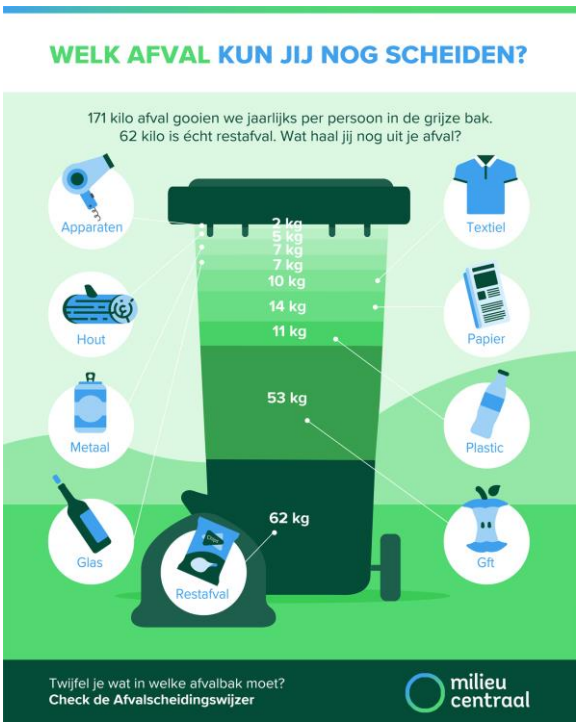
Sustainable transformation of waste management strategies in Dutch municipalities

a case-study of Nijkerk and Putten



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Master thesis
Environment and Society studies
Nijmegen School of Management
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October 2022

Colofon

Title:	Sustainable transformation of waste management strategies in Dutch municipalities: a case-study of Nijkerk and Putten
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Thesis:	Master thesis
Version:	End version
Word count:	22 089 words

Images on front page:
Left: MilieuCentraal, 2018
Top right: Twente Milieu, n.d.
Bottom right: KRO NCRV, n.d.

Summary

Limiting the amount of residual waste per resident is a goal for many Dutch municipalities, trying to reach the VANG-goal, which challenges municipalities to have only 30kg residual waste per resident in 2025, and to achieve a 100% recycling rate. To be able to limit the amount of residual waste, municipalities need to analyse their residents' practice of waste separation to see how their governance can better align with their residents' needs. This master thesis investigated the extent to which the municipalities of Nijkerk and Putten can improve their waste management. The main question for this research was: '*In what ways can governance of the municipalities of Nijkerk and Putten influence the current practice of waste separation of their residents, in order to get to a new practice of waste separation that better enables the two municipalities to achieve the national VANG-goal?*'.

The conceptual model is based on the idea of three main elements of practises; meaning, material, and competence (Shove, Pantzar, & Watson, 2012). Residents need to have certain environmental beliefs to be motivated to participate in the practice of waste separation (meaning). Next to that they need objects to collect waste (containers or waste bags), and they need a waste collection infrastructure to distribute the waste from residents to the processing facility (material). And lastly they need to have certain skills and knowledge to know how, and be able to, separate waste (competence).

This research was deductive; hypotheses have been formulated based on existing theories, after which they are tested on the collected data from policy makers and residents from the two municipalities Nijkerk and Putten (Creswell & Plano Clark, 2007). Data has been collected through an online survey, and interviews with both residents and policy makers.

The results showed that the main governance tools recommended to be applied by the two municipalities are handing out home waste containers, strategically placing collection points, providing feedback and information, educational campaigns and motivating others to correct each other. Furthermore the municipality of Nijkerk is advised to provide more information about waste processing, to increase residents' knowledge so that they can also convince other people that waste does get processed separately. The municipality of Putten is advised to improve knowledge of the benefits of waste separation, to limit nuisance by either offering smaller waste bags, better promote the possibility of bringing waste to the waste collection station, or to collect waste more often.

Keywords: waste management, circular economy, household waste, recycling behaviour, social practice theory

Preface

When I first visited a friend in the municipality of Amersfoort, I was shocked to learn that there are no incentives for households to produce less waste or separate their waste so it can be recycled. Residents pay a fixed amount of taxes and get unlimited use of the underground (residual) waste container. This is quite different to where I used to live; on a farm in the rural area of the municipality of Raalte. We had our own container for residual and plastic waste, which is the maximum amount per month we can dispose of. You can dispose of unlimited paper one day each month, but this is not picked up at your front door, you have to bring it to a large container in the centre of the village (± 2km away). The default option was even that we had to care for our own organic waste, but since we lived on a farm that was no problem.

And these different waste-methods are not the only options for household waste collection; Rotterdam, Leiden and Amsterdam apply post-separation, in which they separate the waste themselves, after collection of household waste (van den Brand, 2020). These differences made me wonder, how can waste policy lead to a reduction of (residual) waste? And how can a waste policy be optimised to improve waste sorting, and eventually an even lower amount of waste?

These questions I studied during my internship at the municipality of Nijkerk, by comparing two different municipalities; Nijkerk and Putten. During my internship I worked with André Meijerink, who is working at both the municipality of Nijkerk and the municipality of Putten as a waste manager. I would like to thank André for the help I received during, and after, my internship. I would also like to thank my supervisor Mark Wiering for providing great guidance, offering good insights when I got stuck, and challenging me to get everything out of myself to do even better research and reporting. Lastly, I want to thank my friends and family for providing a listening ear and encouragement to help me bring the thesis to a successful conclusion.

I hope you enjoy reading my thesis!

Jo-Ann Preuter,

Amersfoort, 13 October 2022

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List of abbreviations

Some abbreviations are frequently used in the thesis, to improve understanding they are listed below with their meaning. Some abbreviations are names of companies or stand for slogans, these translate to the original language (Dutch), therefore between brackets the English translation is included to give some context.

CBS:	Centraal Bureau voor de Statistiek *(Central Agency for Statistics*)
HBO:	Hoger beroepsonderwijs (*university for applied sciences*)
MBO:	Middelbaar beroepsonderwijs (*post-secondary vocational education*)
NVRD:	Nederlandse Vereniging van Reinigingsdirecteuren (or Koninklijke Nederlandse Vereniging voor Afval- en Reinigingsmanagement) (*Dutch Association of Cleaning Directors or Royal Dutch Association for Waste and Cleaning Management)*
PMD:	Plastic, Metaal en Drinkpakken (p*lastic, metal, and drink cartons*)
VANG:	Van Afval Naar Grondstof (f*rom waste to 'raw' material*)
VNG:	Vereniging van Nederlandse Gemeenten (*Association of Netherlands Municipalities*)

1. Introduction

A circular economy is aimed at preventing waste and therewith preserving natural resources as much as possible, thinking in terms of cycles instead of linear flows. This means rethinking the way society does things, from utilising residual flows to preventing waste (Bastein, Roelofs, Rietveld, & Hoogendoorn, 2013). The principle of circular economy will lessen the pressure on the environment, by producing less waste and reducing CO_2-emissions (Kishna et al., 2019, p.14). The R-ladder was introduced by Lansink in 1979 to score the different strategies that aim at reduction of natural resource usage (Lansink, 2020; Weenk & Henzen, 2021). This research focuses on one of the steps on this ladder; recycling. The goal is to improve the way households in Dutch municipalities separate their waste, which will make these waste flows easier to recycle.

Waste management practices can help to realise climate benefits which are beneficial in two ways. The first one is that the climate benefits are leading to local adaptation outcomes; improvement of community health, environmental and economic benefits. The second one are global mitigation outcomes like the reduced greenhouse gas emissions due to the direct effect of less incineration and the indirect effect of better waste separation and recycling (Vergara & Tchobanoglous, 2012).

International pressure on municipal waste management is given via the Sustainable Development Goals, more specifically SDG 11: sustainable cities and communities (United Nations, n.d.). As part of their environmental infrastructure, cities should not just have an infrastructure for their water, sanitation, and drainage, but for their solid waste management as well. The European Union has established more detailed goals; the municipal waste recycling rate goals. The recycling rate is the waste that is to be recycled and prepared for reuse, excluding the energy recovery and reprocessing for fuel or backfilling operations ((EEA) European Environment Agency, 2018). The goal is to have a recycling rate of 50% by 2025 for at least the four categories paper, glass, metal, and plastics. Many nations have introduced ambitious national plans to limit their waste as well. However, as The World Bank (2021) notes; the actual achievement of these national plans remain limited, because these national targets are dependent on the municipalities' ability to deliver a good, fitting service. The result of which is a gap between the intended goal in the national plan and the actual performance of the sub-national authorities (ibid.).

The national government of the Netherlands acknowledges the importance of municipalities in waste management. In the law on environmental conservation (art. 10.23 lid 1, Wet milieubeheer 1979) it is stated that the municipalities are responsible for the management of domestic waste (Tweede Kamer der Staten Generaal, 2000). This includes not just the removal of domestic waste, but the whole chain of waste management; collection, transport, recovery, and disposal of waste. The national government further challenges the municipalities through a national VANG[1]-goal. This goal challenges municipalities to have only 30kg residual waste per resident in 2025, and to achieve a 100% recycling rate. The sub-goal of a 100kg of residual waste per resident, and a 75% recycling rate in 2020 has been reached by only 26 of the 169 municipalities participating in the national benchmark, and 33 more did manage to reach 75% recycling, but did not get to 100kg residual waste per resident (NVRD, Rijkswaterstaat, & Cyclusmanagement, 2021). This is not quite promising for the outcome of the national 2025-goal.

The success of municipalities' waste sorting strategies depends on two types of critical factors; motivation or cooperation, and profitability or efficiency (Chen & Lee, 2020). The first

[1] VANG stands for 'van afval naar grondstof', which translates to 'from waste to raw material'.

type concerns the motivation and cooperation of households/residents, which is difficult to predict and dynamic. An example to demonstrate this unpredictability is when motivation depends on peer pressure or influence, when friends or neighbours who used to recycle stop, motivation might decline (Scott, 1999). Another would be motivation based on tangible financial rewards, when costs for disposal of plastic waste will increase, motivation to recycle might drop, since the financial benefits decline. Lack of motivation is dependent on multiple factors, of which hygiene is an important factor, when packaging is not cleaned properly there is a risk of attracting vermin. Another important factor is convenience of the infrastructure, it needs to be quick and easy to separate waste, separation can fail due to the simple fact that the correct bin is further away (Bernstad, 2014).

The second one is the overall profitability or efficiency. Recycling produces less emissions compared to incineration; incineration of plastic waste led to 2.82 tonnes of CO_2 emissions in the Netherlands in 2015, whereas recycling led to just 1.66 tonnes (Gradus, Nillesen, Dijkgraaf, & van Koppen, 2017). However, certain financial costs are connected to the practice of recycling; the costs of collection and transport, possible post-separation and sorting, and recycling itself. When implemented correctly, recycling can lead to profit for the whole chain. The CO_2 emissions are limited given that waste is being recycled and not incinerated, and reducing the use of raw materials also limits the depletion of natural resources. And even some financial benefits are connected to recycling; the organisation that collects the waste can sell the recovered materials, and households will see a decline in costs of waste, given that disposal of residual waste is more expensive than the separate categories (glass/paper/plastic/biodegradable). When households are able to experience profit from participating in the practice of waste, they will be more motivated (Ryan & Deci, 2000)

1.1 Problem statement

The Dutch national government had established a VANG-goal of 100kg residual waste per person, per year, and a 75% recycling rate in 2020 (Rijkswaterstaat, VNG, & NVRD, 2021). The long term goal is to reach 30kg residual waste per person, per year, and a 100% recycling rate in 2025. The amount (kg) of residual waste in this goal is the amount of waste which can not be post-separated or recycled, and the only options left are incineration or the landfill. The recycling rate is defined as all the household waste (bulky and ‘normal’) which can be separated (at source or via post-collection separation) in order to be recycled or reused as a percentage of the total amount of household waste (Starreveld, 2017). The amount of residual waste per resident and the recycling percentage, in 2021, are given in figure 1 for the municipality of Nijkerk and the municipality of Putten.

The amount of household waste per resident for the municipality of Putten is nationally communicated at 69kg (Rijkswaterstaat & Centraal Bureau voor de Statistiek (CBS), 2021). Putten however applies post-separation, next to their source separation. After washing and fermentation they estimate to have a rendement of 28%; therefore they would say that they have 50kg instead of 69 kg residual waste per capita. Furthermore they apply post-separation especially for diapers (since 2021); about 14kg of their 50kg per capita of residual waste is still recovered in this way, leading to a total of 36kg (A. Meijerink, personal communication, 5 October 2022). However, for this research the nationally communication information (the 69kg) will be used.

		Nijkerk	Putten
Amount of residual waste (per resident) [2021]	**Bulky household waste**	17.1kg	15kg
	Household waste	87.5kg	69kg
	Total	104,6	84
Waste recycling rate (after post-separation) [2021]		77%	83%

Figure 1: Collected amount of residual (household) waste
(adapted from Rijkswaterstaat & CBS, 2021)

As one can see in this figure, although the municipality of Putten was able to reach the 2020 goal of having 100kg residual waste per resident (84kg), and Nijkerk was very close to reaching it (104kg), both municipalities still have to limit their residual household waste (including bulky household waste) with approximately 54kg[2] for Putten and 74.6kg for Nijkerk from 2021 to 2025 in order to reach the national VANG-goal of 30kg.

A national goal is set, but the strategies to reach it are to be determined by the municipalities themselves. Therefore multiple different strategies for waste management exist among the Dutch municipalities. Even for the two neighbouring municipalities Nijkerk and Putten differences exist; whereas Nijkerk charges a bigger yearly, general costs for waste collection, and less specific costs per waste category, Putten charges more per waste category (as one can see in figure 2). In Nijkerk disposal of plastic and biodegradable waste is free, whereas in Putten residents have to pay a small fee. And where residents of the municipality of Nijkerk are given the choice of collection method (waste bag, mini-container or underground container) all residents of the municipality of Putten are using waste bags and have no other options.

	Nijkerk	Putten
Waste collection charge (yearly)	€148.70	€119.40
Residual waste	€3.30/140L	€1.50/50L
Plastic waste	Free	€0.15/50L
Vegetable/fruit waste	Free	€0.15/10L
Garden waste	Free	€0.75/50L

Figure 2: Costs for households' waste disposal in 2022
(adapted from Gemeente Putten, 2022; Gemeente Nijkerk, 2022)

Whether the differences in waste management strategy from these two municipalities are leading to the difference in the amount of household residual waste per resident is unclear. This lack of clarity inspired the researcher to conduct this study and try to find out which waste management strategy would lead to a lower amount of residual waste per resident, and eventually, in the long term, to the more circular system of resources the national government is striving for.

Whether a waste management strategy leads to less residual waste per resident is dependent on the waste separation practice of residents. To investigate whether the waste management strategy is supporting residents in their waste separation, or perhaps unintentionally hindering it, the model of social practice of Shove et al. (2012) has been used. This model states that a practice exists of three elements; meaning, material, and

[2] When the estimated reductions of residual waste weight of post-separation (washing, fermentation, and post-separation of diapers) is included, the total amount is 36kg, and Putten would only need to lose 21kg.

competence. The practice of waste separation consists of beliefs, norms, and values of the residents concerning waste separation (meaning), the waste collection infrastructure provided by the municipality (material), and skills, and knowledge of the residents to be able to properly perform the practice of waste separation (competence). A good waste management strategy should be supporting residents to have appropriate beliefs about waste separation (good for the environment, something all people should do, etc.), make sure residents have the correct material, and enough knowledge. This research has thus looked at the governance of practices; what can municipalities do to better govern the waste separation practice of their residents?

1.2 Research aim

The theoretical aim of this research was to deliver a potential explanation for the struggle that the municipalities are facing in trying to further limit the amount of household's residual waste, in order to meet the national target. With the model of social practices of Shove et al. (2012) the waste separation practice of residents has been investigated as a potential barrier. In their model, Shove et al. introduce three main elements of practices; meaning, material, and competence. In the creation of a practice these elements make links, and the practice changes when these links are broken. The hypothesis for this research was that residents' current waste practice is limiting their full potential to reduce their residual waste, and by reshaping their waste practice, a new, more effective, waste separation practice can form. This reshaping can be realised by making changes in the waste management strategies. By means of a new policy, the residents will be either more inclined (meaning), better equipped (material), or more skilled (competence) to better separate their waste.

The practical aim of this research has been to gather information about the waste management strategy of two Dutch municipalities, Nijkerk and Putten, and to know how residents relate to waste separation and their municipality's strategy, to form a mental model of the waste separation practice. This is helpful in order to comprehend the difference between the two neighbouring municipalities, and to eventually come up with an idea of what strategy will be more likely to reach the national 2025-goal (30kg residual waste per resident and a recycling rate of 100%) (Rijkswaterstaat, VNG, & NVRD, 2021). This aim has been realised by gathering information about the waste management strategies, by talking with policy makers and conducting a survey among the residents.

1.3 Research questions

The purpose of this study was to investigate the practice of waste separation of the citizens in the municipalities of Nijkerk and Putten in order to find out how the municipalities can better support their citizens in waste separation, which will then lead to a new practice that results in a lower weight of residual waste per capita. Thus a connection has been investigated between the governance of the two municipalities, their strategy of waste management and the actual practice of waste separation of their residents. Therefore the main question for this research was: '*In what ways can governance of the municipalities of Nijkerk and Putten influence the current practice of waste separation of their residents, in order to get to a new practice of waste separation that better enables the two municipalities to achieve the national VANG-goal?*'. This question can be answered in two different ways. When more generalizable points of improvement are found, an answer can be given for both (and perhaps even more) municipalities. However, it is possible that context-dependent points of improvement are found, in that case they can work for a specific municipality, but are not working for another.

To be able to answer the main question, three sub-questions have been established to not only know to what extent policy can be changed, but also to understand why certain factors can be addressed to improve the waste separation practice and others can not. The first sub-question is: '*What led to the differences in the waste management strategies of the neighbouring municipalities of Nijkerk and Putten?*'. This question helps to understand the come-about of the waste management strategies and certain path-dependencies keeping the municipalities from implementing certain measures that another municipality does. Often municipalities are certain of resistance from their residents when they communicate the possibility of a transfer to a diftar system (Vloedgraven, 2017). It could for example be difficult to introduce a price to the disposal of biodegradable waste, when the residents have always been able to dispose of it for free. Another possibility could be that the municipalities work in different partnerships with other municipalities, which can influence the waste processor they can work with or whether post-separation can be applied or not.

The second sub-question is: '*What are the specific components of the three elements of the social practice of waste separation (Shove, Pantzar, & Watson, 2012), that make up the practice of waste separation?*'. This question should help to discover the factors that are limiting the full potential of residents' current waste sorting practice; what is keeping the residents from separating their waste better? It could be a matter of lacking the knowledge to do so (competence), or perhaps they do not have the facilities needed to separate all types of waste (material), or they do not feel the need to do so (meaning).

The third sub-question is: '*What are external factors, like sociodemographic or geographical factors, that influence the practice of waste separation?*'. Whereas the second sub-question focuses on motivational and efficiency factors, this question focuses on external factors. Age could for example be a factor which influences peoples' waste separation practice; McDonald and Ball (1998) found that elderly people (60+) separate waste more than people between the age of 16 and 30. And other external factors like the geographical location (Chen & Lu, 2017), the building type (Zegwaard, 2000) and the gender of the practice carrier (Ekere, Mugisha, & Drake, 2009) also influence the practice of waste separation. The municipality can not directly influence these external factors, but knowing the effect of them on residents' waste separation practice, can help to determine the target groups which need extra guidance. A study in China for example found that market incentives can be targeted at lower income groups of residents, as they are more sensitive to a monetary reward (Xu, Ling, Lu, & Shen, 2017). And higher educated residents should be targeted for waste separation, for example by adding more recycling bins located close to universities.

1.4 Scientific relevance

The first point of scientific relevance of this research is that two knowledge gaps will be filled. The first gap is the perspective of sociology on the extent to which one can change the waste policies of municipalities in order to achieve a lower amount of household residual waste per resident. Most studies focus on more of a psychology view; they try to study behaviour of individuals. Zegwaard (2020) for example used the Triade-model to model waste separation behaviour, and Travaille (2016) used the same model to investigate effective ways to influence waste separation. The Triade-model suggests that a certain behaviour takes place when three factors; motivation, capacity, and opportunity, reach a minimum value (Vermeulen, 2011). Each individual has a different situation. Whereas the model for social practice of Shove, Pantzar, and Watson (2012), that will be used in this research, focuses more on a sociology view; try to explain a practice, and the individual is just the 'carrier' of the practice. To do so they use three elements; meaning, material, and competence, but take on the perspective that

in order for a practice to take place all these elements need to be linked together. The sociological perspective is more useful for municipalities because it looks at the practice of waste separation for multiple residents, whereas the Triade-model looks at the practice of waste separation for one individual.

