that they has trouble with separating waste” -“End-of-chain separation makes people less environmentally aware.” -“The stimulation of behavioral changes in citizens seems at least as important as a proper technical collection system”		As becomes clear from the quotes, it is hard for the citizens of de Wolden to know why they are encouraged to reuse or separate their waste. This will hopefully be mitigated by the municipality by providing them more information.
Public opinion/service	-“The handing in of waste should be as easy as possible” -“Citizens are prepared to help more in waste management but encounter problems and uncertainties which prevent them from doing so”		The municipality of de Wolden hopes to provide a service as easy as possible. This is done by picking the right policy and providing the information to work with this policy. This is something which is still lacking a bit.
Public/private pressures	-“This policy is within the European and national limitations” -“There is a citizens organization which discusses with the municipality three or four times a year”		The policy is build on national and European guidelines. This means that the amount of waste per person has to decrease towards 500 kg and residual waste to 100 kg.

			Another influence is the opinion by citizens given in the discussions by the citizens organizations.
Convenience	<p>-“Most people in de Wolden were satisfied with the current waste policy”</p> <p>-“Source separation is not an option, residual waste will be collected at home for the next few years.”</p>	<p>Since it becomes clear in the document that the municipality is not able to implement every waste management policy they would like to due to the investment costs needed, the convenience factor is weighed most heavily. Their policy is clearly limited by their funds and therefore cannot implement the policy which fits their ideals.</p>	<p>The municipality of de Wolden has multiple reasons to keep their current policy. First of all their citizens were satisfied with their current policy and secondly there was little money to invest in a new policy, even though this policy might be better in the long run.</p> <p>The municipality does however invest in future waste management policies like the diaper collection and monitor their citizens waste closely.</p>
Policy costs	<p>-“Although diftar combined with reverse collection would be the most cost-effective policy, we are fiscally not able to implement the infrastructure needed”</p> <p>-“Because the volume system is cheaper to implement than the weight system, a lot of municipalities choose for this system. De Wolden has also chosen this option.”</p>		<p>Although the municipality can improve their financial situation by changing to a different policy, there is little money to invest in this new policy. Therefore there is chosen for the cheapest and most convenient way of waste management system</p>
Knowledge	<p>-“We collected a considerable amount of information in the last few years”</p> <p>-“Currently there is no recycling available for diapers in the north of the Netherlands. However it is expected that this will happen in the next two years. Therefore we already separate this waste.”</p>		<p>The municipality of de Wolden is collection information from their citizens to be able to choose the best policy for them. They are also aware of future policy changes and are already adapting to those.</p>

Appendix 5: Hoekse Waard

Hoekse Waard	What is being said?	Importance	Interpretation
Environmental	<p>-“By implementing a policy where you pay less if you supply less waste, we already decreased our residual waste percentage by 37%”</p> <p>-“We still have three quarters of our waste which can be recycled”</p> <p>-“We have to find a balance in the waste triangle, especially since environmental reasons increase in importance.”</p>	In this policy, environmental reasons are the second most important. A lot of attention is paid to environmental concerns but it does have to make way for service levels.	In the municipality of Hoekse waard there is still a lot of gains to be made in the separation of household waste. Still a big part of their waste can be recycled. However they are aware of the consequences and are looking for a way to fix their problem.
Greenhouse emissions	<p>-“During our incineration process we recover some of the energy”</p> <p>-“The residual waste with resources in it is a shame to incinerate”</p> <p>-“Our main goal is the prevention of residual waste at the incineration plant”</p>		The municipality is conscious about the consequences of incineration. Especially the GHG which are emitted and the energy lost during the incineration.
Greenhouse emissions due to garbage trucks	-“We are going to implement reverse collection to decrease the amount of trips made by garbage trucks and increase the possibility to keep waste for a longer period of time. ”		The municipality is looking for alternatives for garbage trucks to minimize GHS emission.
Economical	-“We have to change from a linear to a circular economy where we need to maximize the reusability of our waste”	Economical reasons are third most important. In the report it becomes clear that economical resources are mainly used to optimize service levels and	The municipality tries to use the economical part of their waste management system to improve the economical situation for people in the region. But since their choice