From an exploratory literature review one research has been found which applies the model for social practice of Shove et al. (2012) on waste; Bissmont (2020) studied waste minimisation. However, she is more focused on the 'entrance of waste', the consumption patterns, not the disposal of the waste. She notes that consumption is an outcome of individual behaviour, so she applies the three elements (material, meaning, and competence) on the individual level, not on a group of people. And the objects of study are people that are already trying out waste minimisation, the so-called zero-waste bloggers. These people have what is called a strong attitude (Holland, Verplanken, & van Knippenberg, 2002). Strong attitudes are persistent over time, resistant to change, and able to influence information processing and action. Whereas this research tried to explain human behaviour in its social structure, and does not just include strong attitudes, who are advocates of environmental behaviour and thus waste separation, but also weak(-er) attitudes. Weak attitudes will less likely guide action, people with weak attitudes create their attitude 'on the spot', and are not able to retrieve it from memory (Holland, et al., 2002). In the survey people with strong(-er) and people with weak(-er) attitudes were questioned.

Next to a knowledge gap in the perspective of sociology on the practice of waste separation, there is a knowledge gap on the methods which municipalities use to limit their total amount of residual waste. The main method that is applied currently is to collect the waste separately; paper, glass, plastics, metal, biodegradable, electronic equipment and residual waste. This has been mandatory since July 2020, and from January 2025 it will be mandatory for Dutch municipalities to also separately collect textiles and hazardous waste (Rijksoverheid, 2020). However separate collection is not enough, the municipality with the highest recycling rate (Horst aan de Maas: 95%) still has more than 30kg residual waste per resident (36kg) (Rijkswaterstaat & CBS, 2021). Therefore additional measures should be taken to affect other factors which could decrease the amount of residual waste per resident. This research will show in which components of the three elements of the practice of waste separation, the municipalities can further support their residents to achieve better results. This could, for example, be to better communicate which pieces of waste belong in which waste category, or to be more transparent about the waste processing.

The second point of scientific relevance would be the inspiring function this research might have for future research. Ideally other researchers, or municipalities themselves, would come across this research and decide to conduct a similar research. Furthermore, this research can help to understand the social practice of waste separation in the light of the waste management strategies of municipalities. There has not yet been found any other similar research that explicitly connects a municipality's waste management strategy to the practice of waste separation, using the model of social practice of Shove et al. (2012).

1.5 Societal relevance

The societal relevance of this research can be seen on two levels. The first is that it will help municipalities to reach the European and national waste goals. This research will show municipalities the possible effects of their waste management policies on reducing the amount of residual waste per resident. All Dutch municipalities are aiming at reducing the amount of residual waste per household to meet the national goals for 2025, however, they might be uncertain where to begin, offering the ability of this research to inspire them.

When municipalities decide to start working on the factors that influence their waste outcomes, based on the outcome of this research, a second level of societal relevance can be reached, namely the residents themselves. The residents of these municipalities will be producing less residual waste, leading to possibly decreased costs of waste disposal, since they need to dispose of waste less often. And they will be contributing towards a more sustainable future for their future relatives, which might lead to improved well-being for the people that experience climate anxiety (Clayton, 2020).

Together these two levels, the municipalities and their residents, can realise benefits for both their own health and the environment (European Commission, 2014). More effective (re-)use and recycling of materials leads to less pressure on the environment, since the need for 'raw' natural resources will decline. When there is less residual waste, there will be less incineration, which will lead to a lower amount of CO_2-emissions, which positively benefits human health.

1.6 Reading guide

The first chapter has provided an introduction to this thesis; the research questions, the research practical and theoretical aim, and the relevance of the research have been discussed. The next chapter (chapter 2) will discuss the theoretical framework; an historical overview on the practice of waste separation in the Netherlands, different modes of waste separation, and factors that influence the practice of waste separation, will be discussed. Chapter 2 ends with a paragraph on the model of social practice (Shove et al., 2012) and a paragraph on the conceptual model which has been used to guide the research. Chapter 3 starts with a review of the researcher's philosophy, and discusses the method used during the research. Chapter 3 ends with a section on the reliability and validity of the research. Chapter 4 will present the results found in the secondary literature review, interviews, and survey, and answer the three sub-questions. Chapter 5 firstly answers the main research question and presents the possible improvements for the municipalities of Nijkerk and Putten on their governance of the waste sorting practice, in the paragraph on the conclusion. The chapter ends with a paragraph that presents some reflection and discussion on the research and suggests topics for possible further research. The thesis ends with the bibliography and appendices.

2. Theoretical framework

In this chapter the current academic literature on the social practice of waste separation, its history and the factors influencing the practice, will be discussed after which the relevant framework for this research will be introduced. The current academic literature will be divided into three sections, the first section discusses the historical overview of recycling in the Netherlands, in the following section the different modes of waste separation will be discussed, after which an introduction of the possible factors influencing the effectiveness of waste separation will follow, and lastly challenges found in similar studies in waste separation and recycling will be discussed.

2.1 Review of the academic literature

2.1.1 Historical overview of recycling

Recycling, and waste separation as a part of it, of usable materials from waste at the source is a relatively young concept. In 1979 the commonly used option was the separation of usable material from post-consumer waste (post-separation), and waste was still collected 'mixed' (Mieszkis & Thomas, 1980). In most countries the collection system was divided into four units; paper, glass, metal, and rest. In the Netherlands separate waste collection was perceived as difficult; the cost of collection for glass was too high, and, due to the relatively small amounts of metal collected, it was difficult to match the quantity required for detinning (Joosten, 1978).

However, due to the lack of space for landfills there was a need for more prevention and recycling (Rijkswaterstaat, n.d.; Nagelhout, Joosten, & Wieringa, 1990). Lansink promoted this idea in the parliament back in 1979, where it was unanimously adopted. 13 years later, in 1993 this 'Ladder van Lansink' (waste hierarchy) was covered in the national law on environmental conservation (art. 10.29a Wet milieubeheer 1979) (Lansink, 2020). Lansink's waste hierarchy described a preferred order for actions to prevent or handle waste. The least preferred option is disposal, where waste is dumped on a landfill or incinerated without energy recovery (Lansink, 2018). Energy recovery is the next step, where waste is incinerated with energy recovery, through heat or gas extraction. Recycling follows where waste is separated (at source or after collection), and materials are prepared for reuse. Reuse is the next step, in which materials and products are not discarded as waste but find a new purpose and are reused. The last, and most preferred, step is prevention or reduction, in which waste is prevented by rethinking practices. Not long after, from 1980 onwards, the landfills in the Netherlands had to comply with the Directive Controlled Landfilling, and in 1993 a decree was added on Landfill and Soil Protection (Lieten & Witteveen+Bos, 2018). The amount of waste land filled decreased with 33% from 1985 to 2016, and in 2016 77% of the national waste was recycled (Rijkswaterstaat, n.d.).

Nowadays municipalities are responsible for separation of multiple types of waste: biodegradable waste, paper, metal, plastic, glass, textile, hazardous waste, and discarded electrical and electronic equipment (Ministerie van Infrastructuur en Waterstaat, 2020). They can choose whether to collect it separately from the households or apply post-separation. In 2019, 9,551,000 tonnes of municipal waste have been collected in the Netherlands, of which 32% has been recycled, 27% has been composted, 16% has been post-separated, and at last 24% has been incinerated and 1% went to landfilling (CBS, 2021a). To comply with the national goal set for 2025, the amount of waste going to be incinerated or sent away to the landfill needs to be just 30kg per resident, which in 2019 was 136kg, and the recycling rate needs to be 100% in 2025, and was 60% in 2019 (Rijkswaterstaat, VNG, & NVRD, 2021; CBS, 2021a). Therefore, the practice of recycling, and waste separation as part of it, needs to be improved.

2.1.2 Modes of governing waste

A mode of governing can be defined as "*a set of governmental technologies deployed through particular institutional relations through which agents seek to act on the world / on other people in order to attain distinctive objectives in line with particular kinds of governmental rationality*" (Bulkeley, Watson, Hudson, 2007, p.2739). Many different authors have tried to develop modes of governing; Jessop (2003) thought of four different types of governing, a basis for all fields; the anarchy of market, the hierarchy of command, the hetarchy of self-organisation, and solidarity based on relatively unconditional social commitments. Bulkeley et al. (2007) built from this and came up with the four modes specifically for municipal waste: disposal, diversion, eco-efficiency, and waste as resource. And Pollans (2007) tried to rework these modes in the concepts of dominant, incremental, visionary, and aspirational.

For this research the four modes of Bulkeley et al. (2007) are applied. These modes mirror the R-ladder: disposal is the lowest step, diversion is a step higher (recover/recycle), and eco-efficiency and waste as resource both are the highest steps (reuse/reduce). Every mode has their own governmental rationality and their main governmental technologies. Governmental rationalities define the object of governing (what) and the method in which they should be governed (how). Governmental technologies make these rationalities practicable, and can be split up into technologies of performance and technologies of agency (Murdoch, 2000, p.505). Technologies of performance delimit relevant expertise and drive local action to governmental programmes, examples are targets, monitoring, and audit processes. And technologies of agency call for particular subjects and their participation in processes of governing, examples of which are participation and partnerships, infrastructures, and material through which action can be created and sustained.

At disposal the governmental rationality is economic efficiency, public health and environmental efficiency, and the main governmental technologies are dustbins, weekly collections, and landfill sites. With diversion the governmental rationality changes to reducing the (global) environmental impact of landfill, and the main governmental technologies are performance targets and auditing, new policy instruments, education campaigns, and funding mechanisms. At eco-efficiency the governmental rationality is recovering value and reducing the environmental impacts of waste, and the main governmental technologies are kerbside collections, new technologies, and reuse and reduction practices. At last with waste as resource, the governmental rationality is also reducing the environmental impacts of waste, as at eco-efficiency, but social and economic benefits as well, and the main governmental technologies are provision of alternative infrastructures and collections.

2.1.3 Different modes of waste separation

So-called 'source separation', is a type of waste separation where waste is separated at the source, at household-level for this research. Benefits are that waste should be relatively 'clean', since the different streams did not get mixed up. However, quite often residual waste is more costly, which leads to people putting residual waste in other waste-streams (Stikkelorum, 2020). Furthermore, source separation leads to extra transport movements, and requires more space in the public space or people's gardens (Danvers, 2020).

The main types of source separation in the Netherlands are the diftar system and the so-called 'omgekeerd inzamelen' method (reverse collection). Diftar is a system for waste collection per household, it stands for differentiated rates, and is a unit-based garbage pricing (Dijkgraaf & Gradus, 2007). In 2019, 48% of the Dutch municipalities used the diftar system, some with a volume-based pricing, residents pay per container or waste bag, others with a

weight-based pricing (Rijkswaterstaat, 2021). With a diftar system it is registered how many, and what types of waste someone disposes. An incentive is offered to households; less waste will lead to a lower waste charge (Allers & Hoeben, 2010). Therefore two effects are observed; the amount of waste for which is paid (more) declines (residual waste), and the amount of waste which is free (or costs less) inclines (recyclable streams), leading to a better waste separation. However, diftar can also lead to more waste being dumped to avoid higher costs. Some municipalities, like the municipality of Deventer, decided to replace the public trash cans, because people dumped their own household waste in it, to avoid costs (van den Brink, 2017).

Reverse collection is a system which tries to limit the effort to separate waste by placing recyclable waste streams around people's home, and residual waste further from home. This way residents' residual waste will not be collected from their front door, but brought to an underground container or the civic amenity site. In 2018, 21% of the Dutch municipalities used the reverse collection system (Meindertsma, 2018). The goal is to stimulate residents to separate their waste better, and offer less residual waste, since they can dispose of plastics in their own container and have their residual container further away. However, it has been studied that it does not lead to less residual waste, and the waste separation is less secure, leading to 'dirtier' plastic waste (Meindertsma, 2018; Dijkgraaf & Gradus, 2019). Because it takes more effort to dispose of residual waste, sometimes this waste ends up in the recyclable waste streams out of convenience. For some people, like the elderly or people with disabilities, it might be even more inconvenient, because they have to walk to the end of the street with a full trash bag.

Other than source separation, one can also choose post-separation; where waste is separated not by the households themselves, but after collection at the waste processor. Post-separation is not possible for biodegradable waste, paper, glass, and textile (Ministerie van Infrastructuur en Waterstaat, 2021; de AfvalSpiegel, 2019). Biodegradable waste will get too contaminated with other materials, like metals, glass, and plastics, which will make processing in the form of composting no longer possible. And biodegradable waste will also contaminate other waste streams; the wet food wastes for example, will get mixed with the dry papers, leading to both not being able to get recycled. Therefore biodegradable waste is, as much as possible, collected separately, to be recycled through composting or fermentation. For paper to be recyclable it must have little to no contamination and moisture, which will be guaranteed to fail with post-separation, because it will be mixed up with 'wet' waste streams like residual waste, plastics, and biowaste. Glass can not be post-separated because it will get damaged by materials like plastics, stone, ceramic and porcelain, and it is hard to extract glass splinters from waste. Textiles will be irreversibly contaminated when in contact with other waste streams, which will lead to textiles not suitable for textile fibre recovery. This leaves only plastics, metals and drink cartons suitable for post-separation.

The benefits of post-separation can be seen on three levels; the environment, the implementation, and the finances. The result of post-separation is not dependent on the willingness of residents to separate waste, since it is collected together with the residual waste. Compared to source separation, post-separation will lead to less CO_2-emissions in transport, waste can be collected in one go, instead of twice for plastics and residual waste (Andrews, 2021). For implementation the main benefit is the convenience for residents; they will no longer have to doubt about which plastics belong in the residual waste container and which can be recycled (Rijkswaterstaat, 2020a). For some people with little space in and around their home the extra container for plastic, metal, and drink cartons (PMD) have been a source of frustration (Laconi & van Dillen, 2021). Another aspect of implementation is that it is easy for

municipalities; they no longer need a separate collection system, and can use the same contract for the waste processor and the post-separator (Rijkswaterstaat, 2020a). And at last, for finances, the costs and benefits of post-separation are more predictable than the costs and benefits of source separation, since the contracts are determined for long periods. On top of that post-separation will lead to a lower amount of residual waste, resulting in less costs for incineration.

When post-separation and source separation are compared, waste that is separated at source is cleaner material, which makes it more useful for recycling than waste that is post-separated from residual waste. And by separating at source, residents will be more aware of the amounts of waste they produce, and the value that waste can have. As an extra benefit it has been found that by separating their plastics, metal, and drink cartons, residents will separate all of their waste better, including the other waste categories like paper, glass, and biodegradable waste (de AfvalSpiegel, 2019). Separating at source has several financial benefits for municipalities; the material often meets the standards for recycling of plastics resulting in money from the wastefund (‘afvalfonds verpakkingen’) (Rijkswaterstaat, 2020a). Lastly, once a municipality decides to apply post-separation, it is hard to reverse this choice; residents will likely not want to go back once used to the change.

A research executed bij Witteveen+Bos (2021) found that for the municipality of Almelo source separation of PMD cost roughly €2.7 million a year, post-separation costs roughly €3 million, and a combination of the two (source and post-separation) would be €3.4 million a year. When post-separation and source separation are compared on the recycling rate of their output, source separation is a little more effective than post-separation. 20% of the total waste which was separated at source is recycled, whereas with post-separation only 19% is recycled. However, a combination of source and post-separation would result in 29% recycling. The municipality of Almelo decided to introduce post-separation although the statistics had shown source separation as the more effective option, because they allowed convenience for their residents to play a large role in their choice making process (Bouwhuis, 2021) This shows that municipalities have many factors to include in their decision making process; costs and benefits, effectiveness, convenience, etc. (As a remark the residents of Almelo have been shown to be poor at separating waste; in 2020 more than half of the PMD-waste has been rejected by the waste processor (Bouwhuis, 2021). Therefore the costs and effectiveness are no guarantee for other municipalities.)

2.1.4 Factors influencing waste separation effectivity

The waste separation behaviour of individual residents is dependent on multiple factors; which can be divided into socio-demographic factors like age and gender, socio-psychological factors like moral norms or environmental concern, and technical-organisational factors like information provision and convenience. The socio-demographic factors are most commonly investigated predictors for recycling behaviour (Miafodzyeve & Brandt, 2012). One of these is age; McDonald and Ball (1998) found that elderly people, the category of 60 years and older, contribute more to plastic recycling (65%) than people between the ages of 16 and 30 (28%). Gender also influences waste separation behaviour; women care more about the environment than men, and are more inclined to participate in pro-environment actions (Abdullah, Sadq, Othman, & Faeq, 2019). Another factor is income; participation in waste separation is the highest in high-income areas (Kurz, Linden, & Sheeby, 2007). However, for this factor researchers note that it is not significant on its own, but most often connected to other factors; people with a higher educational level often have a higher income (Rousta, Zisen, & Hellwig, 2020). Educational level has an influence on peoples’ waste separation practice; a higher

educational level increases the knowledge about waste separation, and thus the possibility of source separation, and lowers the difficulties they encounter (de Feo & de Gisi, 2010).

Socio-psychological factors are factors which combine the individual and the social; an individual aims to live up to society's expectations and society helps the individual to attain their goals. An example of these socio-psychological factors is moral norms. Moral norms positively affect individual waste separation behaviour, when these external norms are internalised (Barr, Gilg, & Ford, 2001; Meneses & Palacio, 2005). Individuals are more inclined to participate in the practice of waste separation when they feel personal responsibility. Personal responsibility can also grow from someone's environmental concern; individuals with a higher, general environmental attitude are more likely to separate waste better (Bruvoll, Halvorsen, & Nyborg, 2000; Negash, Sarmiento, Tseng, Lim, & Ali, 2021). Peoples' intention to participate in the practice of waste separation is positively affected by their awareness of the benefits, and negatively affected by their perceived difficulties (Cudjoe, Yuan, & Han, 2020). The benefits can be promoted in educational campaigns, and by increasing the publicity and media coverage of waste separation. The perceived difficulties can be limited by providing the necessary facilities, and taking time and place of the practice of waste separation in consideration. All of these factors come together in someone's perceived behavioural control. Which is a factor that describes whether someone feels they have the skills needed, and the ability, to perform a specific behaviour; in this case waste separation (Wang, Wang, Yang, Li, & Zhou, 2020). The perceived behavioural control is connected to a person's knowledge of waste separation, and their understanding of the positive effects of waste separation, and the negative effects of the alternative (disposal).

The technical-organisational factors include the measures that can be taken to improve knowledge, awareness and convenience. Campaigns and increased media coverage positively influence knowledge on the practice of waste separation and awareness of the effects. Information can also help increase and sustain the intentions of residents to separate waste (Robinson & Read, 2005). The importance of convenience has been studied by Knickmeyer (2020), she notes that the easier it is to understand and use the waste management system, the more likely it is to be used. Factors that can improve the convenience are strategic location of collection points, and connected to that the short distance to them, appropriate waste storage space at home, high frequency of collection, clean appearance, and a smart visual design of the collection points, including colour, shape, and capacity. Bernstad (2014) also noted the importance of appropriate waste storage at home; in her study in Sweden it became clear that it was even more important than information campaigns.

2.1.5 Challenges of waste separation

Similar studies on waste management systems have been conducted, in this section the findings of these studies will be discussed. A study in Iran found that there was a low level of participation among citizens, which was mainly due to an unsuccessful attempt at providing the necessary infrastructural and cultural conditions for source separation (Babazadeh, Nadrian, Mosaferi, & Allahverdipour, 2018). The residents were waiting on incentives, they did not have a feeling of responsibility to initiate action. The respondents also reported inappropriate waste systems, their containers were filled too quickly, and thus not collected often enough, or not designed to fit its use. A study in Denmark found that residents perceived inconvenience and time scarcity (Pedersen & Manhice, 2020). They mostly reported a lack of space to store all containers needed to separate the waste; the challenge of interim

storage. And they regarded biodegradable waste as repellent, given the hygiene and potential extra cleaning for leakage of bio-waste bags.

A study in Sweden also found that it is important to look at the capacity of the waste bin infrastructure. Sometimes the shared biodegradable bin is full, and residents dump their biodegradable waste in other containers (Ordoñez, Harder, Nikitas, & Rahe, 2015). Furthermore residents were not provided with feedback on their waste separation practice, which means that they had no idea how much waste they generate and which type of waste is most generated. Ordoñez et al. (2015) suggest campaigns that focus on better information provision, motivation, and engagement. Residents should both be able to share their needs and preferences, and to learn about how they should be separating their waste in a better way.