		environmental reasons, which are therefore clearly more important	of policy is more focused on environmental concerns and service levels, the other benefits are minimal. The costs of their policy is based on the willingness of the citizens to separate their waste.
Resource retention	-“Separately collected resources can generate revenues”		
Production costs	-“Incinerating waste costs a lot of money” -“The increase in service levels will have a price. In this we can only partly support our citizens”		The municipality is aware of the high costs which come with incinerating their waste. This high cost they can only partly mitigate for their citizens, but is mainly based on the citizens willingness to separate.
Economic benefits	-“Due to the implementation of this system, costs for citizens have decreased with 80,-” -“We want to increase our employment in the region with our policy”		The municipality tries to use the waste management to improve the amount of jobs in the region. They also attempt to lower the costs of waste processing.
Political	-“The waste triangle was the basis of our policy”	Political reasons are the number one factor in this municipality. They state that the service level determine the amount separated but also the costs. They also clearly state that they want to achieve the highest possible service	The waste management policy of this municipality revolves around the service levels for the citizens. They mention that the service levels determine the success of separation and thus the success of the policy. They are busy with getting a

		and determined based on that the costs.	high public opinion
Citizen resilience	-“The service levels determine the waste separation and waste costs. Therefore it is an important factor.”		The success of this policy is based on the citizens happiness. With high happiness, resilience seems high.
Public opinion/service	-“We strive to achieve the highest possible service and environmental result against the lowest possible costs.” -“In 2013 the citizens gave our waste management system an 8. But with our diftar system we got an 7.8” -“We want to increase our happiness rating to an 8.5”		The public opinion seems to be the most important factor in this policy. The municipality goes to long lengths to maintain their citizens rating on an 8 or even increase it to an 8.5. The rest of the policy seems to be aimed at this goal.
Public/private pressures	-“Suggestions given to us by the citizens were implemented in the policy.”		The opinion of the citizens seems to be the most influencing factor for this policy. Little is told about the influence of private entrepreneurs.
Convenience	-“The low hanging fruit has been plucked, now we need to increase our efforts”	Convenience is the least influencing factor. They make it clear that they are prepared to invest resources to increase service levels.	The municipality seems to have gone first for the easy tasks, but to really achieve their goal they need to step up their game. They try to do this by increasing investments and researching what the weak spots are in their policy.
Policy costs	-“We want to ensure that our implementations go a long way” -“We are prepared to increase our costs and		The municipality tries to use their resources for long term. Costs are mainly focused on service level

	investments if that means we can achieve higher service levels.”		
Knowledge	<p>-“To find out what is still present in our residual waste we conduct a yearly research”</p> <p>-“We want to evaluate the collection of waste paper by organizations to see if there is anything to gain in it.”</p>		The municipality does research after their weak spots and try to gain efficiency by being sure that what they are doing is the right thing.

Appendix 6: Groningen

Groningen	What is being said?	Importance	Interpretation
Environmental	<p>- “Already half of our waste is separated”</p> <p>-“There is an phenomenon, the plastic soup, which we find unacceptable. Therefore we want a circular economy in which as much as possible is recycled.”</p> <p>-“Due to population increase, humans use more resources than ever before. Therefore we need to be efficient with our resources”</p> <p>-“We choose for sustainability to be our starting point in everything we do”</p> <p>-“We want Groningen to be energy neutral in 2035. Therefore we attempt to use new sustainable energy sources”</p> <p>-(Vision and goal) “We wish for Groningen to be a city where as little as possible household waste is generated and that the generated waste is recycled as much as possible”</p> <p>-“We want to prevent the export of waste to countries where they do not process this waste ethically”</p> <p>-“With Diftar, the highest percentage of reuse will be realized”</p> <p>-“Diftar will result in a decrease of more or less 35kg of residual waste”</p>	<p>Clearly first, most references and its focus becomes really clear. Environmental reasons are not only mentioned numerous times, it is also their first point on their list of goals. In almost every section they first address environmental impacts.</p>	<p>As clearly can be seen from the amount of quotes, environmental reasons seem to be the most important for the municipality of Groningen. They are concerned over global and local environmental issues and try to address these as much as possible. By being conscious about their greenhouse gas emissions they try to prevent environmental pollution. However rather than source-separating they try to encourage citizens to reuse their waste. They believe that preventing to make waste is more important than separation.</p>
Greenhouse emissions	<p>-“By making the switch to green energy, the government thinks we can become more competitive while decrease our burden upon the environment.”</p> <p>-“Amongst our goals, decrease</p>		<p>The municipality of Groningen seems aware of the problem of incinerating their waste. By reducing their total amount of residual waste they hope to minimize their incineration and thus decrease their</p>