Wang and Zhang (2022) studied the effect of social capital on engagement in the practice of waste separation. They found that environmental norms in people's social networks promote individual participation in the waste separation practice. People are exposed to useful information during social interactions, which can increase their environmental awareness and knowledge. Furthermore the social capital ingrained in intimate social relationships is useful for upholding a form of social control and enforcing shared restrictions on individual participation in waste separation. Thus having social ties influences the waste separation practice of individuals through an internalisation of environmental norms and a light form of peer pressure (ibid; Videreas, Owen, Conover & Wu, 2012).

Other countries also introduced a target for the recovery rate or recycling rate. In Geneva, Switzerland they have been experiencing difficulties trying to reach their goal of a recovery 50% rate for household waste, which inspired Bergeron (2016) to conduct an analysis. The results show that an incineration tax can motivate municipalities to participate more actively, something which is used in the Netherlands as well (Rijkswaterstaat, 2020b). The residents can be motivated with a combination of infrastructural and persuasive instruments (Bergeron, 2016). An example of such would be an awareness-raising campaign, which should be continuously implemented, since population does turn over. In the UK the average recycling rate is approximately 46%, whereas the goal is to have a recycling rate of at least 65% (DEFRA, 2021). One of the causes that was found is the effectiveness of communication, therefore it has been suggested that policy should be co-produced, and the language of communication should be appropriate and relevant to local needs and requirements (Oluwadipe, Garelick, McCarthy, & Purchase, 2021).

2.2 Relevant framework

The framework which is considered as relevant for this research is the model of Shove, Pantzar, and Watson (2012). Their model of social practice helped to not only understand the elements of a certain practice, but how the practice came into existence and could disappear or transform as well. Their model differentiates three main elements of social practices; meaning, material, and competence. When performing a practice, like separating waste in this research, the practitioners (residents) actively combine these elements; they are interconnected.

The first element in their model is meaning. They have taken this concept from Reckwitz (2002), who described meaning as mental activities, emotion, and motivational knowledge. Shove et al. use it in their model as the social and symbolic significance of participation at any given moment (2012, p.24). In the practice of waste separation, meaning includes beliefs, ideas, and norms and values of the residents about waste separation. More exactly this would be the beliefs of people, their norms, and values, their environmental

concern, and the aim to translate the shared social norm into an intrinsic motivation (Tabernero & Hernández, 2011). Beliefs, norms, and values include peoples' view on waste, whether people see waste as something that is mostly dirty, or as something that is valuable as a resource, for example. Peoples' view on waste influences their waste separation practice. Do they see waste as dirty, then most often they just want to not be bothered by it, and do not take the time to sort every little element. Environmental concern can be found in certain aspects people value most, as described in the value-belief-norm theory of environmentalism (Stern & Dietz, 1994). Three different types of orientation exist; egoistic, altruistic, and biospheric. When people have mostly egoistic values, they will focus on the consequences on their personal life and resources. These people will value waste separation when it can be connected as having an effect on their personal life. When people have mostly altruistic values, they will focus on consequences for other people most. These people will value waste separation when it can be connected as having an effect on other peoples' lives. Lastly, people that have mostly biospheric values will focus on consequences on nature and the environment. These people will value waste separation when it can be connected as having an effect on nature and the environment. The concept of meaning can be influenced by socio-demographic factors like age (McDonald & Ball, 1998), educational level (de Feo & de Gisi, 2010), and gender (Ekere, Mugisha, & Drake, 2009), and external motivational factors like financial incentives (Midden, 2015).

The second element is competence and Shove et al. (2012) have taken this concept from Giddens' practical consciousness. Practical consciousness is defined as '*What actors know* (believe) *about social conditions, including especially the conditions of his own action, but cannot express discursively*' (Giddens, 1976, p.375). Shove et al. (2012) translate this concept from the individual mind to a group level. They see it as deliberately cultivated skill, and as shared understandings of appropriate performance of the practice. Important for them is that this competence does not just concern knowing in the sense of being able to evaluate a performance of the practice, but als knowing in the sense of having the skills required to perform the practice themselves. Competence thus includes the skills, knowledge, and technique to be able to execute the practice of separating waste. For the residents it is mainly connected to information provision and educational processes (Cudjoe, Yuan, & Han, 2020), but also to the possibility of feedback on their results, both from the municipality and via self-reflection (Ordoñez et al., 2015).

The third and last element is material and Shove et al. (2012) note that previous sociologists did not really write about 'things', but as Schatzki puts it '*practices are intrinsically connected to and interwoven with object*s' (2003, p.106). Material includes the needed objects, infrastructure, tools, and technologies to enable the practice of waste separation to take place. For residents this is mainly connected to the technical-organisational factors; the needed containers and garbage bags, the space to store them (Bernstad, 2014), the organisation of collection, and the design of these materials (Novi Mores, Rijkswaterstaat, NederlandSchoon, & NVRD, 2017). As Knickmeyer (2020) stated the materials should make the practice of waste separation as convenient as possible.

As long as the connection between the three elements are being sustained, the practice continues to exist (Shove et al., 2012). However, once the connections are being broken, and new connections are made, the practice either disappears, or shifts. Stability of a practice is thus not given because of reaching the end state of a practice that has been normalised, but rather a result of constant repetition of linking the elements in the same way. These patterns of stability and change are not controlled by one actor alone, however the

policy makers (municipalities) can influence the range of factors that are included in the circulation of the elements.

To conclude, the model of Shove et al. (2012) distinguishes 3 phases; a proto-practice, a practice, and an ex-practice. During the proto-practice phase the relevant elements exist, but they have not been linked. During the practice phase these elements have been linked and are interconnected. And during the ex-practice phase the practice shifts or disappears, because the links between the elements are no longer sustained. When aiming at a more efficiënt waste separation practice you want the current practice to shift to the ex-practice phase and make place for a more effective version.

2.3 Conceptual framework

The conceptual framework for this research is displayed in figure 3 (see next page). In the bottom left corner the practice of waste separation is displayed; which consists of the three elements meaning, competence, and material (Shove et al., 2012). Meaning refers to the beliefs, and norms and values of the residents (environmental concern for example), competences refers to their knowledge and skills, and material refers to the objects, space, and the infrastructure, as explained in section 2.2. The outcome of the practice of waste separation influences the amount of residual waste per resident. When residents believe waste separation is good for the environment, or they have more knowledge of waste separation or they have enough of the right material helping them to separate, this will likely result in them producing less residual waste.

A Dutch municipality wants to have an amount of residual waste that is as low as possible, in order to meet the national goal in 2025 of 30kg residual waste per resident. The extent to which a municipality is able to reach this goal depends on the actual waste separation practice of its residents. The municipality's waste policy has a two-sided relationship with the waste separation practice of residents; the waste policy influences residents, and residents can influence the waste policy. The waste policy influences residents' meaning (a) by showing them why waste separation is important, either by providing information through their communication channels, or through educational campaigns, and next to that the municipality could use subsidies as external motivation. The municipality's policy can influence resident's material (b) by handing them their waste collection objects (for example, containers, waste bags, etc.) or improving the waste infrastructure. During the design of the collection objects and the waste infrastructure, focus should be given on the possible effect on residents' space and the hygiene of waste separation, to improve residents' waste separation. Lastly, the municipality can influence residents' competence (c), by offering training (combined with educational campaigns) or sharing information or feedback aimed at improving knowledge or skills. (The relationship of the municipality's waste policy on the waste separation practice of their residents are shown in figure 6 and examined in section 2.3.1.) The other side of the relationship between the municipality's policy and the waste separation practice of their residents is feedback from residents on the municipality's waste policy. This will lead to a better match between what municipalities can offer and what residents feel they are lacking. (This relationship is shown in the middle part of figure 3 'proto-practice'.) In order to get to a new practice that results in less residual waste per resident, municipalities should gather feedback and better adapt their

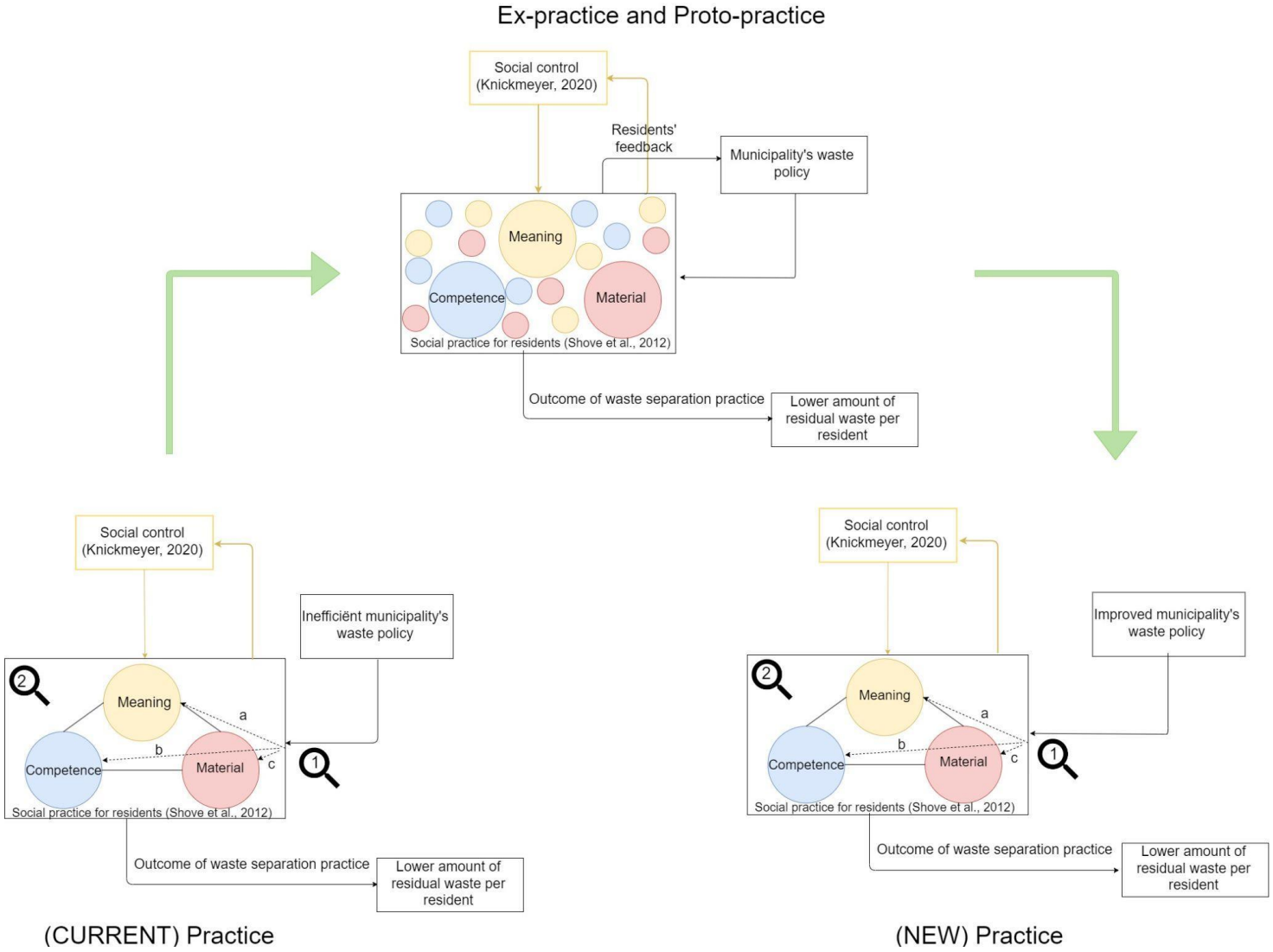

Figure 3: Conceptual model (Adapted from Shove et al., 2012)

policy to the needs of their residents. (An example is the survey that has been conducted in the municipalities of Nijkerk and Putten during this research; municipalities are given feedback on how they can improve.) There is an external factor that can improve the performance of residents on their waste separation, independent of the municipality and their waste policy; the social norm of recycling culture. Knickmeyer (2020) has proposed a 'recycling culture' as a possible solution to improve the practice of waste separation. When the recycling culture successfully integrates in the community, residents will no longer feel like they have to perform the waste separation practice on their own, rather it is something that is done together. People will correct each other on mistakes they make, and will inspire and motivate each other; be each other's external motivation. Therefore in this research the recycling culture is called 'social control', residents observe each other on their performance of waste separation and correct each other when needed.

According to Knickmeyer (2020), in order to promote social control, a municipality should make use of both targeted communication, and educational programmes that involve the community and present waste separation as a social norm, and waste separation should be as convenient as possible. Next to that, municipalities should apply financial incentives and acknowledge the efforts taken by residents, to assure a continuation of the recycling culture, even after the educational programme ended. Once in place, the recycling culture (social control) will influence residents' competence, their knowledge and skills, as well as their meaning; their beliefs. Social control has been shown in the conceptual model as independent of the waste separation practice itself. As Hitchings (2013) puts it, social control, as a form of social network, has a supporting factor; it is an essential part for strategies and practices of comfort to circulate and change. However, social control and the waste separation practice are interconnected; social control can be seen as both the outcome of past practices of waste separation and as something through which the practice of waste separation exists, people keep motivating each other to actively engage with the practice. This interconnectedness is shown in figure 3 by the yellow arrows.

2.3.1 Relation between waste policy and the practice of waste separation

In this section the practice of waste separation will be discussed in more detail. The specific components of the three elements: meaning, material, and competence (figure 4) will be talked through, as well as the relationships between governance (municipalities' waste policy) and the social practice of waste separation by residents (figure 6). The first element that will be discussed is meaning, which is related to the significance of participation in the practice of waste separation. This is related to the environmental concern that residents have. Individuals with a higher environmental concern are more often practising recycling and waste separation (Bruvoll, Halvorsen, Nyborg, 2000). This environmental concern is found in beliefs that residents hold about certain aspects. Whether they believe waste is separately processed or all ends up being incinerated influences their motivation to separate waste and the meaning they attach to the practice of waste sorting. Environmental concern can also be found in certain norms or values people feel as being important, as described in the value-belief-norm theory of environmentalism (Stern & Dietz, 1994). Through informational or educational campaigns, a municipality can promote the importance of waste separation. In these campaigns they should focus on all three of the orientations described by Stern and Dietz (1994), egoistic, altruistic and biospheric. They should thus make clear in what ways it can help residents themself, other people, and the environment. An example is the national campaign in the Netherlands specifically targeted at food waste; a mascot called Becky (Rijksoverheid, 2019). Becky teaches people about food waste in short video clips, since 2019, topics like the

difference between the two dates of ‘use until’ and ‘best before’, and checking your fridge before you do your groceries (Samen Tegen Voedselverspilling, 2021).

The environmental concern of residents can also be influenced by certain socio-demographic factors. Some researchers found that for example age (McDonald and Ball, 1998), educational level (de Feo & de Gisi, 2010), and gender (Ekere, Mugisha, & Drake, 2009) influence a person’s environmental concern and their participation in the practice of waste separation. A municipality can not directly influence these socio-demographic factors, but knowing the effect of these factors on residents’ meaning of the waste separation practice, can help them to determine the target groups which need extra guidance. External motivation can help to trigger environmental concern, and motivate residents to start separation waste or improve their waste separation practice. External motivation given by the municipality often takes on the form of financial incentives (taxes/subsidies). However, this form only works temporarily; the external motivation stops as soon as the financial incentive ends (Midden, 2015).

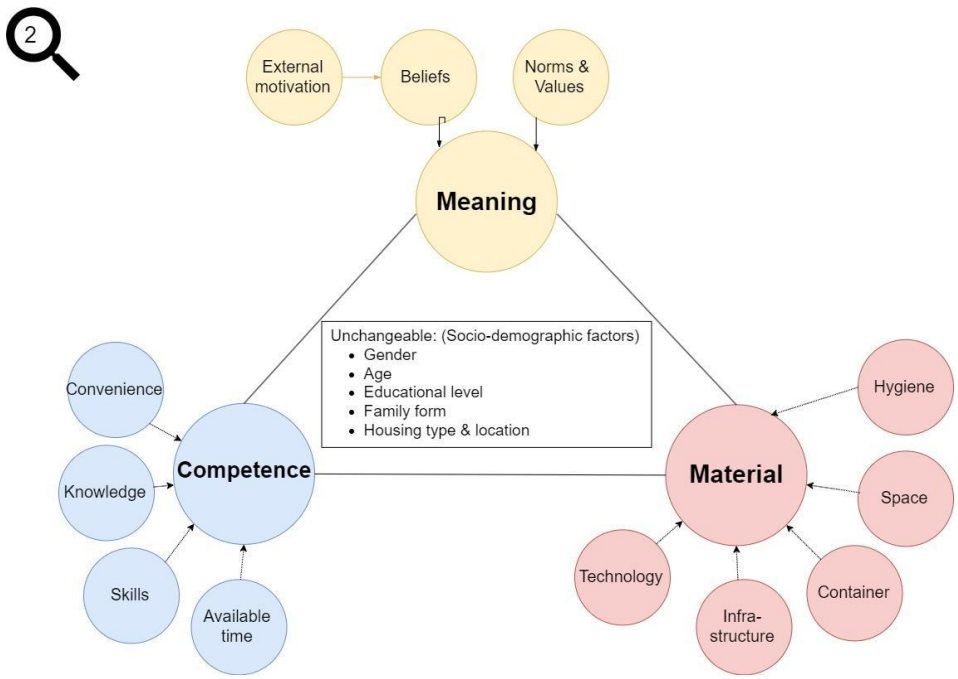

Figure 4: Conceptual model of the specific components of the waste separation practice (Adapted from Shove et al., 2012)

The second element is competence, which is related to knowing in the sense of knowing to be able to evaluate a performance, but also, and even more important, knowing in the sense of having skills that are required to perform certain actions that are needed for the practice of waste separation. Shove et al. (2012, p.24) describe knowledge as ‘*practical consciousness, deliberately cultivated skill, or more abstractly, as shared understandings of good or appropriate performance*’. Knowledge can be obtained from the informational or educational campaigns, which support residents in understanding which waste belongs to which waste category, and teach them how they can conduct the practice of waste separation at home.

Competence is also related to feedback, which can help guide practitioners (Shove et al., 2012). Residents might perform waste separation in a certain way which they believe is the right way, and without feedback they will not be corrected. Monitoring the waste separation outcome of residents by the municipality can help them to understand how well people are

conducting their practice, and on what aspects residents are possibly lacking knowledge. Based on this monitoring, they can provide their residents with feedback on the qualities of their past performances of waste separation. This can be given on a personal level, but since waste is collected from multiple households at the same time, it is difficult to keep these apart. Feedback can also be given on a group level (a street, a neighbourhood, or the whole municipality), in that case it might help to know how well people are doing compared to others, and it is easier to organise separate collection per group. For the purpose of giving residents feedback on their waste separation practice, a waste-coach can be designated (Rijkswaterstaat & VANG-Hha, 2018). A waste-coach is a person that is enthusiastic about waste separation, and has a strong attitude. This person helps residents to enjoy waste separation more, they improve residents' motivation and are able to answer residents' questions.

Convenience influences people's competence; whether people separate their biowaste in the correct container does not only depend on their knowledge or on having the right material to do so, but als on convenience. Is the bin still closeby, or is it in the garden while it's raining? The municipality can not fully solve the convenience problem, since they can not change the inside of people's houses. However, the municipality could offer cheap or free material to be able to dispose of waste inside when its' raining. The possible negative effect that convenience could have on the optimal practice of waste separation can be reduced or prevented, by handing out waste separation material, or by offering infrastructure that fits the needs of residents more. An example of improving the infrastructure would be maintaining a specific short distance from housing to the shared container, so it does not cost much time or effort to dispose of waste. Municipalities could also consider putting different waste containers at the same spot where many people come, for example, at the nearby supermarket, to improve convenience.

The third and last element is material, which includes objects, infrastructures, tools, hardware and the body of the practitioner itself. The objects needed by residents to be able to dispose of their waste (garbage bags, waste containers, or access to shared underground containers) should be offered by the municipality, either for free or a small price. Each waste category needs their own object, whether a municipality chooses to only sort waste to the extent that it is legally prescribed, or sort several extra categories; residents need to have enough different waste collection materials to sort all different waste categories. Next to these objects, the space inside and outside housing determines the extent to which residents can practise waste separation. Municipalities can not fix peoples' bodies, but they need to consider certain barriers when designing infrastructure. For people with a physical disability (lacking energy, being in a wheelchair, etc.) it might be more difficult to dispose of waste in underground containers or at the recycling centre.

The infrastructure of the waste disposal facilities can nudge residents as well. When the placement of waste collection points is thought through, it can make it easier to sort waste. When waste is collected regularly, full containers will not be hindering the waste separation practice. And collection points that are located on popular routes, closeby the supermarket for example, make it easier for residents to combine activities, and dispose of their waste while shopping. (See figure 5 for an example in a mall in Utrecht.)

The design of objects for waste separation can nudge people into a better performance of the waste separation practice. When the container for paper has a smaller opening, residents will be able to see in a glance that it is the paper container, and will also be nudged to flatten paper boxes. Whereas bigger openings are needed for residual waste,

Figure 5: Waste disposal in Hoog Catharijne (Preuter, august 2022)

since residual waste is often disposed of in bigger garbage bags. The design of collection points can also make waste separation more interesting for children by using cartoons for example (Yu, Lu, Qian, & Zhou, 2018). Illustrations are also more effective than text on what type of waste belongs in which container, since you can see it easily, and do not need to be able to read it. Furthermore, it has been found that design of waste collection materials can help prevent so-called 'bijplaatsing', which is the placement of waste next to containers (when it does not fit or the container is temporarily out-of-use). By making the container shiny and using the colour red for the ground around the container people are more likely to place their waste in the container or take it home, instead of placing it next to the container (Novi Mores, et al., 2017).

In order to improve their residents' waste separation practice, municipalities can use seven governance instruments, as displayed in figure 6. The first instrument for municipalities would be to offer financial support (subsidies) to improve external motivation. This instrument is not ideal, since residents' motivation would stop when the subsidy stops (Midden, 2015). Another possible instrument would be to provide information to influence residents' knowledge, norms and values, and beliefs, or provide feedback to improve knowledge, and skills. When municipalities want to put in a little more effort they could start an educational campaign, which would improve knowledge, skills, and beliefs. To improve residents' material, municipalities could either improve the existing infrastructure, hand out more or different objects, and/or change the design of collection material to improve hygiene and space.

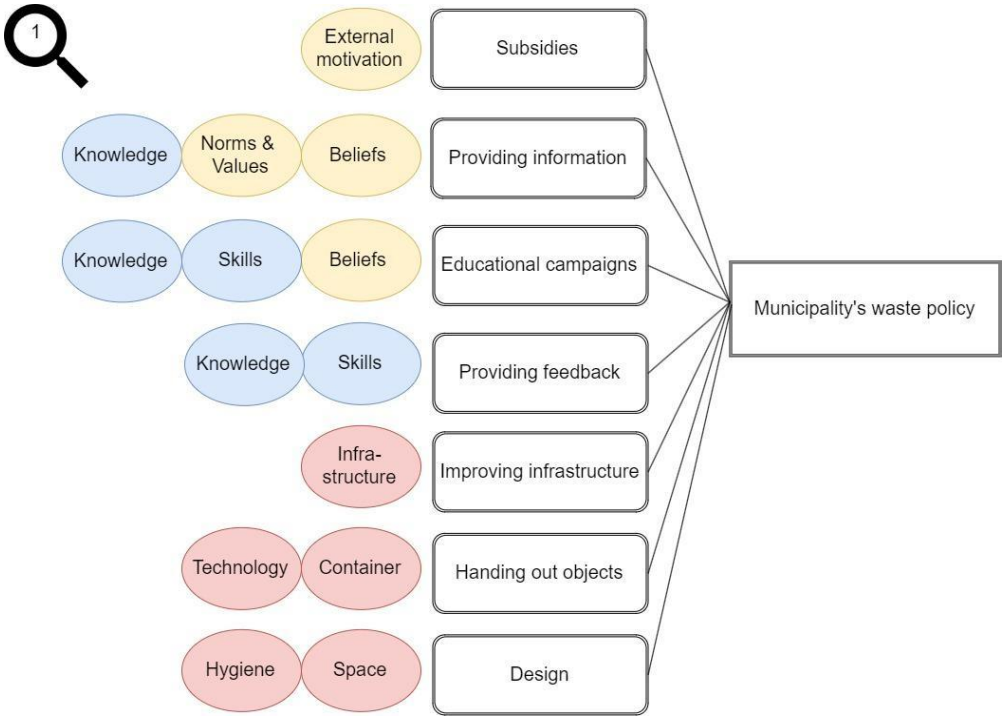

Figure 6: Conceptual model of governance of waste separation practice (Adapted from Shove et al., 2012)

3. Method

In this chapter the methodology of this research is explained. First, the research philosophy of the researcher will be introduced, after which the method used to investigate (the governance of) the practice of waste separation, will be discussed. The chapter ends with a reflection on the validity and reliability of the research, its researcher and their methods.

3.1 Research philosophy

Many different authors have written about the importance of research philosophy. Saunders, Thornhill, and Lewis (2019, p.130) define research philosophy as "*a system of beliefs and assumptions about the development of knowledge*". During the conduction of research for this thesis, the researcher has been developing knowledge for the municipalities of Nijkerk and Putten, as well as stakeholders of their waste management. It is important to be aware of the assumptions made by the researcher during the different stages of the research, since they shape the research process and possible outcomes.

The research philosophy can be divided into three categories: ontology, epistemology, and theoretical perspective (Moon & Blackman, 2014). Ontology is concerned with assumptions about the realities, how the researcher sees the world. Ontology itself is a spectrum from realism to relativism, in which realism believes only one reality exists, and relativism believes that multiple realities exist. The researcher in this thesis takes on a critical-realist perspective, this perspective is in the middle of the spectrum; it believes there is only one reality, but this reality can never be understood perfectly (Saunders, Thornhill, & Lewis, 2019). The aim was thus to identify a generalizable research-result of the two cases under investigation, which will be fitting for more Dutch municipalities. However, the researcher is aware that one can never fully understand this one reality, why certain factors improve and others limit waste management.

Epistemology is concerned with assumptions about knowledge and the way people generate knowledge. Three different forms of epistemology exist; objectivism, constructionism, and subjectivism (Moon & Blackman, 2014). Objectivists assume that reality exists independent of the individual mind, the truth is objective, and thus empirically verifiable, independent of social conditions. Constructionists reject the idea of one objective truth, they believe that different individuals construct meaning of the same phenomenon in different ways, meaning arises through interaction with the social world. Subjectivists believe that what constitutes knowledge is dependent on how people perceive and understand reality; reality is pluralistic. The researcher in this research takes on a constructionist perspective, they will talk to different respondents, since each constructs their own meaning of waste management and separation. People construct knowledge by engaging with the world, and interpreting it (Crotty, 1998). From their critical-realist perspective, the researcher realises that they will never fully understand reality, and the constructionist perspective adds to that; no real world exists that is independent of human activity or symbolic language. Meaning is created from interplay between the researcher and the respondent, the subject (researcher) constructs reality of the object (households waste-management).

The theoretical perspective is concerned with the philosophical orientation of the researcher that guides their research. The central theoretical perspective in this thesis will be post-positivism, since humans can never know reality perfectly. The ideas of the researcher will influence what they observe and therefore their ideas will impact upon what they will conclude (McGlinchey, 2022). The main belief of the researcher will be that multiple methods are needed to identify the different factors and their relationship with waste management, to see the phenomenon from different perspectives. Another theoretical perspective will be

symbolic interactionism, which believes that meaning is something that emerges out of interactions between people (Moon & Blackman, 2014). Societies are created and kept alive through the repeated actions of individuals; the interactions (Carter & Fuller, 2015). During their research, the researcher took the position of the research objects (households and policy makers) and tried to exchange meaning through language and symbols in interaction, and gather the necessary data. This has been done by attending meetings from policy makers, to observe the social interaction and better understand their reality (Saunders, Thornhill, & Lewis, 2019). However, during these observations the researcher was aware of their own ideas that can influence their conclusions (post-positivism) and thus tried to observe as neutrally as possible.

3.2 Research strategy

After determining the researcher's philosophical position, the next step is to look into the research strategy. This research is deductive; hypotheses have been formulated based on existing theories (see appendix 7.2), after which they are tested on the collected data from policy makers and residents from the two municipalities Nijkerk and Putten (Creswell & Plano Clark, 2007). After analysis it became clear whether this research adds to the existing theories or is contradicting them. The goal has been to find a relationship between the waste separation practices and a potential decline in the amount of residual waste. This relationship ideally would be found in both municipalities, leading to a potential model for a broader set of municipalities.

The research takes the form of a comparative, descriptive case study. A case study is seen as most fitting to the research questions, since it allows the researcher to describe the complexity of the waste-management practice (Stake, 1995). A case-study also offers the opportunity to conduct an in-depth research of the waste separation practice for the two municipalities Nijkerk and Putten. This in-depth understanding has been possible by combining surveys with small interviews, to not only see whether certain factors are influencing peoples' waste separation practice, but also why they create this effect.

3.3 Data collection

The research method aligns with the researcher's philosophical perspective (see section 3.1); they broadened their perspective on the possibility of multiple views on reality, although one reality has been found in the literature. For example, the reality of age having a positive effect on recycling behaviour has been found as a result from previous research (McDonald and Ball, 1998), but the researcher was open to the possibility of other outcomes (in other words a negative relation or no significant relation). Data has been collected via secondary literature, conservations with policymakers, and via surveys and interviews with residents. The research method is both qualitative and quantitative, making it a mixed-methods strategy. A mixed-methods strategy will increase the understanding of the phenomenon under study (Bryman, 2012). Another advantage of a mixed-methods strategy is methodological triangulation; interviews can be used to verify the results from the survey.

The survey asks individuals about their experiences with waste separation, and how they perceive the practice of waste separation. This does not quite square with how Shove et al. (2012) came up with their model of social practice; they see individuals just as carriers of these practices. In the survey practices are individualised, whereas Shove et al. (2012) advocate to see a practice that is the same for all residents. However to improve generalizability of the research a large sample of residents have been looked into. A survey allows us to look into a large group of people in a little amount of time, whereas it would cost

more time to observe each of them in their performance of the practice of waste separation. The researcher also chose not to conduct observations, although it would have been an enrichment to the data, because it is difficult to actually observe the residents; bias can arise. Either a recall bias about residents' waste separation in the past, when they are questioned on historical events, or a distortion of the practice through interfering, residents are aware and will act in a socially responsible way, instead of according to their usual actions (Colombo et al., 2020).

3.3.1 Secondary literature

The data-collection started by approaching the so-called 'experts', in order to establish a first set of key problems and potential categories, keeping the municipalities from limiting their households' residual waste. This has taken on multiple forms, depending on the respondent. First of all a document has been analysed from a company focused on behavioural change; D&B. D&B (2017) has published a document in which they advise other companies and governmental organisations on how they could improve waste separation via nudging. Since this document answers the questions that would have been asked during an interview, there has not been an interview with D&B. Next to this national expert, the local experts, policy makers, have been questioned about policy choices of the past and possible new policy choices in the future, to be able to determine what factors can and can not be changed in the two municipalities. This has not taken place during one interview that has been prepared and recorded, but through multiple informal questions over the course of the internship. The results of which will be discussed in chapter four.

3.3.2 Survey and interviews

After the elements of the practice of waste separation were identified through the literature study in chapter two, a survey has been established, which is included in appendix 7.1. In the survey, residents from both municipalities have been questioned about their waste separation practice. Residents could anonymously answer the questions, making it easier to be open about their own shortcomings during the separation of waste and to reflect on the municipality's waste separation strategy. The survey would take approximately 20 minutes to fill in. The survey has been held online for a period of two weeks, which resulted in 293 respondents in Nijkerk and 104 respondents in Putten. At a 95% confidence level, statements about the municipality of Nijkerk have a 6% margin of error and statements about the municipality of Putten have a 10% margin of error. (For example, if it is stated that 70% of the people often separate plastics; in the municipality of Nijkerk this could in reality be anywhere between 64% and 76%, and in the municipality of Putten this could be between 60% and 80%.) These survey samples are sufficient, because for this research it was needed to get some general ideas about how well people separate waste and what they would need from the municipality. When research would look more into details of the practice of waste separation a larger sample would have been required, to have a larger confidence level (99%) and a smaller margin of error (2%).

Some respondents of this survey have been asked to elaborate on their answers during a short interview, in order to gain further insight into the factors limiting their waste separation performance. These respondents have been selected out of the people that had indicated in the survey to be willing to further elaborate their answers in an interview. The added value of the interviews is that the researcher can be more flexible; they can probe for more detailed answers or repeat questions when they are not satisfied with the answer, or explain certain questions when residents do not fully understand them (Bailey, 2008).

3.4 Data-analysis

The process of data-analysis for the qualitative data, from the secondary literature and the interviews, mostly follows the idea of the grounded theory approach (Glaser & Strauss, 1967). Data has been collected from the respondents, which is coded by the researcher. The coding first takes the form of initial coding, where what is written or said is coded in short, resulting in clear, recognizable codes (Bryman, 2012). After this first form is finished, the researcher has tried to categorise the initial codes in a group of codes, in a process of more focused coding. These group codes do not mirror the factors found from existing theories, the coding process is open, making way for the possibility of finding new factors.

The more quantitative data from the surveys have been analysed in a different way. The data from the survey has been inserted in SPSS which is a software that assists the researcher during the analysis. The hypotheses found in chapter 2 (appendix 7.2) have been tested on the data from the two municipalities. The specific tests in SPSS that have been used are crosstabs, and the Chi-square test. Crosstabs are used to describe variables and differences in groups, and it helps to visualise the relationship between two variables, for example to compare people in groups based on their age/gender/etc. (De Vocht, 2019) The Chi-Square test is used to compare multiple independent groups and check whether there is a statistically significant relationship between variables. The Chi-Square test can help to check whether the variables in a crosstab are significantly related.

3.5 Validity and reliability of the research

Validity can be divided into internal validity and external validity. Internal validity is concerned with the extent to which the data reflects reality; has the theoretical construct adequately been operationalized, and does the pressupposed causal relationship actually exist? (Van Thiel, 2014). Internal validity can be negatively affected by the observer-expectancy effect; a researcher tends to, subconsciously, influence the participants of an experiment. They might interpret results incorrectly, because of their tendency to look for information that confirms the results from theory. And by the subject-expectancy effect; in which the respondent thinks a certain result is expected and therefore, unconsciously, affects the outcome. To limit the negative effect on the internal validity multiple methods have been used; interviews, survey, and secondary literature, and multiple actors will be addressed; policy makers, and residents themselves.

External validity is concerned with the possibility of generalizability of the results. The external validity of this research is negatively affected by the fact that the waste management of both of the municipalities are executed by the same person, and they are neighbouring municipalities which could have influenced the outcomes. This effect is limited by being careful in making statements about observed relationships; these also need to be examined in other municipalities before it can be concluded with certainty that this is generalisable.

Reliability is concerned with the indepence of the researcher; the researcher might make mistakes, or have a bias. Because of the fact that the researcher has been working for the municipality of Nijkerk, and not the municipality of Putten, a bias might have arisen. The researcher has been aware of this effect, and tried to reflect on this to limit bias. Furthermore, to improve the reliability, and more specifically the consistency of the research, the method is transparent, and data will be available, to allow another researcher to conduct a similar research.

4. Results

Before answering the three sub-questions, a description of the municipalities of Nijkerk and Putten on their waste separation will be given to give some more context. The municipalities are neighbouring municipalities, as shown in figure 7. When classifying the two municipalities into the four modes of governing (discussed in chapter 2), they both are located in the disposal mode. The municipalities make use of the governmental technologies dustbins, weekly collections, and landfill sites (waste disposal sites from where waste is distributed to the parties that process the waste).

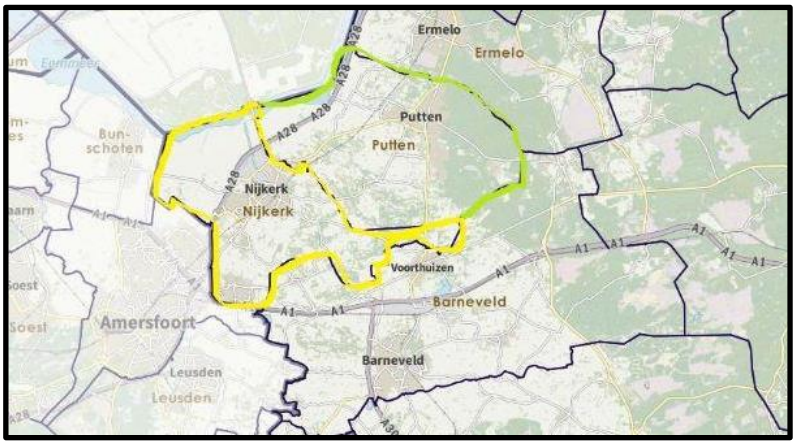

Figure 7: Overview map of the province, including municipal borders, largest places and major infrastructure (van Aalst, 2019) [Edited]

The municipality of Nijkerk has 43,600 residents (CBS, 2022a), of which 291 people have completed the survey. Waste from residents is collected in waste bags, containers or from a shared underground container by an external party; Remondis. To promote waste separation, people can dispose of the recyclable waste streams for free (paper, PMD and biowaste), whereas they have to pay for the disposal of residual waste. (€1.40 for a 60L waste bag, €3.30 for a 140L container or €1.40 for a disposal in the underground container.)

In the last five years the residual waste per resident has been decreasing; in 2017 each resident produced 130.6kg residual waste, of which 14kg was bulky waste, and in 2021 each resident produced 104.6kg residual waste, of which 17.1kg was bulky waste (as shown in figure 8). From 2019 to 2020 there has been a slight increase in residual waste per resident, which policy makers have attributed to the corona crisis. (It was compulsory to wear face masks, many people opted for single-use face masks, which added up to the residual waste. During the lockdowns people had more free time, so they started cleaning up their houses and taking items to recycling centres and/or landfills.)

Compared to 2017 each resident in Nijkerk produces 26kg less residual waste in 2021 (a period of 4 years), however in 2025 the national goal is to have only 30kg residual waste per resident (including bulky waste). Policymakers must find a way to lose the extra 74.6kg residual waste per resident, this is again a period of 4 years, in which municipalities are given the task to find more effective ways to decline residents' residual waste.

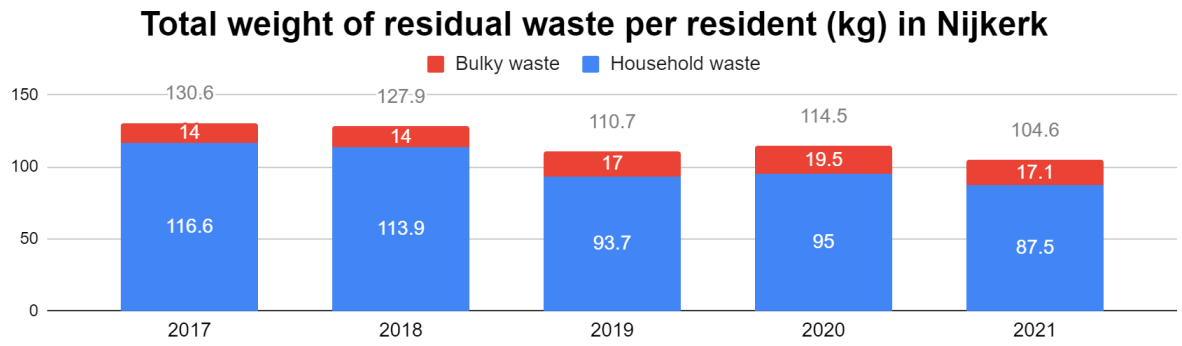

Figure 8: Total weight of residual waste per resident (kg) in Nijkerk

The municipality of Putten has 24,365 residents (CBS, 2022a), of which 104 people have completed the survey. The municipality collects the waste from residents themselves, they mostly use waste bags, and only glass and textile is collected via shared underground containers. The waste bags are cheaper for the recyclable waste streams; disposal of paper is free, residents pay €0.15 for 10L biowaste, €0.75 for 50L garden waste, and €0.15 for 50L PMD, whereas they pay €1.50 for 50L residual waste.

In the last five years the residual waste per resident has been fluctuating; in 2017 each resident produced 71.5kg residual waste, in 2018 this was roughly the same (73.1kg), it peaked in 2019 (96.7kg), the lowest was 68kg in 2020, and it increased to 84kg in 2021 (as shown in figure 9). The increase in residual waste per resident in 2019 is due to a tripled amount of bulky household waste, the reason is unclear. It is interesting to see that Putten does not have the sudden increase in residual waste in 2020, which Nijkerk did have and would attribute to the corona crisis. However, the corona crisis was a national crisis, and one would expect to see the sudden increase in each municipality. On average a Dutch resident produced 491kg of residual waste in 2019, 524kg in 2020, and 505 in 2021, there we can see the sudden increase in 2020 as well (CBS, 2022b). It is interesting to explore this further, but given the limited scope of this study, it is not explored further herein.