	greenhouse gas emissions is an important one. By reusing waste instead of burning it, we reduce CO2 emissions greatly.”		emission of greenhouse gasses.
Greenhouse emissions by garbage trucks	-“We aim to use the most sustainable way to power our garbage trucks” -“We aim to drive efficient routes for our trucks and on the most sustainable energy source” -“We will attempt a pilot to run our garbage truck on hydrogen rather than fossil fuels”		The municipality of Groningen seems to actively try to find new ways to make every aspect of waste management efficient. This becomes clear when you look at their use of garbage trucks. They are going to experiment new types of garbage trucks run on hydrogen.
Economical		Third most present factor. The municipality of Groningen has a clear view on the costs of their policy. All details of the costs are worked out in the policy document and carefully planned. Since the municipality is actively looking for innovative ways to benefit from waste, it can be stated this is their third most important factor.	The municipality of Groningen is doing an important job by integrating their waste management system in the economy. They are aware of the possibilities hidden in waste. They focus more on the moment before something becomes waste by motivating the population to give a product a second live rather than throwing it away. They attempt this by implementing economic stimuli. They build their policy in such a way that it is economically beneficial to decrease your amount of waste. They also actively support entrepreneurs trying new ways to process waste. Also they attempt to implement their policy in such a way that people with a disadvantage are still able to participate.
Resource retention	-“What for one person is waste, for the other is a new product” -“Due to global reasons, resources become scarce and more expensive” -“Waste is an valuable resource. Therefore we want as much as possible reused” -“The benefit of a circular		The municipality of Groningen is aware of the high costs which are a part of residual waste. Therefore they try to motivate their citizens to minimize their residual waste by giving them a second life.

	<p>economy is that resources are reused and get new economic value”</p> <p>-“Economic costs of processing residual waste is in general higher compared to separately collected waste”</p>		
Production costs	<p>-“We want a system where citizens can save money and people neglecting waste separation pay extra”</p> <p>-“We wish to use source-separation as much as possible for this is cheaper”</p> <p>-“We want waste processing as cost efficient as possible”</p> <p>-“We want service levels to be as high as possible against equal or even lower prices”</p> <p>-“With diftar, the average costs decrease with more or less €3,00”</p>		<p>With this policy the municipality of Groningen decrease the costs for the average citizen. However if you neglect your duty to monitor your own waste this will result in higher costs. This way the municipality of Groningen ensures that the processing costs of waste is paid by the people responsible for the majority of the waste generation.</p>
Economic benefits	<p>-“If we process waste in a smart way, this will result in revenue and work”</p> <p>-“We notice that by growing into the sustainable sector, we delve into great economic opportunities. Therefore we encourage sustainable entrepreneurs and stimulate citizen initiatives”</p> <p>-“With our policy we want to stimulate local employment possibilities”</p> <p>-“We want to take social responsibility and aim to employ 45 citizens with a distance to the job market in 2020”</p>		<p>The municipality of Groningen consciously ties to integrate waste management in the economy of Groningen by providing local jobs or supporting entrepreneurs. They also try to ensure that people with a distance to the labor market get an opportunity in the business of waste management so all social layers are benefitting from the process.</p>
Political		<p>Second most important factor is political. It is mentioned a lot especially the involved parties are an important factor. The municipality tries to use the opinion of every party which is willing to invest in the policy.</p>	<p>To establish their policy, the municipality of Groningen largely depended on the input of involved parties. They realize that by giving in to the demands of every involved party they increase the chances of success and participation of the policy. Although they do not concede to every demand of the</p>