Putten applies post-separation, next to their source separation. After washing and fermentation they estimate to have a rendement of 28%; therefore they would say that they have 50kg instead of 69 kg residual waste per capita, in 2021. Furthermore they apply post-separation especially for diapers (since 2021); about 14kg of their 50kg per capita of residual waste is still recovered in this way, leading to a total of 36kg (A. Meijerink, personal communication, 5 October 2022). However, for this research the nationally communication information (the 69kg) will be used.

Since 2017 each resident in Putten produces 12.5kg more residual waste, however in 2022 the municipality has set their own goal to reach 45kg per resident (excluding bulky waste), and in 2025 the national goal is to have only 30kg residual waste per resident (including bulky waste). Policymakers must find a way to lose 29kg in this year, and 30kg more in the next three years, to reach both goals. (When the estimated reductions of residual waste weight of post-separation (washing, fermentation, and post-separation of diapers) is included, the total amount of household residual waste (excluding bulky waste) is 36kg, and Putten would have already succeeded at their goal for 2022, and they only need to lose 21kg (Of which 15kg is bulky waste) in the next three years.

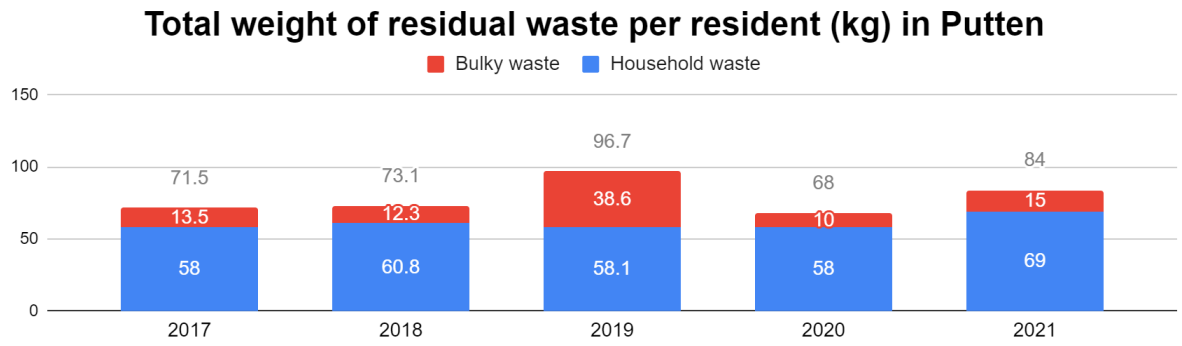

Figure 9: Total weight of residual waste per resident (kg) in Putten

4.1 Question 1: Differences in waste management strategies

As seen in the introduction of this chapter the municipality of Nijkerk charges more general waste disposal costs, and less specific costs per waste category, whereas the municipality of Putten charges more specific costs, and less general costs. The municipality of Nijkerk has seen a decline in residual household waste since 2019 (see figure 8), when they started separately collecting plastics (PMD). Whereas the municipality of Putten has seen a relatively stable trend in residual household waste, and a surprising increase in 2021 (see figure 9).

The first sub-question looks more into the differences between the municipalities of Nijkerk and Putten; '*What led to the differences in the waste management strategies of the neighbouring municipalities of Nijkerk and Putten?*'. The two municipalities are part of different partnerships with other municipalities in the region. In these partnerships the municipalities work together on multiple aspects, of which the collaboration on the aspect of waste is important for now. In these partnerships the municipalities can benefit from economies of scale. They can collaborate in the organisation of waste collection and/or the waste processing, which is more beneficial for municipalities than each having to organise it on their own. However, both municipalities still develop their own waste policy.

Nijkerk is part of 'Regio Foodvalley', a region of eight municipalities, of which five work together on waste (Regio Foodvalley, n.d). Together the municipalities decide upon which tenders to do, when it comes to processing of the larger waste streams. However Nijkerk also organises part of their waste processing via Remondis, the party that collects waste for Nijkerk.

Putten is part of 'Regio Noord-Veluwe', a region of six municipalities, who have established their own sub-organisation for the organisation of waste collection and processing: ACONOV[3] (ACONOV, 2021). From 2025 onwards this organisation will be dissolved, and each municipality will be collecting their own waste (Kooijmans, 2022). Putten is not a part of this organisation, they organise the waste collection on their own. For the waste processing Putten does work together with the other five municipalities, and this cooperation will continue even after the dissolvement of ACONOV.

The differences in organisation of waste collection and waste processing are the main reasons for different waste management strategies. Other reasons the waste management strategies differ are policy choices that are so to say embedded; the municipality of Putten has been collecting their waste in bags for quite some time, and it would not easily change that. To organise a waste infrastructure with mini-containers and underground containers would be a huge investment for a small municipality. They would, for example, need different vehicles to empty the containers and transport the waste. And overall Putten is satisfied with the current

[3] ACONOV stands for Afval Combinatie Noord-Veluwe.

system: the amount of residual waste is low, and people are content about the current system of waste separation. The municipality of Nijkerk offers multiple collection means; waste bags, mini-containers and underground containers. Changing the collection system in Nijkerk would be more easy; they could include the change in a tender from the collector, whereas Putten has to invest in new means themselves (or they should expand the external party's work in a new contract, for not only emptying the underground containers of textiles and glass, but also other categories).

4.2 Question 2: Factors (Shove et al.) limiting municipalities

The second sub-question is '*What are the specific components of the three elements of the social practice of waste separation (Shove, Pantzar, & Watson, 2012), that make up the practice of waste separation?*'. This question will be answered by testing the hypotheses found in the existing literature (appendix 7.2), and will be presented separately for each of the three elements; meaning, material, and competence. Remarkable differences between the two municipalities are discussed in section 4.2.5.

It is important to keep in mind that the results are based on a survey, and not on observations. When a statement is given that for example 90% of the people separate paper, it is 90% of the people that say they separate paper, it is uncertain whether all these people actually always separate paper.

Furthermore one should keep in mind the margin of error for statements about a part of the population. At a 95% confidence level, statements about the municipality of Nijkerk have a 6% margin of error and statements about the municipality of Putten have a 10% margin of error. (For example, if it is stated that 70% of the people often separate plastics; in the municipality of Nijkerk this could in reality be anywhere between 64% and 76%, and in the municipality of Putten this could be between 60% and 80%.)

4.2.1 Meaning

The hypotheses that could be assigned to the element meaning of a social practice (Shove et al., 2012) touch upon moral norms (norms and values) and environmental attitudes (beliefs). The first hypothesis states that moral norms positively affect individual recycling behaviour (Barr et al., 2001; Meneses and Palacio, 2005). It has been tested on two moral norms: 'Everyone is expected to participate in the practice of waste separation.' and 'You need to correct others when they separate their waste incorrectly.'. It has been found in the survey that people who do believe that participation in the practice of waste separation is expected from them, less often separate their waste. This effect was the strongest for separation of biowaste (see figure 10); of the people that believe participation is expected from them 78.4% often separates kitchen waste, and 88.5% often separate garden waste, whereas out of the people that do not believe participation is expected from them 86.9% often separates kitchen waste, and 95.5% often separates garden waste[4]. Therefore the hypothesis that moral norms positively affect individual recycling behaviour is falsified for the norm 'Everyone is expected to participate in the practice of waste separation.'. This is a norm that is external to the person themselves, and motivation is stronger when it comes from within the person themselves; intrinsic motivation (Tabernero & Hernández, 2011).

[4] It is important to keep in mind that the results are based on a survey, and not on observations. When a statement is given that for example 78.4% of the people separate kitchen waste, it is 78.4% of the people that say they separate kitchen waste, it is uncertain whether all these people actually always separate kitchen waste.

The second moral norm is that people correct each other when someone is performing the practice of waste separation incorrectly. 67.1% of the people have seen others separating waste incorrectly, but only 22.5% of them would correct others. It has been found that people that correct others, separate waste more often themselves. This effect was strongest for the separation of electronic devices; out of the people that correct others 96.6% say they often separate electronic devices, whereas out of the people that do not correct others 85.4% say they often separate electronic devices. Therefore the hypothesis that moral norms positively affect individual recycling behaviour is verified for the norm: 'You need to correct others when they separate their waste incorrectly'.

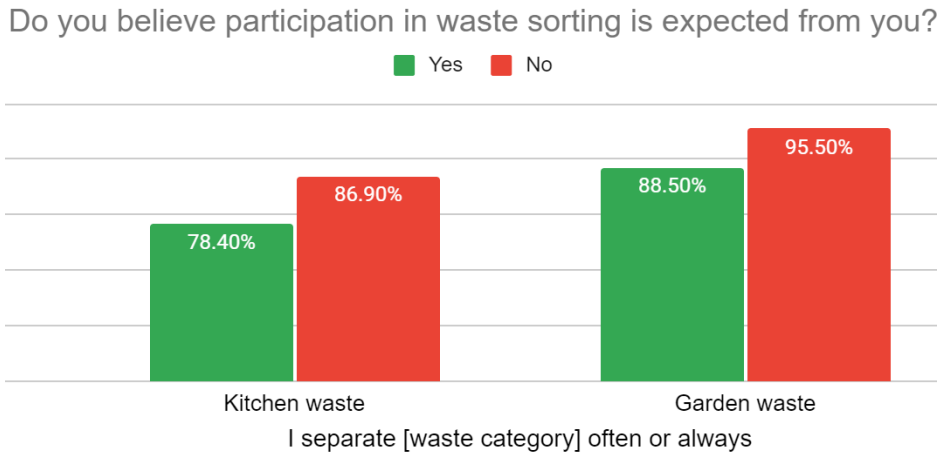

Figure 10: Effect of feeling participation in practice of waste separation is expected

The second hypothesis states that people with a higher environmental attitude are more likely to separate waste better (Bruvoll et al, 2000; Negash et al., 2021). This hypothesis has been tested using the categories for environmental attitudes of Stern and Dietz (1994). People with mainly egoistic values will focus on the consequences on their personal life and resources. The egoistic attitude is measured in this research with the statement '*I separate waste because it is cheaper.*'; the consequence of waste separation is lower costs, which influences the individual themself. People with mainly biospheric values will focus on the consequences on nature and the environment. The biospheric attitude is measured in this research with the two statements '*I separate waste because it is good for the environment.*' and '*I believe I contribute to a better environment by separating waste.*'. People with mainly altruistic values will focus on consequences for other people. This category is left out, because it was not sufficiently covered in the survey. No 'closed'-questions were asked on altruistic values, only a few people stated they separate waste to leave a better world for their (grand-)children in the open questions.

The effect of the egoistic attitude only affects six of the ten waste categories, and people with an egoistic attitude separate waste 5.2% to 11.2% more often than people without an egoistic attitude. The effect of the biospheric attitude is stronger, it affects nine of the ten waste categories, and people with a biospheric attitude separate waste 9.0% to 41.3% more often than people without a biospheric attitude. (The effects are shown in figure 11, in which 'x' stands for no significant effect.) The hypothesis that people with higher environmental attitudes are more likely to recycle better is validated; and it can be added that people with a biospheric attitude are even more likely to separate waste better than people with egoistic attitudes.

Waste category	*I separate waste because it is cheaper for me.* (Egoistic attitude)			*I separate waste because of the positive effects on the environment* (Biospheric attitude)		
	Yes	No	Difference	Yes	No	Difference
Kitchen waste	88.7%	79.1%	9.6%	89.1%	47.8%	41.3%
Garden waste	96.1%	90.3%	5.8%	95.6%	81.8%	13.8%
Paper and Cardboard	96.6%	91.4%	5.2%	96.0%	87.0%	9.0%
Plastic packaging	97.0%	90.8%	6.2%	96.4%	87.0%	9.4%
Metals	95.2%	84.0%	11.2%	93.0%	82.6%	10.4%
Glass	93.5%	85.8%	7.7%	90.4%	65.2%	25.2%
Textile	x	x	x	80.8%	69.6%	11.2%
Small Chemical Waste	x	x	x	88.3%	60.0%	28.3%
Electronic devices	x	x	x	91.9%	81.0%	10.9%
Diapers	x	x	x	x	x	x

Figure 11: The effect of environmental attitude on waste separation.

4.2.2 Material

The hypotheses that could be assigned to the element material of a social practice (Shove et al., 2012) touch upon strategic location (infrastructure), storage at home (objects), collection frequency (infrastructure), and design. The first hypothesis is that a strategic location of waste collection points, and the short distance to them, can improve the participation in waste separation (Knickmeyer, 2020). D&B (2017, p.15) adds that these waste collection points should be located at places where people often transpass; they should be located on the so-called natural routes. For most waste categories the fact that people state they think the collection point is too far (and their experienced convenience is limited), does not have a significant effect on their waste separation practice. However, for both the separation of electronic devices, and glass, approximately 20% of the people that state the collection point is too far, do never or sometimes separate electronic devices, against approximately 7% of people that do not state so. This hypothesis is thus partly validated; for the waste categories ‘electronic devices’ and ‘glass’, a strategic location of the collection points can improve the practice of waste separation.

The second hypothesis is that having appropriate waste storage at home positively influences the practice of waste separation (Bernstad, 2014), and that it can decrease nuisance, especially for biowaste (Pedersen & Manhice, 2020). D&B (2017, p.11) adds that it is important to have appropriate waste storage at home, because that is where the practice of waste separation takes place. For all of the waste categories, people that have appropriate waste storage at home, separate their waste more often; as shown in figure 12. Therefore the first part of the hypothesis can be validated: having appropriate waste storage at home indeed positively influences the practice of waste separation. (This relationship could also be the other

way around; people do not separate their waste because they have a waste separation facility in their home, but have a waste separation facility in their home because they want to separate waste. A recommendation for further studies will be to investigate this dependency relationship further.)

Residents have been asked whether they sometimes do not separate waste because they do not have the appropriate storage, to check if they are aware of this relationship. The results showed that people only see this relationship with the waste categories glass and kitchen waste. The second part of this hypothesis; having appropriate waste storage at home can decrease nuisance, especially for bio waste is falsified. In the sample none of the waste categories show a statistically dependent relation with a notification of nuisance.

I separate [waste category[1]**] often or always** *(Chi-square value <0,001, except metals 0,008)*	**Do you have waste storage at home?**	
	Yes	No
Kitchen waste	93.4%	55.3%
Garden waste	97.0%	82.5%
Paper and Cardboard	96.2%	84.0%
Plastic packaging	96.3%	80.0%
Metals	92.2%	77.8%
Glass	96.5%	75.0%
Diapers	73.7%	15.9%

Figure 12: The relation between waste storage at home and waste separation

The third hypothesis is that collecting waste more frequently will positively influence the practice of waste separation (Babazadeh, et al., 2018). This hypothesis has been falsified in this sample; none of the waste categories show a statically dependent relation with a change in the collection frequency.

The last hypothesis is that smart design will nudge people into correct waste separation, by making separating waste more convenient (Knickmeyer, 2020; Pedersen & Manhice, 2020). D&B (2017, p.6) adds that smart design focuses mainly on recognisability and associations; the colour orange is for example associated with the waste collection of plastics (PMD). This hypothesis has not been tested, design has not been questioned in the survey, given its complexity. The effect of design on waste separation is an implicit memory of people; they are not able to consciously bring the effect in to awareness; it can not be verbally articulated (Bauer, Larkina & Deocampo, 2018). Whereas people recall their explicit memories, which can be verbally explained, when being questioned about something (in the survey). The municipality of Nijkerk does apply smart design; by using these images residents will be able to see at a glance what type of waste belongs where, as shown in figure 13. To the researcher's knowledge, the municipality of Putten does not (yet) apply smart design.

Figure 13: Use of cartoons at local supermarket (Preuter, March 2022)

4.2.3 Competence

The hypotheses that could be assigned to the element competence of a social practice (Shove et al., 2012) touch upon awareness of benefits (knowledge), perceived difficulties (convenience), skills, knowledge, and feedback (knowledge). The first hypothesis is that peoples' intention to participate in the practice of waste separation is positively affected by their awareness of the benefits (Cudjoe, et al., 2020). The effect of not seeing any use in separating waste has been found to be significantly affecting someone's separation of plastic packaging. Whereas 95.3% of the people that do see use in separating waste, separate plastics often or always, just 71.4% of the people that see no use in separating plastics do so. It is no surprise that this waste category has the strongest effect, in the interviews it became clear that people find it most difficult to separate plastics, due to the large number of different rules; people can not separate on the basis of material like they do with glass or biowaste. People seeing use (benefits) in separating waste; like for example that it is better for the environment, have been found to significantly waste more often, for all waste categories, except textile and diapers. Therefore the hypothesis can be validated; people that are aware of the benefits of waste separation on the environment are more inclined to separate waste than people that are not aware of the benefits for the environment.

The second hypothesis is that people are less inclined to participate in the practice of waste separation when they perceive difficulties (Cudjoe, et al., 2020). This hypothesis has been tested on four different difficulties; distance (Knickmeyer, 2020), storage (Bernstad, 2014), nuisance (Pedersen & Manhice, 2020), and time (Pedersen & Manhice, 2020.). The hypothesis is falsified for the perceived difficulties 'distance' and 'nuisance'; the people that noted they do sometimes not separate waste because they have to walk too far, or because they experience nuisance, do not significantly separate less waste for any of the categories. The hypothesis is validated for the perceived difficulties 'storage' and 'time'. For the separation of kitchen waste and glass, people that do not have appropriate storage separate significantly less often than people that do have appropriate storage. And people that think separation costs a lot of time, significantly separate less waste (for the waste categories biodegradable waste, metals, glass, textile and small chemical waste), than people that do not think so.

The third hypothesis is that people will be more likely to participate in the practice of waste separation when they feel that they have the skills needed to perform (Wang, et al., 2020). This hypothesis has been validated; people that say they think waste separation is

easy, separate waste significantly more often than people that do not say so, for four categories; kitchen waste, glass, textile, and small chemical waste.

The fourth hypothesis is that knowledge increases the participation in waste separation (Rousta, et al., 2020; Miadfodzyeva, et al., 2013). D&B (2017, p.9) states that residents who lack knowledge are more inclined to believe myths about waste separation, and therefore lose motivation to participate in the practice of waste separation. This hypothesis has been tested on the knowledge people think they have or lack, and on the knowledge they have, revealed by a few test questions in the survey. The hypothesis would have been falsified if only people's own perceptions of their knowledge were taken into account; the effect of people stating they sometimes doubt about which waste belongs to which category has no significant, causal, effect[5]. The influence of actual, tested knowledge of separation of waste on the practice of waste separation is significant. People who have more knowledge, separate waste more often or always. Therefore, the hypothesis that knowledge increases the participation in waste separation, has been validated.

The fifth, and last, hypothesis is that people who are not provided with feedback will separate less waste since they miss information, and possibly lack knowledge (Ordoñez, et al., 2015). The wish for feedback is statistically dependent on the practice of waste separation for five of the ten categories. However, the effect found in this research is not as Ordoñez et al. (2015) described, people that noted they would like feedback actually separate waste more often or always. It could be that the people that separate waste less often, actually are not interested in separating waste, and therefore would not be enthusiastic about receiving feedback. The hypothesis that people who are not provided with feedback will separate less waste, is thus falsified.

4.2.4 Social control

As described in the previous chapter, social control, or recycling culture, and the waste separation practice are interconnected. This recycling culture can be seen as both the outcome of past practices of waste separation and as something through which the practice of waste separation exists, people keep motivating each other to actively engage with the practice. Whether such a culture exists among residents in the municipalities of Nijkerk and Putten will be examined by asking questions about the behaviour of residents. These questions are about the relation of residents with other practitioners; '*Do you see other people make mistakes when separating waste?*' and '*Do you correct other people's mistakes?*'. 67.1% of the people note that they sometimes see others making mistakes, which goes to show that people do look at other people's performance of waste separation. However, of these people only 33.6% correct others. People do observe each others' performance of waste separation, but are still hesitant on correcting them. To conclude, social control to the degree of a recycling culture does not exist yet, people do not yet motivate each other to do better.

Next to determining whether a recycling culture exists, the hypothesis that social control would promote individual participation (Wang & Zhang, 2022), will be tested. To evaluate this hypothesis three groups of people will be compared; the people that do not observe others, people that observe others, and people that observe ánd correct others (recycling culture). The hypothesis has been validated; people that show more behaviour

[5] It only has a significant effect on garden waste (Chi-Square = 0,42). However this effect is not relevant, since 96,1% of the people that doubt separate garden waste often or always, against 91,0% of the people that do not doubt. Although the two variables are statistically dependent, they are correlated, but not causally related. When people are asked about which particular piece of waste they doubt about, only a few doubt about products in the waste category of garden waste (cat litter, cooked leftovers).

related to social control or a recycling culture; observing and correcting other people, separate waste more often, as shown in figure 14 for the three waste categories that show the strongest relation.

Figure 14: The relation between recycling culture and waste separation

4.2.5 Remarkable differences between the two municipalities

In this section four remarkable differences that have been found between the municipality of Nijkerk and the municipality of Putten are discussed. It is important to keep in mind the margin of error for statements about a part of the population. At a 95% confidence level, statements about the municipality of Nijkerk have a 6% margin of error and statements about the municipality of Putten have a 10% margin of error. (For example, if it is stated that 70% of the people often separate plastics; in the municipality of Nijkerk this could in reality be anywhere between 64% and 76%, and in the municipality of Putten this could be between 60% and 80%.)

The first difference is the effect of having a waste separation facility at home on the extent to which residents separate biowaste. Although more residents of the municipality of Putten (81.7%) have a waste separation facility at home for biowaste than in Nijkerk (75.3%), less residents separate kitchen waste in Putten (89.4%) than in Nijkerk (92.1%). Further research should look into the effect of having a waste separation facility at home and the actual waste separation of the residents.

The second difference is the amount of people that are aware of the positive environmental effects of waste separation. In the municipality of Putten, 74.0% of people consider it a reason to separate waste because it is good for the environment, while in the municipality of Nijkerk this is the case for 82.8% of the people. It could be that people in the municipality of Putten are not fully aware of the environmental benefits of waste separation, or this is not enough of a motivation for them.

The third difference is that residents of the municipality of Putten see the collection system of waste bags as inadequate. 18.3% of the people say they sometimes do not separate waste because they have too little waste, compared to 11.0% of people in the municipality of Nijkerk. People in Putten might therefore benefit from a smaller size waste bag. People in Putten also report more nuisance from smells or pests (54.8%) than people in Nijkerk (42.3%).

The fourth and last difference is the attitude of residents towards separating waste. Compared to the municipality of Nijkerk, it is notable that people in the municipality of Putten want to get rid of their waste quickly (41.3%), compared to 5.8% in the municipality of Nijkerk. In designing policy, it is good to keep this in mind; residents of the Putten municipality like convenience; getting rid of their waste as quickly as possible. While residents of the Nijkerk municipality do take the time to separate waste themselves. Another option would be to convince residents of the municipality of Putten of the importance of waste separation so that they will more often take the time to separate their waste.

4.2.6 Conclusion

The second sub-question is '*What are the specific components of the three elements of the social practice of waste separation (Shove, Pantzar, & Watson, 2012), that make up the practice of waste separation?*'. For the first element 'meaning' the factors that keep the municipalities from reaching a lower amount of residual waste per resident are: environmental attitudes (beliefs) and the norm that people correct each other when someone is performing the practice of waste separation incorrectly. For the second element 'material' these are: strategic location (infrastructure) for the waste categories 'electronic devices' and 'glass', and storage at home (objects) for all waste categories. And lastly, for the third element 'competence' these are: awareness of benefits (knowledge), perceived difficulties (convenience) for the factors 'storage', and 'time', skills, and knowledge. Next to these three elements the factor recycling culture also influences the practice of waste separation.

4.3 Question 3: External factors

The third sub-question is '*What are external factors, like sociodemographic or geographical factors, that influence the practice of waste separation?*'. The external factors found in the literature have been tested, these are: age, educational level, and gender. The first hypothesis is that people of 60 years and above contribute more to waste separation (of plastics) than people younger than 30 (McDonald and Ball, 1998). The relation between age and waste separation is not the same relation as McDonald and Ball have found, the hypothesis is thus falsified. However, a new hypothesis on the influence of age on the separation of waste has been formed in this research; people between the ages of 45 years and 64 years old contribute more to waste separation of small chemical waste and electronic devices, than any other ages.

The second hypothesis is that people with a higher educational level participate more in the practice of waste separation (Rousta et al., 2020). The relation between educational level and waste separation has been found for six of ten waste categories. As shown in figure 15, people with a higher educational level (HBO/WO) separate waste more often than people with a lower educational level (high school / MBO). However, the percentage of people with the educational level MBO that separate electronic devices is higher than any of the other educational levels. This raises the hypothesis that knowledge of a product also influences the practice of waste separation. People that studied MBO have a more practical study than people that studied HBO or WO. Therefore they might have acquired more knowledge about the electronic devices than the other groups, which led to them separating electronic devices more often.

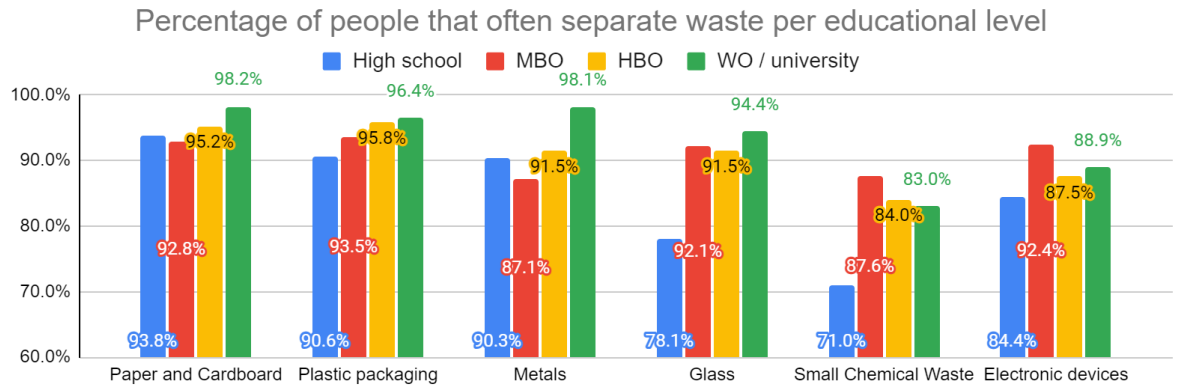

Figure 15: Percentage of people that often separate waste per educational level

The third hypothesis is that women care more about the environment than men, and are more inclined to participate in pro-environment actions (Abdullah et al., 2019). From the gender ratio of the participants in the survey this hypothesis can be partly strengthened; whereas both municipalities have a 1:1 gender ratio, the survey sample showed the men:women ratio as 2:3. Thus women (67.8%) showed more interest in the survey than men (32.3%). Women seem to care more about the environment; they are more interested in participating in research on waste separation, then men. However, more detailed research is needed to be able to eliminate other factors; perhaps the invitation for the research reached more women than men.

Between gender and the belief that waste separation is contributing to a better environment a dependent relation has been found; 89,6% of the women believe that waste separation is contributing to a better environment, against 78,0% of men. The relation between gender and participation in recycling has not been found. Therefore although women are more inclined to participate in pro-environment actions, like waste separation, they do not participate more.

4.4 Conclusion

Wrapping up, chapter 4 has analysed the practice of waste separation in the municipalities of Nijkerk and Putten. The relationships discussed in the theoretical framework, chapter 2, have been tested, which enabled a new zoom-in on the conceptual model. The updated model for the two municipalities is shown in figure 16 (see next page). The complete conceptual model and general conclusions will be discussed in the following chapter; chapter 5.

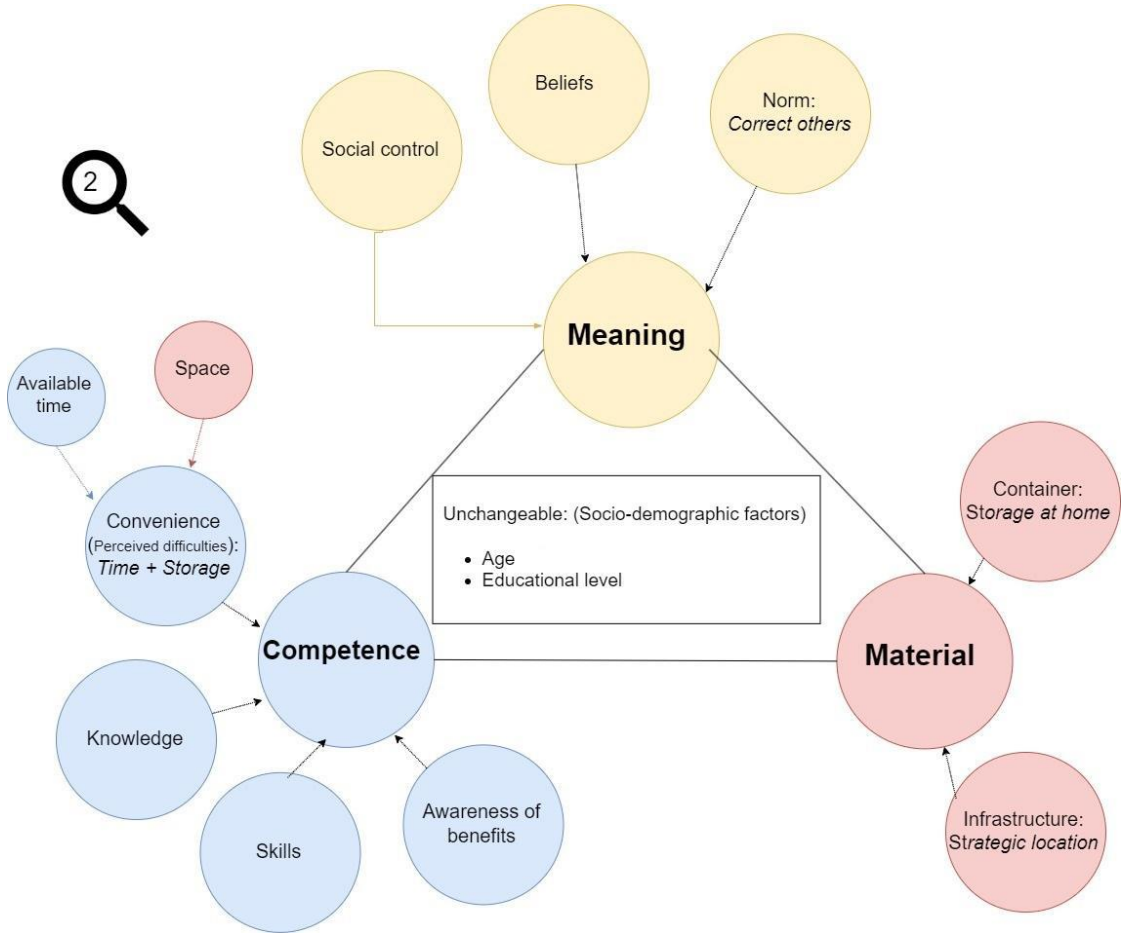

Figure 16: Conceptual model of the specific components of the waste separation practice in the municipalities of Nijkerk and Putten (Adapted from Shove et al., 2012)

5. Conclusion and discussion

The practical aim of this research has been to gather information about the waste management strategy of two Dutch municipalities, Nijkerk and Putten, and to know how their residents relate to waste separation and their municipality's strategy, to form a model of the waste separation practice. (The model of residents' waste separation practice has been formed in the previous chapter, and is displayed in figure 16.) This has been the aim to eventually be able to give advice to Dutch municipalities that are struggling to limit their residual waste to achieve the national VANG-goal of 30kg of residual waste per inhabitant, on how they can improve their waste policy in such a way that residents will be reinventing their waste separation practice in order to produce less residual waste. Thus a connection has been investigated between the strategy of waste management and the actual practice of waste separation.

The main question for this research was: '*In what ways can governance of the municipalities of Nijkerk and Putten influence the current practice of waste separation of their residents, in order to get to a new practice of waste separation that better enables the two municipalities to achieve the national VANG-goal?*' After the research question will be answered in paragraph one, the recommendations for policy makers will follow in paragraph two. The chapter ends with a paragraph that reflects on choices made during the research, and will make some recommendations for further research.

5.1 Conclusion

Before answering the main question, it is important to keep in mind that change in the practice of waste separation will not be achieved overnight. Several specific components in residents' practice of waste separation (see figure 16) have emerged from the previous chapter that have the potential to limit waste, however most of them need to grow on people. It takes time for residents to take on new beliefs and act according to new norms; they need to not only interact with others, but also possibly acquire new skills and knowledge. The different measures that the municipalities can apply to improve their governance of the waste practices of their residents will now be discussed and displayed in figure 17. (Differences between the two municipalities are discussed in the section on recommendation in the next paragraph.)

In order to achieve a lower amount of household residual waste per resident, one practical change in the municipalities' waste policy would be to improve the waste collection infrastructure. Especially the separation of the waste categories glass, and electronic devices would improve, when collection points are shifted, or the amount of collection points increases. Residents that state they think the collection point is too far, do separate significantly less waste; leading to glass and electronic devices potentially ending up in residual waste. This would also reduce the perceived difficulties with time, and storage. When the disposal location is closer-by, less time is needed to dispose of waste, and therefore will also lead to less trouble with storage; when it is easier to dispose of waste, it is not needed to store waste at home for too long. To improve the effect of this measure municipalities could also publish a map of the locations of waste collection across their municipality. This way residents will be more aware of where each waste collection point is located, and can map out which collection points best fit their daily routes.

Peoples' attitudes can change when they see things from a different perspective; residents should see that waste separation is not just a way to dispose of their waste with lower costs, but it is also better for the environment and leaves a better world for the generations after us. When a process is facilitated by the municipality through which residents can get to know each other and speak with each other about waste separation, they will be

able to share their knowledge, and it can help to achieve change in the existing norms (Cislaghi et al., 2019). The process in which residents meet each other and talk about waste separation, could also support peoples' knowledge and skills, since they can learn from each other. All together this could also encourage the rise of a recycling culture; people know each other better as a result, and so are more likely to correct each other if they perform the practice of waste separation incorrectly; social control increases.

Not only should the knowledge and skills of residents increase, the knowledge and skills of employees of the municipalities should increase as well. Residents might ask employees for help, at the recycling centre for example. When these employees do not have enough knowledge to answer questions, like for example '*In which container do used clothes belong?*', residents will feel demotivated because if these waste separation experts do not know it, who will (D&B, 2017, p9)?

The socio-demographic factors, age, and educational level, that were found to have an effect on the extent to which people separate their waste, can not be changed. The policy makers should therefore keep in mind that people with a higher educational level, and people between the ages of 45 and 64 years participate more in waste separation. The municipalities could consider an educational campaign with additional focus on people with a lower educational level or the people younger than 45 or older than 64 years.

The current mode of governing of the municipalities is disposal. If the municipalities were to implement the changes suggested; looking into alternative infrastructures and collections, and educational campaigns (possibly combined with the function of a meeting point for residents to talk with each other), they would be able to change their mode into modes that are located higher on the Ladder of Lansink.

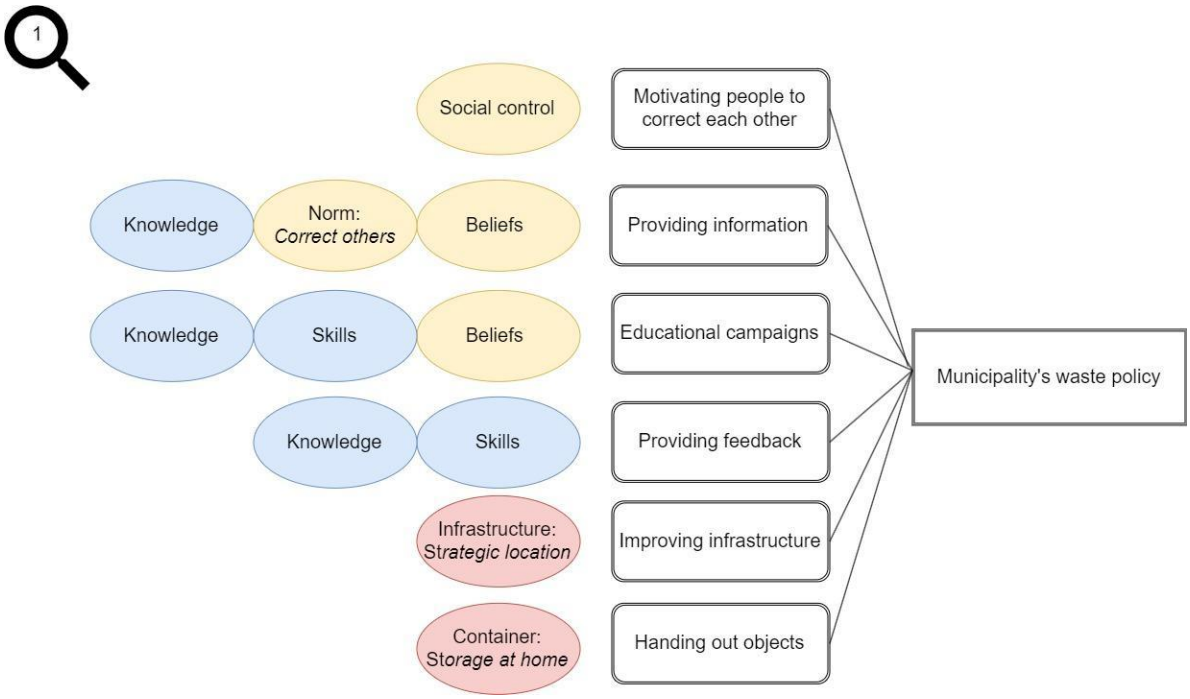

Figure 17: Conceptual model of governance of waste separation practice for the municipalities of Nijkerk and Putten (Adapted from Shove et al., 2012)

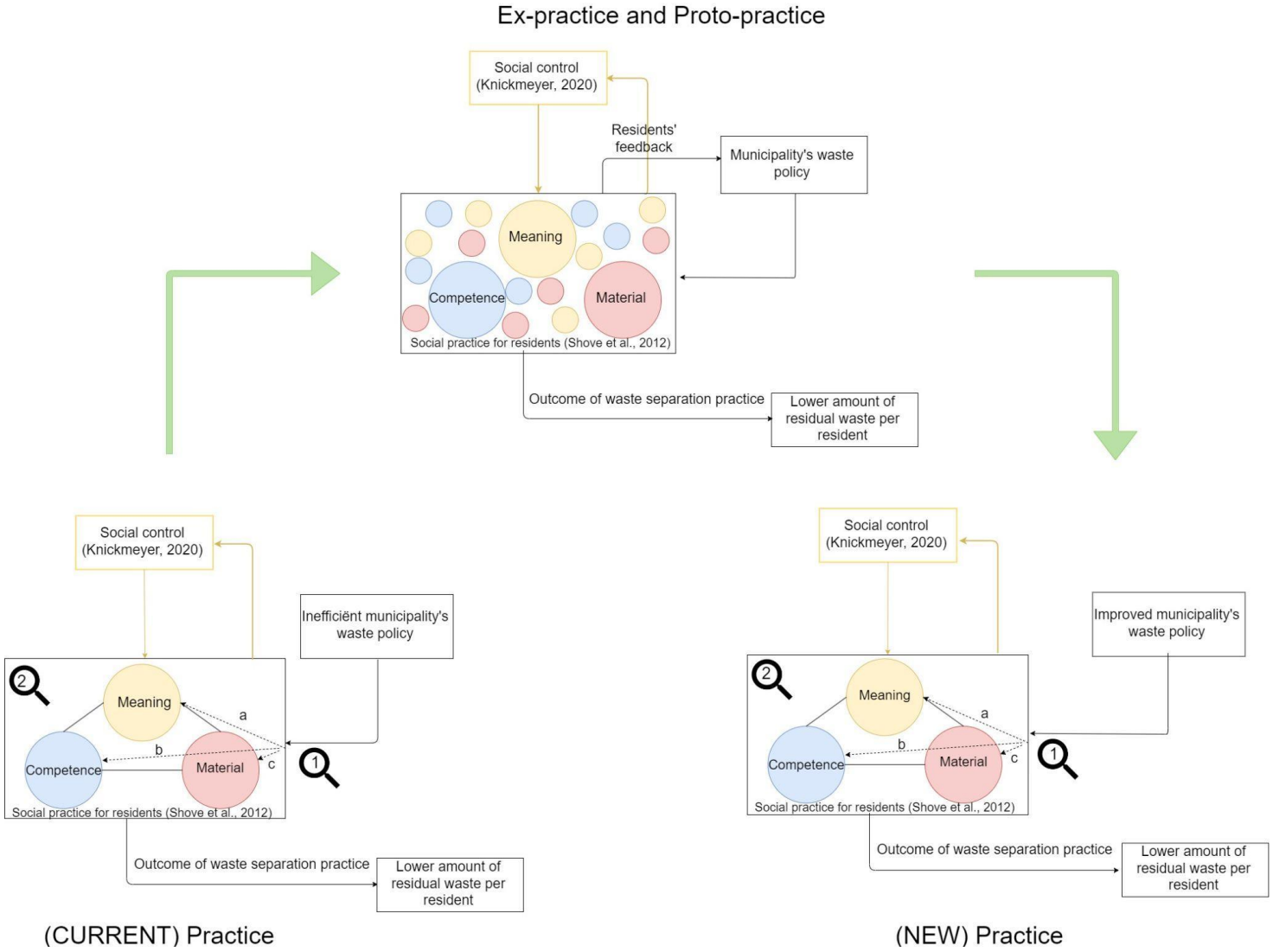

Figure 18: Conceptual model (Adapted from Shove et al., 2012)

The conceptual model (figure 18; see previous page) looks similar to the conceptual model discussed in chapter 2, however the two zoom-ins on the specific components of the social practice of waste separation (figure 16) and the measures of governance (figure 17) have been updated.