			involved parties, they do make enough concessions to make them happy.
Citizen resilience	<p>-“To realize our goals, we are mainly dependent on our citizens”</p> <p>-“We focus on a phased approach with plenty of information to make our citizens aware to be economical with their waste”</p> <p>-“We value communication with our citizens to achieve the best results”</p>		As is the case, the municipality is aware of the resilience needed by their population to make the policy a success. Therefore they implement their policy in stages to build up the resilience of their population. In this they consciously try to communicate their ambitions with the citizens.
Public opinion/service	<p>-“The municipality tries to ensure that you can separate your waste as easy as possible”</p> <p>-“We want to make waste separation as easy as possible for the citizens. We attempt this by providing as much service as possible for people separating their garbage.”</p> <p>-“According to our survey, 15% of the population believes source-separation has no use because waste is separated at the treatment facility”</p>		To help the citizens, the municipality of Groningen provides stimuli to reduce waste. By letting heavy waste producers pay more and providing different services if one wishes to separate their waste, they hope to reduce their total amount of residual waste. According to their studies, a small part of the population does not believe in source-separation.
Public/private pressures	<p>-“We involved several parties to create this policy. We have surveyed Stadjers, we requested the wishes of the local council, asked the neighbourhood organizations for their opinion and lastly we asked extern experts for their views upon the matter”</p> <p>-“Currently the government wants big cities like Groningen to recycle 75% of their waste in 2020. This goal seems impossible. However the government cannot reinforce this goal”</p> <p>-“According to European guidelines, countries can make producers responsible for the reuse of their packaging. However this policy is not</p>		The policy of Groningen has a lot of involved parties. Firstly the policy is based on national guidelines. Then the realization of those guidelines are discussed with involved parties. Some citizens received a questionnaire and those results have also been taken into account. They also received input from local entrepreneurs and made sure that their policy was received in a positive way. A striking observation can be made when looked at the back of the policy. There is says “With thanks to Attero”. Attero is the waste treatment company for the municipality. This thanks clearly shows that

	<p>reinforced”</p> <p>-“We currently let drinking cartons be separated at the treatment plant”</p> <p>-“We look together with our local stakeholders how we can realize our ambitions”</p> <p>-“From our research, people are most excited about the higher service levels”</p> <p>-“We use this information to choose a form of waste collecting which is conform to the wishes of the Stadgers”</p> <p>-“With thanks to Attero”</p>		<p>the whole policy is made in collaboration with the company, so they probably had a considerable impact upon it.</p>
Convenience		<p>Least important factor. Barely things are mentioned which can be stated in this factor. Therefore it seems like convenience did not play a major role in the decision making in the municipality of Groningen.</p>	<p>Convenience seems to have played only a minor role. There is clearly stated what the costs are of diftar. The investment costs would be initially making it slightly more expensive but over time it would become cheaper. For the citizens it would also become cheaper if they consciously disposed of their waste. They state their desire to attract new innovative ways to dispose of waste. This would increase their knowledge regarding the subject significantly and increase their capabilities on disposal of waste.</p>
Policy costs	<p>-“To implement diftar, additional investments have to be made”</p>		<p>There is little mention of the importance of the policy costs. There is a clear overview of the different costs associated with the new policy. This shows that diftar is a slightly more expensive policy.</p>
Knowledge	<p>-“We want people to be aware of prevention and recycling of waste from an early age”</p> <p>-“We see Groningen as a experimenting area for sustainable innovation, among which waste”</p>		<p>The municipality of Groningen states her ambition of become an experimentation lab for new innovative ways to dispose of waste. This way they would attract new knowledge and also generate new knowledge regarding the topic. They also state their desire to educate their</p>

			population on the importance of dealing consciously with their waste.
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