5.2 Recommendations

At the moment residents from the municipality of Putten produce a smaller amount of residual waste per person (84.0kg), than residents from the municipality of Nijkerk (104.6kg). However, from this research it became clear that residents from Nijkerk have a more positive attitude; more of them believe waste separation to be good for the environment (82.8% against 74.0% in Putten[6]), and less want to dispose of waste as quickly as possible (5.8% against 41.3% in Putten). Therefore there are less recommendations specific for the municipality of Nijkerk, because they are doing really well at the moment.

Some residents from the municipality of Putten have made clear in the survey and interviews that they sometimes take their waste to a private waste collector (van de Mheen) themselves, rather than to the council's waste delivery station; it may therefore be that certain amounts of residual waste of residents of the municipality of Putten are not included at the moment. This could explain why the municipality of Nijkerk seems to do better, residents have better attitudes, but still has a larger amount of residual waste than the municipality of Putten.

5.2.1 Recommendation Nijkerk

Although 51,9% of the people in Nijkerk believe that waste is processed separately, against 41,3% of the people in Putten. More people in Nijkerk say they do not receive enough information about waste processing (57.0%) than in Putten (49.0%). The municipality should provide more information about processing, not so much to change their beliefs, but more to increase their knowledge so that they can also convince other people that waste does get processed separately.

5.2.2 Recommendations Putten

For the municipality of Putten three different points of recommendation are found; to improve knowledge about the benefits of waste separation, to limit nuisance, and to know residents' main attitude. In the municipality of Putten, 74.0% of people consider it a reason to separate waste because it is good for the environment, while in the municipality of Nijkerk this is the case for 82.8% of people. It could be that people in the municipality of Putten are not fully aware of the environmental benefits, or this is not enough of a motivation for them. Therefore it is even more important to focus on improving knowledge in the municipality of Putten, so that beliefs improve and people are more motivated to separate waste because they are better aware of the positive effects.

In Putten, 18.3% of people say they sometimes do not separate waste because they have too little waste, compared to 11.0% of people in the municipality of Nijkerk. Residents in the municipality of Nijkerk have multiple options to dispose of their waste; mini-containers, waste bags, and underground containers, whereas residents in the municipality of Putten only have the waste bags. Residents in the municipality of Putten might therefore benefit from a

[6] At a 95% confidence level, statements about the municipality of Nijkerk have a 6% margin of error and statements about the municipality of Putten have a 10% margin of error. (If it is stated that 82.8% of the residents from Nijikerk have a positive attitude, it is in reality located between 76.8% and 88.8%. And if it is stated that 74.0% of the residents from Putten have a positive attitude, it is in reality located between 64.0% and 84.0%.)

smaller size waste bag. Residents also report more nuisance from smells or pests (54.8%) than residents in Nijkerk (42.3%). Therefore another recommendation for Putten is to help to alleviate the nuisance of bin liners by offering smaller waste bags, promoting that waste bags can be returned to that waste collection station, or by collecting the waste bags more often.

Compared to the municipality of Nijkerk, it is notable that people in the municipality of Putten want to get rid of their waste quickly (41.3%), compared to 5.8% in the municipality of Nijkerk. In designing policy, it is good to keep this in mind; residents of the Putten municipality like convenience; getting rid of their waste as quickly as possible. Next to that they should try to convince residents of the municipality of Putten of the importance of waste, as part of an educational campaign, so that residents will more often take the time to separate their waste.

5.2.3 Practical recommendations

Several more practical points of recommendation have come forward during the research, which are collected in this paragraph. Some are aimed at the municipalities of Nijkerk or Putten in particular, but other municipalities can also learn from them.

1. Make sure that the municipality sets a good example, when residents come by they should be able to separate waste at the town hall as well. D&B (2017, p.3) recommend municipalities to do so to make sure that residents feel that waste separation is not asked from them to fix the problem of the municipality, but something they do together with the municipality. Furthermore the municipality could promote waste prevention as well, ask employees to make use of reusable coffee mugs instead of single-use alternatives, etcetera.
2. Investigate whether more return points for glass and electrical appliances can be assigned, since it has been found that residents separate less waste because they think the distance to the collection point is too far. Municipalities could also publish a map to show where each type of waste can be returned.
3. Communicate a list of the products that are most difficult to match with the correct bins. In the survey many people indicated that they often doubt about matching certain products with the correct waste category. Examples of which are: chips bags (previously residual waste, but allowed in PMD since 2020), tea bags (contain plastics, not allowed in biowaste, should be residual waste), food waste (biowaste, contains only compostable materials). By simply highlighting a few products each week and sharing the right way to sort them in the newspaper and on social media, or by designing a poster that people can hang at home, close to the location where they separate their waste, you could help to make it easier. Or by organising a special event where people can come and bring a week's worth of residual waste to, together with ‘professionals’, check whether their waste can be separated even better, or in other words to check whether their residual waste still contains substances for recyclable streams.
4. It is important to communicate that in the waste category PMD (plastics, metal, and drink cartons), the plastics stand for plastic packaging and not hard plastics such as broken toys. In the ‘knowledge test’ in the survey, many people thought that broken toys belong to plastics. And one person asked why their ‘agricultural plastic’ could not be sorted into the PMD category.
5. Promote the use of a small bin in the kitchen for small bio-waste, like food scraps. In both municipalities it appears that kitchen waste in particular is poorly separated; many people do not go to the waste bin in the garden for every piece of kitchen waste. For this reason, people should be encouraged to buy a small bin for kitchen waste; people

who have a waste separation facility for biowaste in their home are more likely to separate kitchen waste. Another option is to offer residents this bin for free (D&B, 2017). Giving the bin as a gift also works as an incentive to separate better; you get something and then you want to do something in return (Midden, 2015).

6. Share more information about the waste processing. Residents indicate that they would like to receive more information on waste processing. This could be done by describing waste processing per stream or sharing some video clips of waste processing facilities. Consideration could also be given to promoting a tour of a waste processing company.
7. In Nijkerk they have the so-called 'sustainable Nijkerker', a news article where a resident is put in the spotlight who is doing something good, in the field of sustainability (Duurzaam Nijkerk, 2022). In this way, a municipality could occasionally highlight someone who is doing a good job at the separation of waste, and can share tips for others.
8. Evaluate your waste policy with residents regularly; this way, the discoloration and illegibility of the PMD sticker on the waste bin in Nijkerk (see figure 18) would have become known sooner.

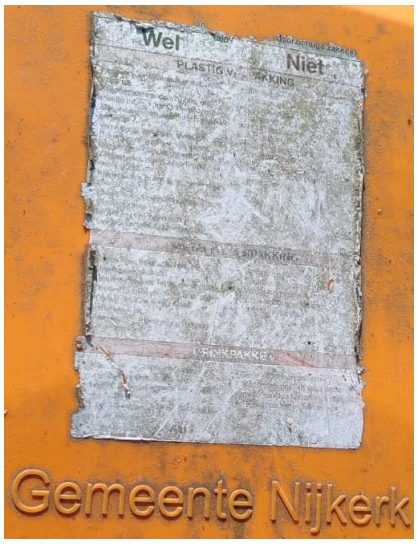

Figure 19: Failed design with sticker on PMD container (Preuter, May 2022)

5.3 Discussion

This research developed a model of the practice of waste separation of residents (see figure 16), and gave advice to municipalities on how they can govern the practice to improve waste separation. In this section reflections will be made on the results, on the method of research and the limitations of this study. The section ends with recommendations for further research.

5.3.1 Reflection on results

When the conceptual model from the theory (figure 3) is compared with the conceptual model in the chapter on results, at first they are quite similar. However, once you zoom in on the practice of waste sorting (figure 4 or 16) or the governance of the practice of waste sorting (figure 6 or 17), changes are found.

When figure 4 is compared to figure 16 most of the hypotheses on the specific components of the practice of waste sorting have been tested and validated. However, whereas previous researchers found a relation with the degree to which people separate waste and their gender, and family form, these relations have not been found in this research.

For the component ‘gender’ it was interesting to see that more women (approximately 67% in both municipalities) participated in the survey than men, however no differences were found in the extent to which they separate their waste. For family form no significant relationship has been found with the extent to which they separate their waste.

When figure 6 is compared to figure 17, the only differences on the governance of the waste separation practice are the absence of subsidies and design. These governance instruments have not been used in the two municipalities yet, and have not been suggested by residents to help them to separate their waste better. The use of subsidies are discouraged, since they would only help short-term, once the financial incentive of a subsidy is taken out, the motivation would drop soon as well (Midden, 2015). The use of design was too complicated to test in this research, so was not included.

5.3.2 Reflection on method

The existing theory about similar researchers was limited, therefore the hypotheses that were formed based on existing theory (appendix 7.2) were mostly found in different countries (for example Iran, Sweden, and China). This weakened the hypotheses, since different countries have different cultures, different norms and values, and different national laws. Falsifying or validating the hypotheses thus comes with the caveat that while it is (not) true in these particular municipalities, it could be different in other municipalities (in other countries).

In addition, the list of hypotheses (appendix 7.2) is not exclusive, there are other conceivable hypotheses in the existing literature, but given the limited scope of this study, not all could be included. Also, not every hypothesis found in the literature could be investigated in this research. For example, the effect of living in an urban or rural area could not be investigated, because both municipalities largely fall under urbanised areas, and not enough respondents from the rural area were willing to participate in the study.

Although the chosen method to test the hypotheses; a survey and short interviews, allowed to involve a large group of residents, it does not fully reflect the whole practice of waste separation. The chosen research method asks individuals about their experiences, and how they perceive the practice of waste separation. However, whether residents’ own reflections and their actual actions correspond is unclear. These doubts could be dispelled by observing residents, what do they do with waste in their daily lives; do they use a reusable cup at the office, do they take their own bags to the shop or do they buy a single-use variety, and where do food scraps go while cooking?

Another limitation of this research is that it is focused on a light weight of residual waste as a good waste sorting practice result, since the VANG-goal, which was the starting point of this study, sets targets on the amount (kg) of residual waste per resident (Rijkswaterstaat, VNG, & NVRD, 2021). (The target of 100 kg of residual waste and 75% waste separation by 2020 and 30 kg of residual waste and 100% waste separation by 2025, which the municipalities in the Netherlands are striving to achieve.) So one can criticise this target, because it mainly focuses on waste reduction, and not on the quality of the waste streams. As a result, the quality of waste separation from textiles, for example, could be much better, but is given less attention because of the light weight of this waste stream (Rood & Hanemaaijer, 2014). Another criticism on this VANG target, is that the targets are very ambitious, while the instrumentation does not yet adequately reflect this (Rood & Hanemaaijer, 2014). VANG makes no use of financial instruments, and no sanction is set for municipalities that do not meet their targets. There is little chance that the targets will be met (The World Bank, 2021).

5.3.3 Recommendations for further research

In this research, governance by municipalities has been looked into on the level of their governance instruments; the measures that the municipalities can take to improve the waste separation practice of their residents are discussed. However, governance itself can be seen as a practice, consisting of the three elements meaning, material, and competence. Follow-up research could look into this in more detail, what would change in the outcomes of this research if you look at governance as not just the measures, but as a practice itself?

The study focused mainly on the two municipalities Nijkerk and Putten, therefore the results found do not guarantee success for other municipalities. Although the two municipalities use different collection systems; Putten mostly[7] uses waste bags and collects these door-to-door, and Nijkerk uses 'omgekeerd inzamelen' (reverse collection) for residual waste, and collects waste from underground containers, and door-to-door with mini-containers and waste bags. However, there are also similarities, for example, both municipalities use the diftar system, and both have the inhabitants separate plastic waste at home, they do not make use of post-separation for plastics. (Putten does apply a system of post-separation for diapers in their residual waste (A. Meijerink, personal communication, 5 October 2022). The municipalities are also located in the same province and region, so some factors may have been overlooked. For follow-up research it will be better to compare several municipalities with different strategies and different locations.

Another recommendation for further research would be to test the positive relation, between having a waste separation facility and separating more waste, that was found in the analysis. Although more residents of the municipality of Putten (81.7%) have a waste separation facility at home for biowaste than in Nijkerk (75.3%), slightly less residents separate kitchen waste in Putten (89.4%) than in Nijkerk (92.1%). Also it would be interesting to look into this relation on whether people make sure they have the facilities at home to separate waste because they want to separate waste, or people separate waste because they have the right facilities at home.

The effect of the corona crisis on the sudden increase in residual waste per capita in 2020 would be another recommendation for further research. Although this increase is seen in the national average and in the municipality of Nijkerk, in the municipality of Putten there is no increase in residual waste per capita in 2020. Therefore it would be interesting to investigate why the municipality of Putten does not have an increase in residual waste per capita, although it would be expected to have.

Lastly, it would be interesting to further investigate the effect of educational level and the participation of residents in the practice of waste sorting. People with the education level of hbo or university separate waste more often in most waste categories, except for the category of electric devices. People with the educational level MBO separate electric devices more often. It would be interesting to see whether the practical knowledge of people with a MBO education leads to more participation in the practice of waste sorting for electronic devices, or there is another factor that could explain this effect.

[7] They make use of shared underground containers for the disposal of textiles and glass.

6. References

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7. Appendices

7.1 Survey

In this appendix the survey is included, this survey has been conducted in Dutch, because that is the native language of both municipalities. In blue the differences of the survey from Nijkerk to Putten are given.

The survey is made up of five different sections. The first part questions the respondent about their personal situation; which waste categories do they separate, for which categories do they have a waste separation facility at home, what are their motives for separating or not separating waste, and what are their obstacles they experience while separating and preventing waste. The second part asks for their opinions on waste, and their relationship with separating waste, as well as their suggestions on how to improve information and possibly switching to another collection method. The third part is the shortest part and asks what information residents use while performing the social practice of waste sorting and consists of a number of questions designed to test residents' knowledge. The fourth part asks residents to come up with their own points of improvement for municipal governance, by waste category and for the waste collection station. The fifth section asks for demographics, age, gender, education, living and family status and their current waste collection method. The survey ends with some space for the residents to share any final information, and to inform whether they would be willing to participate in an interview with the researcher.

Beste bewoner,

Welkom bij de enquête over het scheiden van afval in de gemeente Nijkerk/Putten. Deze enquête is onderdeel van een afstudeeronderzoek naar het verbeteren van de huishoudelijke afvalscheiding. (Uitgevoerd door Jo-Ann Preuter, student Environment and Society studies aan de Radboud Universiteit, en stagiaire bij de gemeente Nijkerk.) Door u naar uw ervaring over de dienstverlening van de gemeente Nijkerk/Putten te vragen krijgen we inzicht in de manier waarop onze dienst wordt gewaardeerd. Dit inzicht is een belangrijke vorm van feedback, die mogelijke verbeterpunten aan het licht brengt om afvalscheiding te stimuleren en samen te komen tot minder restafval.
Indien u een melding over uw leefomgeving wil doen, bijvoorbeeld over zwerfvuil, is deze enquête niet de juiste plek, u kunt dit doen via onze website: [LINK]
In 2020 produceerde iedere inwoner van Nijkerk gemiddeld 114 ½ kg restafval, landelijk was dit nog 205kg restafval per persoon, dus we doen het goed. De landelijke doelstelling voor 2025 is om nog maar 30 kg restafval per persoon te produceren, in dat opzicht is nog ruimte voor verbetering. De verwachting is dat het grootste effect via het GFT kan worden bereikt (o.a. via etensresten), het restafval bestaat voor ongeveer 30 tot 40% uit GFT-afval. (Verder bestaat het restafval onder andere nog uit 3-7% papier, 6-11% PMD en 2-6% textiel.)

In 2019 produceerde iedere inwoner van Putten gemiddeld 96,7 kg restafval; landelijk was dit maar liefst 194 kg restafval per persoon, dus we doen het goed. De landelijke doelstelling voor 2025 is om nog maar 30 kg restafval per persoon te produceren, in dat opzicht is nog ruimte voor verbetering. De verwachting is dat het grootste effect via het GFT kan worden bereikt (o.a. via etensresten), het restafval bestaat voor ongeveer 40% uit GFT-afval. (Verder bestaat het restafval onder andere nog uit 3% papier, 8% PMD en 2-5% textiel.)

Het invullen van de enquête zal ongeveer 20 minuten duren. De door u gegeven antwoorden worden strikt vertrouwelijk behandeld, u zult anoniem blijven.

Heeft u vragen over de vragenlijst, dan kunt u contact opnemen met de Gemeente (Tel:__ , E-mail: ___)

Bij voorbaat dankt gemeente Nijkerk/Putten u voor het beantwoorden van de vragenlijst!

Deel 1: Persoonlijke situatie
Om te starten volgen enkele vragen over uw eigen afvalscheiding. Hierbij is geen fout of goed, het betreft uw eigen situatie, dus uw eigen mening of ervaring.

1. Welk afval scheidt u op dit moment van het restafval? (En gaat dus niet in de restafvalzak of container?) [1 antwoord per afvalcategorie toegestaan]

	Nooit	Soms	Meestal	Altijd	Niet van toepassing
Keukenafval	○	○	○	○	○
Tuinafval	○	○	○	○	○
Papier en karton	○	○	○	○	○
Plastic verpakkingsafval	○	○	○	○	○
Metaal (blik)	○	○	○	○	○
Glas	○	○	○	○	○
Textiel	○	○	○	○	○
Klein chemisch afval	○	○	○	○	○
Elektrische apparaten	○	○	○	○	○
Luiers/incontinentiemateriaal	○	○	○	○	○

2. Geef aan voor welk van de volgende afvalstromen u een afvalscheidingsvoorziening **in** uw huis heeft. (Denk hierbij bijvoorbeeld aan een kleine prullenbak in uw keuken waar u uw groenafval tijdens het koken in kan deponeren, of een tas waar u uw papier in verzamelt zodat u niet voor elk stukje papier naar de container hoeft te lopen.)

	Ja	Nee	Niet van toepassing
Restafval	○	○	○
Groente, fruit en tuinafval	○	○	○
Plastic verpakkingen	○	○	○
Oud papier en karton	○	○	○
Glas	○	○	○
Luiers	○	○	○

3. Wat is/zijn voor u de belangrijkste reden(-en) om mee te werken aan gescheiden inzameling van afval? (Meerdere antwoorden mogelijk)

- Het wordt van me verwacht.
- Het is goedkoper / dan betaal ik minder.
- Het kost me weinig moeite.
- Het is goed voor het milieu
- Geen, ik doe niet mee aan de gescheiden inzameling van afval.
- Andere, namelijk……

4. Stel dat uw afvalzak of container nog niet helemaal vol is, maar hij wel de volgende dag wordt geleegd. Wat doet u dan? (Er zijn meerdere antwoorden mogelijk, selecteer alle antwoorden die u wel eens heeft gedaan.)

- Ik bied hem aan, ook al is hij niet helemaal vol.
- Ik vul hem met andere stromen aan (gft/plastic/papier) zodat hij toch vol is.
- Ik laat hem staan tot het volgende inzamelmoment.

5. Heeft u anderen wel eens verkeerd hun afval zien scheiden?

- Ja, regelmatig.
- Ja, soms.
- Nee, nooit. [Ga door naar vraag 7]

6. Als u anderen hun afval verkeerd ziet scheiden, spreekt u ze daar dan op aan?

- Ja
- Nee

7. Wat is/zijn voor u de belangrijkste reden(-en) om wel eens afval niet gescheiden aan te bieden? (Niet gescheiden aanbieden is het mengen van stromen; gft-afval/PMD/glas/etc. bij het restafval of andersom.)
(Meerdere antwoorden mogelijk)

- Het is te ver lopen.
- Ik heb geen bewaarplaats of opslagmogelijkheid.
- Ik heb te weinig afval.
- Overlast van stank of ongedierte.
- Ik zie het nut niet in.
- Andere, namelijk…….

8. Stel dat uw brood beschimmeld is voor u het hele brood heeft kunnen opeten. Op welke manier gooit u het dan weg?

- In zijn geheel (brood + zak) in het restafval
- Brood bij het groente, fruit en tuinafval (gft) en de zak bij het plastic afval (PMD).
- Brood bij het restafval en de zak bij het plastic afval (PMD).
- Andere, namelijk ……..

9. Heeft u voldoende middelen in huis om uw afval gescheiden te bewaren?

- Ja [Ga door naar vraag 11]
- Nee

10. Waarom heeft u niet voldoende middelen in huis om uw afval gescheiden te bewaren?

[OPEN VRAAG]

11. Twijfelt u bij sommigen producten over in welk inzamelmiddel ze behoren?
    - Nee, ik twijfel niet. [Ga dor naar vraag 13]
    - Ja ik twijfel wel eens.

12. Over welk(-e) product(-en) twijfelt u in welk inzamelmiddel ze behoren?

[OPEN VRAAG]

13. Veel dingen zorgen voor afval, vaak zonder dat we erbij stilstaan. Wat doet u wel eens? (Meerdere antwoorden mogelijk)
    - Een deel van mijn maaltijd weggooien.
    - Kleding die ik niet meer draag bij het restafval gooien.
    - Reclamefolders ongelezen weggooien.
    - Tijdens het winkelen mijn aankopen in een papieren tas laten doen.
    - Voedsel laten bederven.
    - Drinken uit een wegwerpbekertje drinken.
    - Speelgoed waar niet meer mee wordt gespeeld of boeken die uitgelezen zijn weggooien bij het afval.

14. Welk van onderstaande maatregelen neemt u voor het voorkomen van afval? (Meerdere antwoorden mogelijk)
    - Ik neem mijn eigen tas mee als ik boodschappen ga doen.
    - Ik heb een sticker op mijn brievenbus om ongeadresseerd drukwerk te weren.
    - Ik probeer een zo gepast mogelijke hoeveelheid te koken.
    - Ik maak thuis compost van mijn gft-afval.
    - Ik leen speelgoed in de speel-o-theek, en/of boeken in de bibliotheek.
    - Ik stop restjes van maaltijden in de diepvries, en eet ze later nog eens op.
    - Ik laat een kapot apparaat of kledingstuk repareren.
    - Geen van bovenstaande opties.

15. Neemt u nog andere maatregelen voor het voorkomen van afval dan genoemd in de vorige vraag?

[OPEN VRAAG]

Deel 2: Uw mening over afvalscheiding
Dit deel gaat over uw mening over onder ander het belang van afvalscheiding, er is dus ook in dit deel geen goed of fout antwoord.

16. Vindt u afval vies?
    - Ja
    - Nee
    - Neutraal

17. Denkt u dat u door het scheiden van afval bijdraagt aan een beter milieu?
    - Ja
    - Nee
    - Weet ik niet / Heb geen mening

18. Vindt u dat het scheiden van afval veel tijd kost?
    - Ja
    - Nee
    - Neutraal

19. Welk van de volgende opties omschrijft uw relatie met afval het best?
- Het moet zo snel mogelijk weg, dus alles bij het restafval.
- Ik vind het geen probleem om afval langer vast te houden, om het zo grof te kunnen scheiden.
- Ik neem uitgebreid de tijd om alle verschillende materialen te kunnen scheiden.

20. Denkt u dat uw afval na inzameling gescheiden wordt verwerkt?
- Ja
- Nee
- Weet ik niet

21. Vindt u het prettig om te zien in hoeverre de inwoners van de gemeente Nijkerk/Putten erin slagen om hun afval te scheiden? (Denk hierbij bijvoorbeeld aan resultaten van een sorteeranalyse van een deel van het ingezameld afval.)
- Ja
- Nee [Ga door naar vraag 23]
- Weet niet / geen mening [Ga door naar vraag 23]

22. Heeft u bepaalde suggesties voor het delen van informatie over de resultaten van afvalscheiding in de gemeente Nijkerk/Putten?

[OPEN VRAAG]

23. Voor elk van de volgende afvalstromen, zou u willen overstappen naar een ander inzamelsysteem?

	Ja, liever een ondergrondse container.	Ja, liever een mini-container bij huis.	Ja, liever inzamelzakken.	Nee, ik wil geen verandering van inzamelsysteem.
Restafval				
PMD				
Oud papier en karton				
Gft				

24. Waarom zou u graag gebruik willen maken van een ander inzamelsysteem? (Geef aan voor welke afvalcategorie u zou willen overstappen en waarom) [Restafval, PMD, Oud papier en karton, gft]

[OPEN VRAAG]

Deel 3: Informatie over afvalscheiding
Dit deel gaat over de informatievoorziening op het gebied van afvalscheiding. Ook hierbij gaat het over uw eigen mening en is er geen goed of fout antwoord.

25. Welk van de volgende vormen van voorlichting over afvalscheiding gebruikt u als u iets wilt opzoeken over afvalscheiding? (Meerdere antwoorden mogelijk)
- Afvalkalender van de gemeente.
- De website van de Gemeente Nijkerk / Putten.
- De wekelijkse gemeentepagina in de krant Stad Nijkerk / de Puttenaer.
- De scheidingswijzer (MilieuCentraal)
- Ik weet niet waar ik informatie over afvalscheiding kan vinden.
- Niets, ik weet al voldoende / hoef niets op te zoeken over afvalscheiding.
- Andere, namelijk……

26. Geef voor elk van de volgende producten aan in welk inzamelmiddel het volgens u behoort.

	Restafval	Gft	PMD	OPK	Glas	KCA	Milieustraat
Gekookte etensresten	○	○	○	○	○	○	○
Leeg yoghurtpak	○	○	○	○	○	○	○
Kapot plastic speelgoed	○	○	○	○	○	○	○
Theezakje	○	○	○	○	○	○	○
Keukenpapier (onbedrukt)	○	○	○	○	○	○	○
Batterijen	○	○	○	○	○	○	○
Kattenbakkorrels	○	○	○	○	○	○	○
Luiers en incontinentiemateriaal	○	○	○	○	○	○	○

Deel 4: Verbeterpunten voor de gemeente
Dit deel gaat over de mogelijke verbeterpunten die u voor de gemeente Nijkerk / Putten ziet op het gebied van afvalscheiding. Hier gaat het over wat voor u zelf een verbetering zou zijn.

27. Denkt u dat het scheiden van afval in andere gemeenten beter is geregeld?
- Ja
- Nee [Ga door naar vraag 30]

28. In welke gemeente is het volgens u beter geregeld?

[OPEN VRAAG]

29. Waarom is het hier volgens u beter geregeld?

[OPEN VRAAG]

30. Hoe vaak heeft u in het afgelopen jaar (2021) gebruik gemaakt van de milieustraat?
- Niet
- 1 keer
- 2 of 3 keer
- 4 of 5 keer
- Meer dan 5 keer

31. In hoeverre bent u het eens met de volgende stellingen over de milieustraat?

	Helemaal eens	Eens	Neutraal	Oneens	Helemaal oneens
Ik vind de afstand van mijn woning tot de milieustraat te ver.	○	○	○	○	○
Ik vind de wachttijd bij de milieustraat te lang.	○	○	○	○	○
Ik vind de medewerkers bij de milieustraat klantvriendelijk.	○	○	○	○	○
Ik vind de milieustraat overzichtelijk.	○	○	○	○	○
Ik vind de milieustraat opgeruimd.	○	○	○	○	○

32. Vindt u de informatie die u ontvangt van de Gemeente Nijkerk over de volgende thema's voldoende?

	Ja, voldoende informatie	Nee, onvoldoende informatie
De afvalkalender (Momenten dat de afvalzakken / container worden opgehaald/geleegd.)	○	○
Scheidingswijzer (Welk afval in welk inzamelmiddel behoort.)	○	○
Inleverpunten	○	○
Verwerking	○	○

[Voor de vragen 33 tot en met 40 zijn de antwoordopties in de versie voor de gemeente Putten korter, gezien daar alleen met afvalzakken wordt gewerkt, en geen retourettes of ondergrondse containers. De antwoord categorieën die ook in de enquête voor de gemeente Putten gesteld zijn, zijn blauw gekleurd.]

33. Wat zou er aan de inzameling van het **restafval** moeten veranderen opdat u meer gescheiden gaat aanbieden?
- De afstand tot het inzamelmiddel verkleinen.
- De container/zakken vaker legen.
- Beschadigingen sneller verhelpen.
- Beter informeren over waar ik het kwijt kan.
- Beter informeren wanneer het wordt opgehaald of kan worden weggebracht.
- Iets tegen de stank of het ongedierte.
- Huis-aan-Huis inzameling
- Niets, ik vind de voorziening perfect.

34. Wat zou er aan de inzameling van **het gft-afval** moeten veranderen opdat u meer gescheiden gaat aanbieden?
- De afstand tot het inzamelmiddel verkleinen.
- De container/zakken vaker legen.
- Beschadigingen sneller verhelpen.
- Beter informeren over waar ik het kwijt kan.
- Beter informeren wanneer het wordt opgehaald of kan worden weggebracht.
- Iets tegen de stank of het ongedierte.
- Huis-aan-Huis inzameling
- Niets, ik vind de voorziening perfect.

35. Wat zou er aan de inzameling van het **PMD-afval** moeten veranderen opdat u meer gescheiden gaat aanbieden?
- De afstand tot het inzamelmiddel verkleinen.
- De container/zakken vaker legen.
- Beschadigingen sneller verhelpen.
- Beter informeren over waar ik het kwijt kan.
- Beter informeren wanneer het wordt opgehaald of kan worden weggebracht.
- Iets tegen de stank of het ongedierte.
- Huis-aan-Huis inzameling
- Niets, ik vind de voorziening perfect.

36. Wat zou er aan de inzameling van het **oud papier en karton** moeten veranderen opdat u meer gescheiden gaat aanbieden?
- De afstand tot het inzamelmiddel verkleinen.
- De container/zakken vaker legen. Vaker inzamelen.
- Beschadigingen sneller verhelpen.
- Beter informeren over waar ik het kwijt kan.
- Beter informeren wanneer het wordt opgehaald of kan worden weggebracht.
- Iets tegen de stank of het ongedierte.
- Huis-aan-Huis inzameling
- Niets, ik vind de voorziening perfect.

37. Wat zou er aan de inzameling van het **glas** moeten veranderen opdat u meer gescheiden gaat aanbieden?

- De afstand tot het inzamelmiddel verkleinen.
- De container/zakken vaker legen.
- Beschadigingen sneller verhelpen.
- Beter informeren over waar ik het kwijt kan.
- Beter informeren wanneer het wordt opgehaald of kan worden weggebracht.
- Iets tegen de stank of het ongedierte.
- Huis-aan-Huis inzameling
- Niets, ik vind de voorziening perfect.

38. Wat zou er aan de inzameling van het **textiel** moeten veranderen opdat u meer gescheiden gaat aanbieden?

- De afstand tot het inzamelmiddel verkleinen.
- De container/zakken vaker legen.
- Beschadigingen/Storingen sneller verhelpen.
- Beter informeren over waar ik het kwijt kan.
- Beter informeren wanneer het wordt opgehaald of kan worden weggebracht.
- Iets tegen de stank of het ongedierte.
- Huis-aan-Huis inzameling
- Niets, ik vind de voorziening perfect.

39. Wat zou er aan de inzameling van het **klein chemisch afval** moeten veranderen opdat u meer gescheiden gaat aanbieden?

- De afstand tot het inzamelmiddel verkleinen.
- De container/zakken vaker legen.
- Beter informeren over waar ik het kwijt kan.
- Beter informeren wanneer het wordt opgehaald of kan worden weggebracht.
- Huis-aan-Huis inzameling
- Niets, ik vind de voorziening perfect.

40. Wat zou er aan de mogelijkheid tot het wegbrengen van afval naar de **milieustraat** moeten veranderen opdat u meer gescheiden gaat aanbieden?

- De afstand tot het inzamelmiddel verkleinen.
- De container/zakken vaker legen.
- Beter informeren over welk afval onder welke categorie hoort.
- Beter informeren wanneer het open is.
- Iets tegen de stank of het ongedierte.
- Niets, ik vind de voorziening perfect.

41. Heeft u nog andere suggesties ter verbetering voor de inzameling van afval?

- Nee [Ga door naar vraag 43]
- Ja

42. Welke suggestie heeft u voor het verbeteren van de inzameling van afval?

[OPEN VRAAG]

43. Met hoeveel euro **(€)** of procent **(%)** mag de afvalstoffenheffing stijgen als de afvalinzameling beter wordt? **Geef in uw antwoord aan of het om euro of procent gaat!**

[OPEN VRAAG]

44. De inwoners van de gemeente Nijkerk/Putten scheiden hun afval al goed, de afgelopen jaren lag het scheidingspercentage rond de 73/78%, terwijl het landelijk nog rond de 67% ligt, maar er blijven nog grondstoffen achter in het restafval (voedselresten, metalen, etc.). Wat zou de gemeente volgens u moeten doen om dit te verbeteren?

- Meer voorlichting geven over afvalscheiding.
- Extra inzamelmiddelen in/bij huis.
- Iedereen over op centrale ondergrondse containers voor restafval.
- Vaker afvalstromen (behalve restafval) huis-aan-huis ophalen.
- Inzameling van restafval duurder maken.
- Andere, namelijk…..

Deel 5: Demografische gegevens

45. Wat is uw geslacht
    - Man
    - Vrouw
    - Andere, namelijk….

46. Wat is uw leeftijd?
    - 18-
    - 18-24
    - 25-34
    - 35-44
    - 45-54
    - 55-64
    - 65+

47. Wat is uw hoogst genoten opleiding die u heeft afgemaakt?
    - Basisschool (lagere school)
    - Middelbare school
    - MBO (middelbaar beroepsonderwijs)
    - HBO (hoger beroepsonderwijs)
    - WO/universiteit (Wetenschappelijk onderwijs)
    - Andere, namelijk…..

48. Wat is uw gezinssituatie?
    - Alleenstaand/gescheiden zonder kinderen
    - Alleenstaand/gescheiden met kinderen
    - Samenwonend/getrouwd zonder kinderen
    - Samenwonend/getrouwd met kinderen

49. Hoe woont u?
    - Laagbouw
    - Hoogbouw (appartementencomplex/flat)

50. Waar woont u?
    - Binnen de bebouwde kom
    - Buiten de bebouwde kom

51. Hoe lang woont u al in de Gemeente Nijkerk/Putten?
    - Minder dan 3 jaar
    - Tussen de 3 en 10 jaar
    - Meer dan 10 jaar

52. Welke methode van afvalinzameling gebruikt u? (meerdere antwoorden mogelijk) VRAAG NIET BIJ PUTTEN GESTELD; IEDEREEN ZAKKEN.

- Zakken
- Ondergrondse container
- Mini-container bij huis

53. Welke voorzieningen heeft u in uw straat? Dit gaat om openbare containers die u deelt met andere bewoners in de wijk, zoals een ondergrondse container, en niet om containers die u in eigen bezit heeft. (Meerdere antwoorden mogelijk.)

- Restcontainer
- Plastics-/PMD-container
- Papiercontainer
- Glascontainer
- Textielcontainer
- Geen voorzieningen

54. Is uw huishouden in het bezit van een auto?

- Ja
- Nee

Deel 6: Afronding

55.Heeft u nog andere tips of opmerkingen over de afvalinzameling en het scheiden van afval die u nog niet bij eerdere vragen heeft ingevuld? (Deze ruimte kunt u ook gebruiken om antwoorden op eerdere vragen toe te lichten.)

[OPEN VRAAG]

56. Naast het afnemen van enquêtes zullen er ook enkele interviews met inwoners van de gemeente Nijkerk/Putten plaatsvinden om een beter beeld te krijgen van de huidige situatie en eventuele verbeterpunten voor de afvalinzameling en afvalscheiding. Zou u interesse hebben om deel te nemen aan deze interviews?

- Ja
- Nee [EINDE ENQUÊTE]

57.Via welk telefoonnummer of e-mailadres kan hiervoor contact met u worden opgenomen?

[OPEN VRAAG]

7.2 Hypothese

While studying the existing literature, some hypotheses have emerged, which have been tested during this research. These hypotheses will be listed in this appendix.

7.2.1 Socio-demographic factors

- **Age:** Elderly people (60+), contribute more to (plastic) recycling than people younger than 30 (McDonald & Ball, 1998).
- **Educational level:** People with a higher educational level participate more in recycling (Rousta, Zisen, & Hellwig, 2020).
- **Gender:** Women care more about the environment than men, and are more inclined to participate in pro-environment actions (Abdullah, Sadq, Othman, & Faeq, 2019).

7.2.2 Meaning

- **Moral norms:** Moral norms positively affect individual recycling behaviour, when these external norms are internalised (Barr, Gilg, & Ford, 2001; Meneses & Palacio, 2005).
- **Environmental concern:** Individuals with a higher, general environmental attitude are more likely to recycle better (Bruvoll, Halvorsen, & Nyborg, 2000; Negash, Sarmiento, Tseng, Lim, & Ali, 2021)

  (Stern & Dietz, 1994):
  - *Egoistic:* When people have mostly egoistic values, they will focus on the consequences on their personal life and resources. These people will value waste sorting when it can be connected as having an effect on their personal life.
  - *Altruistic:* When people have mostly altruistic values, they will focus on consequences for other people most. These people will value waste sorting when it can be connected as having an effect on other peoples' lives.
  - *Biospheric:* When people have mostly biospheric values, they will focus on consequences on nature and the environment. These people will value waste sorting when it can be connected as having an effect on nature and the environment.

7.2.3 Material

- **Strategic location:** Strategic location of waste collection points,and the short distance to these points, can improve convenience and therefore the intention to participate in the practice of waste separation (Knickmeyer, 2020).
- **Storage at home:** Having the appropriate storage at home influences the practice of waste separation (Bernstad, 2014). It can improve convenience, because people can dispose of waste at the same place as they produce their waste (Knickmeyer, 2020). Appropriate storage can also decrease nuisance, which can limit the repellent effect of biowaste (Pedersen & Manhice, 2020).
- **High collection frequency:** When waste is collected more frequently, it will be less likely that containers are filled too quickly, and the waste separation practice will not be hindered (Babazadeh, Nadrian, Mosaferi, & Allahverdipour, 2018).
- **Design:** Smart design with colour, shape and clean appearance will nudge people into correct waste separation, making it more convenient (Knickmeyer, 2020; Pedersen & Manhice, 2020).

7.2.4 Competence

- **Awareness of benefits:** Peoples' intention to participate in the practice of waste sorting is positively affected by their awareness of the benefits (Cudjoe, Yuan, & Han, 2020).
- **Perceived difficulties:** Peoples' intention to participate in the practice of waste sorting is negatively affected by their perceived difficulties (Cudjoe, Yuan, & Han, 2020).
- **Skills needed to perform:** When people feel they have the skills needed to perform the necessary behaviour, they will be more likely to participate in the practice of waste sorting (Wang, Wang, Yang, Li, & Zhou, 2020).
- **Knowledge:** Knowledge has a positive influence on waste sorting participation. The more intrinsic or extrinsic knowledge a person has, the more probable is participation in waste sorting. Not knowing how to sort or where to bring sorted waste prevents participation in waste sorting (Rousta, Zisen, & Hellwig, 2020; Miadfodzyeva, Brandt, & Andersson, 2013).
- **Time scarcity:** When people feel the needed actions take too much time, they will be less likely to participate in the practice of waste sorting (Pedersen & Manhice, 2020).
- **Feedback:** Residents who are not provided with feedback on their waste sorting practice, have no idea how much waste they generate and which type of waste is most generated, which means they miss information and therefore possibly lack knowledge (Ordoñez et al., 2015).

7.2.5 Recycling culture

- Environmental norms in people's social networks promote individual participation in the waste sorting practice (Wang & Zhang, 2022).
- Knickmeyer (2020) has proposed a 'recycling culture' as a possible solution to improve the practice of waste sorting. When the recycling culture successfully integrates in the community, residents will no longer feel like they have to perform the waste sorting practice on their own, rather it is something that is done together. People will correct each other on mistakes they make, and will inspire and motivate each other; be each other's external motivation.
- Hitchings (2013) notes that the recycling culture, as a form of social network, has a supporting factor; it is an essential part for strategies and practices of comfort to circulate and change.